AgrInnovation

PHilMech
ANNUAL REPORT 2014

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Department of Agriculture
Philippine Center for Postharvest Development and Mechanization

ABOUT THE COVER

Agrinnovation is a paradigm shift in research and development work. It is a systems approach. It is an adaptation. It is a feed-forward linchpin to agribusiness enterprise and industrialization. It is a game plan for future direction and thrust.

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This Annual Report was prepared by the Applied Communication Division from the reports submitted by the different units of PHilMech.

Disclaimer: The appearance of pictures of branded machinery is meant to present available machines in the market. It does not mean endorsement of the product by PHilMech.

PHILIPPINE CENTER FOR POSTHARVEST DEVELOPMENT AND MECHANIZATION
Science City of Muñoz, Nueva Ecija
Philippines
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FOREWORD

The fast turn of world events necessitates fast pace solutions to pressing problems of the country. At the Philippine Center for Postharvest Development and Mechanization (PHilMech), ***we agrinnovate*** to develop and promote technologies that address the urgent concerns of the agri-fishery sectors.

Thus in 2014, technologies like the compact corn mill, cassava digger, coco water pasteurizer/ chiller, village-level rice mill with impeller huller, hand tractor-mounted transplanter and combine harvester, among others, arose as a result of our paradigm shift in RD & E.

Agrinnovation is our way of doing RD & E to cope up with the challenges of the times. We need not start from scratch. Instead we improve on the existing technologies to adapt these technologies to our needs and situations.

Through Agrinnovation, we fast-track RD&E. Thus, we partner with the public and private sectors to get immediate results at less cost and resources.

We remain committed to our mandate – generate, extend and commercialize appropriate and problem-oriented agriculture and fishery postharvest and mechanization technologies But we want to be more aggressive in our pursuit of ***high impact, short duration RD & E***. This way, research results will immediately reach the target sectors. All these, for the benefit of our industry stakeholders, and in service to the Filipino people.

REX L. BINGABING
Director IV

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PHilMech

The Philippine Center for Postharvest Development and Mechanization was formerly known as the National Postharvest Institute for Research and Extension (NAPHIRE). It was created on May 24, 1978 through Presidential Decree 1380 to spearhead the development of the country's postharvest industry.

NAPHIRE was then a subsidiary of the National Grains Institute Authority (NGA), now the National Food Authority. In 1986, the agency moved to its new home at the Central Luzon State University compound in Science City of Muñoz, Nueva Ecija.

From a government corporation, NAPHIRE was transformed into a regular agency though Executive Order 494 in 1992. It was renamed as the Bureau of Postharvest Research and Extension (BPRE).

Then, pursuant to Executive Order 366 or the government's rationalization plan, BPRE became the Philippine Center for Postharvest Development and Mechanization or PHilMech in 2010.

For years now, PHilMech is engaged in both postharvest research, development, and extension activities.

VISION

Premier center for postharvest and mechanization development for a globally competitive and sustainable agriculture and fishery sectors.

MISSION

To empower the agriculture and fishery sectors by increasing resource-use efficiency and productivity, reducing losses and adding value to the produce through research and development and extension.

MANDATE

Generate, extend and commercialize appropriate and problem-oriented agriculture and fishery postharvest and mechanization technologies, practices and systems.

STRATEGIC THRUSTS

1. Efficient drying and dehydration for increased productivity
2. Appropriate handling, storage and processing techniques for increased economic value
3. Mycotoxin, pests and diseases prevention and control for food safety and food quality preservation
4. Agricultural waste and by-product utilization for environmental protection
5. Appropriate production and postproduction mechanization technologies for increased resource-use efficiency and adoptive capacity to climate change
6. Knowledge management and utlization and profitable entrepreneurship for empowered stakeholders

FACILITIES

Agricultural Mechanization and Demonstration Center

Bio-process Engineering Building

Laboratories:

Entomology	Microbiology
Molecular Biology	Chemistry
Plant Pathology	Physiology
Fumigation	Fungal and Bacterial
Thermophysical	Food Processing

Technonology Demonstration Center

Farm Service Provider and Machinery Pool

Drying Plant

Training Halls

Scientific Literature Services/ Library

Infomation and Communicaiton Technology and Geographic Information Systems Facilities

Auditorium

Dormitory and Hostel

Cafeteria

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OUR 2014 ACCOMPLISHMENTS

RD&E

HIGHLIGHTS of ACCOMPLISHMENTS

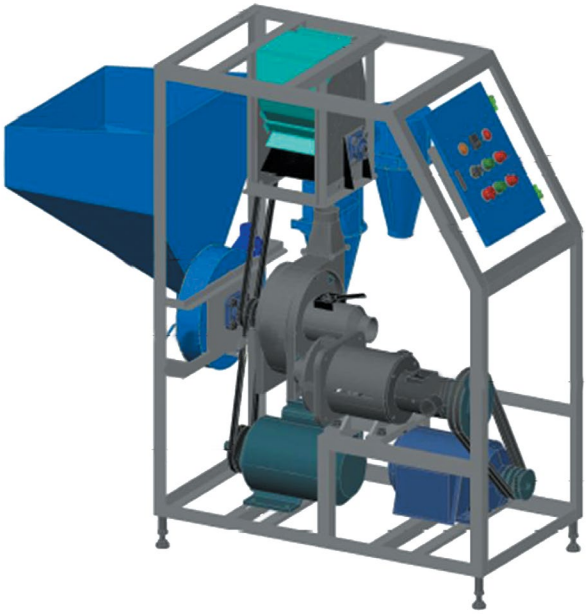
Efficient drying and dehydration for increased productivity

Drying of high moisture paddy was examined using a pilot-scale continuous-flow fluidized bed dryer system with grain flow rate of 500 kg/h. Around 82 % reduction in drying time was recorded in drying paddy with 31.5 % (wb) initial moisture content, as compared to using conventional recirculating batch dryer at 70 °C drying temperature. Quality analysis of dried paddy samples showed that reduction in head rice yield was 4 % which is within the 5 % limit set in the Philippine Agricultural Engineering Standards. The pilot-scale system will be an offshoot for the development of commercial-scale (3 t/h capacity) fluidized bed drying system. ☞p.10

A probe moisture meter for selected grains is being developed to provide low-cost, simple, quick and accurate MC measurement. It also aims to address the subjectivity and slow process of empirical methods commonly used during procurement operations. Benchmarking activities were already conducted. A capacitive-based laboratory set-up was designed and developed to measure electric properties of different paddy and yellow corn varieties at different MC levels. Initial tests for paddy yielded promising results in terms of repeatability and reproducibility of measurements while calibration for corn grains is on-going. ☞p.11

Appropriate handling, storage and processing techniques for increased economic value

PHilMech engineers had successfully designed and developed a compact rice mill with impeller huller. The machine was designed for small volume operation. It has a



dimension of 1.10 m × 0.60 m × 1.2 m (*l* × *w* × *h*) only and requires a single phase electric power. Laboratory and test results showed that the technology has a milling recovery comparable with rubber roll type but higher by 7 % with steel huller. It has a milling capacity of 300 to 350 kg/h and an operating cost per kilogram output of PhP 1.10. ☞p.12

PHilMech developed an improved village level corn mill to address the lack of efficient locally manufactured machine in the country. Pilot testing of the machine is being conducted in different parts of the country. The pilot testing of the prototype units were done to thoroughly validate the technical and socio-economic viability and acceptability of the machine. The newly developed corn mill, based on Agricultural Machinery Testing and Evaluation Center test result, has a main product recovery of 72.3 % and degerminator efficiency of 81.2 %. ☞p.13

A mechanized onion sorter was modified into a horizontal conveyor with loading and unloading hopper. This modification resulted to a semi-mechanized sorting operation that requires human intervention to sort the produce based on size and quality. ☞p.14

As an alternative to conventional blanching for selected perishables, ohmic heat treatments were tested to determine the lethal and efficient process conditions for quality preservation of sweet potato, potato and carrots. The study covers the design and development of a laboratory ohmic blanching equipment, characterization of samples and evaluation of the efficacy of the blanching treatments. Preliminary results showed that ohmic blanching, unlike conventional heat treatment, is responsive to both the product electrical properties and thermal process conditions. ☞p.15

PHilMech developed a coconut water pasteurizer-chiller to add value to the unutilized coconut water during copra processing. Also, appropriate methods and protocol in postharvest handling and processing of mature coconut water were already established. Likewise, Clean-In-Place (CIP) protocol before and after pasteurization was developed, while nutritional analysis, sensory evaluation and shelf-life studies of the processed coconut water are on-going. Meanwhile, a parallel study on the pilot testing of the village level coco water processing system is being conducted in Camarines Sur. ☞p.16

Parboiling is a hydro thermal treatment of paddy before milling. This process minimizes internal fissure and breakage during milling. Eleven rice varieties were subjected to parboling experiments in different settings. Results showed that the quality of parboiled rice process such as soaking temperature and exposure time. Also, through parboiling, the milling and head rice recovery of selected rice varieties significantly increased. ☞p.17

An evaluation on the cooking qualities and nutritional attributes of parbolied rice and milled rice was conducted. Results showed that the parboiled rice has a longer cooking time and higher water absorption, volume expansion, and elongation ration in comparison with milled rice. Nutrient content of the parboiled rice is also significantly higher than the milled rice. ☞p.18

Broccoli when exposed to 5 % ethanol vapor inhibited the rapid degradation of the vegetable during storage. Ethanol vapor delayed the yellowing and decay of broccoli including the rapid reduction of its nutrients and phytochemicals. ☞p.19

A technical and socio-economic evaluation of onion non-refrigerated storage (NRS) for small farmers was conducted. The NRS refers to ambient and high termperature storages. Cold storage served as the control. Results revealed that the percentage of physiological weight loss, rotting and sprouting increases with storage period for all storage systems. Partial budget analysis between immediately selling the onion harvest of farmers versus storing their produce in NRS for 112 days suggests that a farmer will have incremental income of Php 50 998 to Php 52 678 due to price increase after four months of storage. ☞p.20

PHilMech developed the soybean postproduction and processing systems.These were pilot tested in Anahao Bag-o Farmers Association in Tago City, Surigao del Sur, LGU in

San Miguel, Surigao City, and Viva Narra MPCI in Ilagan, Isabela. A soybean processing center was also established in Cabanatuan City, Nueva Ecija. This is managed by the Golden Beans and Grains Producers Cooperative (GBGPC). A member of this cooperative has become a successful soybean processor. ☞p.21

Mycotoxin, pests and diseases prevention and control for food safety and food quality preservation

A PHilMech research also studied the toxigenic potential of fungal species from the coffee beans in the country. Contamination by Aspergillus and Penicilliium species was found on 59 % and 19 % respectively on the samples from the five provinces. ☞p.22

Field evaluation of the BioControl Agent (BCA) in managing crown rot disease of banana was conducted. Field trials were conducted in a chemical farm (FEDCO, Davao City) and an organic farm (Alter Trade, Dumaguete City). Quarantine officers of the importing country assessed the treatment. Results revealed that regardless of treatment time, samples in the FEDCO trials showed 100 % improvement 21 days after treatment. This is comparable to standard pesticide treatment. Likewise, organically grown bananas in the organic farm, Alter Trade showed a minimal rate of rejection (1.5%), 29 days after treatment. ☞p.23

Organically-grown Bungulan Variety 29 days after treatment applied with DGA14

Organic untreated Bungulan banana serving as Control Check under the study

Agricultural waste and by-product utilization for environmental protection

Initial findings revealed that solid onion wastes could be a potential feedstock for the production of biogas. This is a result of a study which aims to optimize the anaerobic digestion of solid onion waste and find cost-effective pretreatment method to produce biogas and biomethane. Preliminary results on thermal treatment showed that by exposing the onion bulb and onion leaves at 120 °C, a considerable increase in biogas yield of 63 % and 57 % were observed, respectively. Solid onion wastes were generated at cold storage facilities and from the farm such as onion leaves and unmarketable onions. ☞p.24

Previously, PHilMech and ITDI had technically proven a process for the production of pharmaceutical grade pectin from mango peels under a laboratory scale. To determine the viability of the processing system, PHilMech partnered with private mango processors and local manufacturer for the establishment of pilot-scale level operations. Two pilot sites are being established in Cebu and Bulacan.

☞p.25

Appropriate production and postproduction mechanization technologies for increased resource-use efficiency and adoptive to climate change

A cassava digger was developed to reduce the drudgery and losses in harvesting the produce. The PHilMech Cassava Digger is a tractor drawn implement with an average depth of dig of 280 mm. Based on performance testing, the digger has an actual field capacity of 0.15 ha/h in a high weed density soil of clay loam rolling terrain and 0.42 ha/h on flat terrain of sandy loam soil. AMTEC test showed that the digger reached 86 % digging efficiency.

☞p.26

Riding-type hand tractor-driven rice transplanter and mini combine harvester were developed by PHilmech to increase the utilization of the hand tractor which is the most common farm machine in the Philippines. Traditionally used only for land preparation activities, the hand tractor can now be used for transplanting upto harvesting and threshing. The use of the machines would also reduce significantly the labor requirement and losses which would mean additional income for our farmers. ☞p.27

Knowledge management and utilization, and profitable entrepreneurship for empowered stakeholders

Benchmark studies on the postharvest handling of lowland vegetables are being conducted by PHilMech. Information on the existing practices, problems and concerns of lowland vegetable stakeholders is necessary to identify gaps and appropriate technologies needed to improve the existing system.Three hundred seventy one tomato farmers, 312 bitter gourd farmers, 202 eggplant farmers and 232 sweet potato farmers from the major producing provinces were already interviewed. Data validation, financial study and development of recommended postharvest processing system follow. ☞p.28

PHilMech also established benchmark information on the postharvest and mechanization of selected commodities. These include onion shallots of Ilocos Region and bulb onions (red and yellow) of Region 3, cassava of Regions 2 and 10 and cardava banana of Regions 2 and 11. ☞p.29

The entrepreneurial capabilities of investors/adopters of postharvest and mechanization technologies are being enhanced by PHilMech through the provision of business development services. These include (1) Amballo South Agricultural Association in Bagabag, Nueva Vizcaya for MCSTD-based enterprise; (2) Federation of RIC in Aritao, Nueva Vizcaya, also for MCSTD-based enterprise; and the (3) Samahan ng Kababaihan ng Conversion Inc. (SKIC) of Pantabangan, Nueva Ecija for the cashew-based enterprise. PHilMech also assisted these three enterprises and the Kababaihang Masigla ng Nueva Ecija (KMNE) in preparing their business plans for financial and facility support. ☞p.32

PHilMech also provides technical assistance to clients who seek to start or expand an enterprise employing mechanization, postharvest and agro-processing technologies and systems. In 2014, various feasibility studies

have been prepared, visit to Lyndon Tan's organic farm in Cavite had been facilitated, access of Mabunga Cacao Farmers Association to facility support of DA-RFU III had been provided and cost analysis of three equipment have been reviewed as input to the brochure on rice mechanization program. ☞p.33

PHilMech, in collaboration with other departments and agencies, is developing a feasibility study on the establishment of a commercial irradiation facility for agricultural products and other purposes. Specifically, the project aims to generate information for the market potential, technical and operational requirements, socio-economic impact and financial profitability of a commercial irradiation facility. In 2014, the project team conducted a series of consultation meetings with the Technical Working Group and with an international expert on irradiation technology. Focused group discussion and key informant interviews were also conducted with concerned stakeholders of the various industries. ☞p.34

Four profitability analysis modules of selected viable MCSTD-based enterprises have been developed by the Enterprise Development Division of PHilMech. These enterprises are located in Nueva Ecija, Pampanga, Bulacan and Marinduque. ☞p.35

In 2014, the Training Section of the Technology Management and Training Division (TMTD) conducted 12 training courses and assessment workshops with a total of 336 participants. Five training designs were developed and packaged to address the training needs of program implementers, provincial LGUs and other agencies.The training section also conducted the techno talakayan on postharvest and mechanization technologies with 259 participants from various agencies nationwide. A national technical conference was also conducted with 53 participants. Meanwhile, the technical capability of the 35 Farm Level Grain Center (FLGC) beneficiaries on mechanization and postharvest technologies was strengthened as part of TMTD's collaborative project with the Philippine Council for Agriculture and Fisheries. ☞p.36

As part of its intensified promotion of PHilMech generated technologies, PHilMech also conducts technology demonstration and skills training activities to prospective end-users. Eleven technology demonstration activities were conducted nationwide during the year with a total of 452 participants. ☞p.38

The PHilMech Industrial Promotion Program taps the local agricultural machinery manufacturing sector in the fabrication and commercialization of PHilMech generated mechanization and postharvest technologies. In 2014, eight license to manufacture certificates were issued to manufacturers. They have complied with all the requirements under the PHilMech Licensing Protocol. ☞p.40

To ensure protection of intellectual property rights (IPR) of PHilMech, the TMTD provides technical support to PHilMech staff. During the year, one utility model was registered, three utility model applications were submitted and four copyright applications were registered. ☞p.41

The Applied Communication Division of PHilMech packages and disseminates Information, Education and Communication (IEC) materials on postharvest and mechanization to extend PHilMech generated technologies and systems to its clienteles. It also provides various communication services like visitors' briefing, scientific literature services, technology fora, and exhibits for viewing. In 2014, 32 kinds of IEC materials were produced with a total of 90 205 copies. Ninety one batches of visitors consisting of 2058 farmers, foreigners, policy makers and students were briefed under the Visitors' Bureau. SLS also served 1225 end-users. School-on-the-Air were also conducted in collaboration with different State Colleges and Universities nationwide which yielded 981 graduates and techno forum with 757 partcipants. ☞p.42

PHilMech leads the implementation of the DA Rice Mechanization and Postharvest Program together with institutions. The Program had assisted numerous farmers' organizations to have their own farming equipment. On-farm machines such as shallow tube well, hand tractor, four-wheel tractor, drum seeder, combine harvester, thresher, rice reaper and seed cleaner were provided to them through counter-parting scheme. Off-farm facilities like mechanical dryers and modern rice mills are also part of the program. ☞p.48

To ensure the functionality and utlization of the distributed facilities, PHilMech is implementing a sustainability program. Continous assessment meetings and technical orientations are being conducted among the partner-beneficiaries. ☞p.49

Upland farmers have been also assisted through the National Agricultural Tramline Program. Tramline systems were established connecting the production area to the nearest access roads. Through this technology, farmers can easily haul their produce and farm inputs. in 2014, six units of tramline have been completed and turned over to farmer's groups. ☞p.50

Paddy hullers and compact corn mill were also delivered to farmer's organizations practicing organic agriculture. On site training on the operation, maintenance and management of the facilities. ☞p.51

The operation and management of the KOICA-Rice Processing Complex in Pangasinan and Bohol had been transferred to farmer's organizations. ☞p.52

RESEARCH AND DEVELOPMENT

Development of Fluidized Bed Dryer for Complete Drying of High Moisture Paddy

Drying of high moisture paddy was examined using a pilot-scale continuous-flow fluidized bed dryer system with grain flow rate of 500 kg/h. Complete drying of paddy with ≥ 28 % (wb) initial moisture content was attained after 2 passes of fluidized drying. This was achieved at 2 min exposure to 70 °C drying temperature and 4.9 m/s superficial air velocity, followed by 60 min tempering period (30 min without air ventilation and 30 min of ambient air ventilation). The total drying time was 2.07 h.

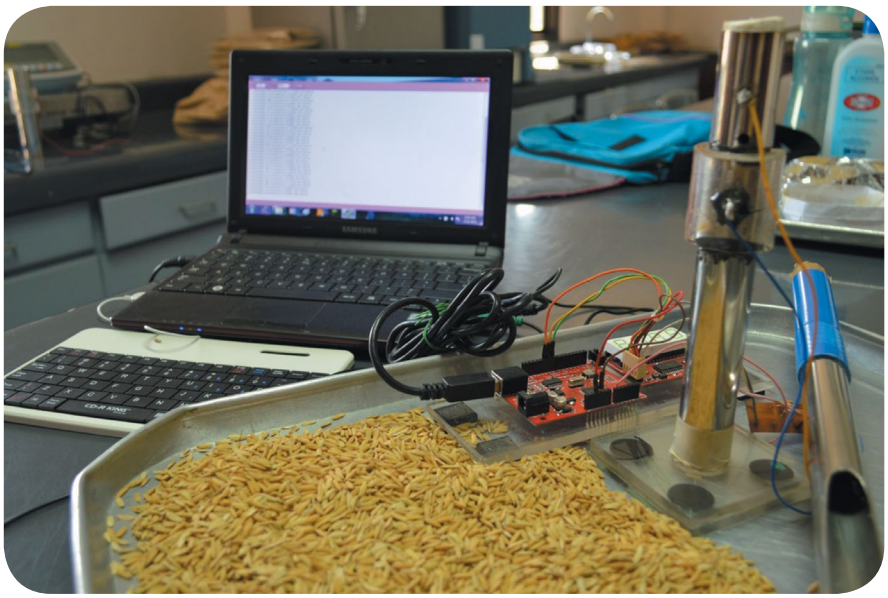
Around 82 % reduction in drying time was recorded in drying paddy with 31.5 % (wb) initial moisture content as compared to using conventional recirculating batch dryer at 70 °C drying temperature. Quality analysis of dried paddy samples showed that reduction in head rice yield was 4 % which is within the 5 % limit set in the Philippine Agricultural Engineering Standards. Specific heat energy consumption was 2.84 MJ/kg of water removed. Sensory evaluation showed that the color and taste of rice samples dried in the fluidized bed dryer were acceptable. The pilot-scale system will be an offshoot for the development of commercial-scale (3 t/h capacity) fluidized bed drying system.

Development of Probe Meter for Moisture Detection of Selected Grains

The development of grain probe moisture meter intends to incorporate a moisture sensing device to standard grain sampling probe. It aims to provide low-cost, simple, quick and accurate moisture content (MC) measurement to address the subjectivity and slow process of empirical methods commonly used during procurement operation.

The project begun with a needs validation and assessment of existing MC meters and practices; thermo-physical experiments of paddy and corn grains; and physical and technical evaluation of commercially available grain sampling probes. A capacitive-based laboratory set-up was designed and developed to measure electrical properties of different paddy and yellow corn varieties at different MC levels. The actual set-up is consists of function generator; a capacitive sensor; signal conditioning unit; and a 10-bit Microcontroller (ATmega32) interfaced with an LCD display. The final output voltage is measured by analog to digital converter (ADC) while capacitance and dielectric constant of samples is computed by the microcontroller. Particular software was developed using C–language for the calculations.

Initial tests for paddy yielded promising results in terms of repeatability and reproducibility of measurements while calibration for corn grains is on-going. Resulting data will be processed and translated into stand-alone test units in collaboration with a local electronic company. A series of field testing and calibration will be done until a low-cost, clip-on type MC meter attachable/ detachable to existing sampling probes be completed and commercially available at the end of the project.



Laboratory set-up

Development of Village Level Rice mill with Impeller Huller

Rice mills play a vital role in the Philippine government's food self-sufficiency program. The widespread use of inefficient rice mills can limit the country's rice supply because of low milling recovery. A rice mill is composed of two major components: the huller which removes the husk (output is brown rice) and the whitener which removes the rice bran to become milled rice.

In the country, the dominant rice mills are those with rubber roll huller: two stage single pass village mill with milling recovery (MR) of >60 %, and the multi-stage with 65 to 70 % MR. Also, the steel disk huller (Engleberg steel mill) with MR of 50 to 55 % is still prevalent.

While the rubber-roll type rice mill is very popular in the Philippines because of its good milling efficiency, it has its own share of disadvantages. According to the International Rice Research Institute (IRRI), this type of rice mill requires higher investment and operating cost, higher power requirement and regular replacement of rubber rolls.

To improve the current milling system in the Philippines, an impeller type rice mill which has a simple hulling mechanism and which performs well for long grain varieties is being developed. The impeller huller is the third major type of hullers for rice mill. It is designed based on centrifugal and Coriolis forces, whereby the paddy is thrown against the liner part of the impeller housing (Sakurai, 2002).

The developed rice mill technology is compact with dimension of 1.10 m × 0.60 m × 1.2 m ($l \times w \times h$) only. It is easy to install in the village that requires only a single phase power supply, commonly available in the barrio and requires a small working area of 4 m x 3 m only.

The project was funded by the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD-DOST).

Based on the results of laboratory and field trials, the milling recovery of the developed technology is comparable with rubber roll type but higher by 7 % with steel huller. It has a head rice recovery of about 72 % (from the huller). The milling capacity of the developed rice mill is 300 to 350 kg/h while the operating cost per kilogram output is about Php 1.10. The technology has a good potential because the milling fee in the barrio is Php 1.75 to Php 2.25 per kilogram output. Most importantly, the estimated initial direct cost of production is less than Php 180 000.

Pilot Testing of PHilMech Compact Corn Mill

Corn grits is one of the staple foods in the country. However, according to the Department of Agriculture Corn program, its consumption diminishes because of the poor quality of corn grits and lack of available corn mill in the countryside.

Existing and newly developed machines did not meet the Philippine Agricultural Engineering Standard (PAES) prescribed minimum degerminator efficiency of 80 % and the main product recovery of 64 %.

Low degerminator efficiency provides poor quality of corn grits while low product recovery indicates high postharvest losses during milling operation.

Facing these challenges in the design of existing corn mills, the Philippine Center for Postharvest Development and Mechanization (PHilMech) has developed an improved village level corn mill. The developed technology has a milling capacity of 180 kg/h with the following features: (1) a rotary cylindrical grading mechanism; (2) a high-speed swing-type mill with sharp edges hammer bars; (3) and an interlock grinding wheels that serves as a degermer. This prototype unit has met the quality standard set by the PAES for the minimum product recovery and degerming efficiency based on laboratory and field trials.

The pilot testing of the machine aimed to validate the technical and socio-economic viability and acceptability of the developed technology to the target end-user and to establish the durability of the prototype unit.

The design and technical specifications of the machine was made available to a private local manufacturer to facilitate the fabrication of commercial units. The three pilot-units were then deployed in Masbate; Bohol and Butuan City for testing.

After several modifications and improvements made on the original design, the milling capacity of the corn mill has increased to 260 kg/h. The total power requirement for the machine is 10 hp.

AMTEC test results revealed that the developed technology has fully satisfied the PAES, as follows:

Items	AMTEC Test Result	PAES Standard	Remarks
Main Product Recovery (%)	72.3	64	Passed
Degerminator Efficiency (%)	81.2	80	Passed
Noise Level [db(A)]			
- Without load	82.2	92	Passed
- With load	91.6	92	Passed

Likewise, the following AMTEC test results have confirmed the superior performance of the developed technology as a compact corn mill, (1) Input capacity of 304.2 kg/h; (2) Output capacity of 240.0 kg/h; and (3) Milling capacity of 260.7 kg/h.

While the developed technology is on its pilot-testing stage, it is already being commercialized. A total of 15 leading local manufacturers in Luzon, Visayas and Mindanao have already applied for license to manufacture the technology. Patent claims were drafted and applied to the Philippine Intellectual Property Office.

Improvement and Field Testing of the Mechanized Onion Sorter

A mechanized onion sorter was modified to function as a semi-mechanical sorting facility. This requires human action to sort onions based on its quality and size.

Quality is the foremost and important reason for sorting onions specifically on its condition or state of freshness, color, shape. At present, it is only by touch and senses of sight and smell that these factors of quality are determined.

The most recent modification was a horizontal-conveyor with stationary loading and unloading hopper. This resulted to zero loss. No onion was damaged or spilled during the sorting operations. Performance tests revealed capacities of 927 and 1,100 sacks per day of red onions and yellow granex onions, respectively. Moreover, results suggested that using a conveyor for sorting was efficient as it had sorting efficiency of 87 % to 100 % depending on the onion size category. The objective of this project to modify the BPRE Quick Sorter to specifically improve mechanized onion sorting. In terms of reduced mechanically damaged onions was achieved.

Ohmic Blanching of Selected Vegetables

As an alternative to conventional blanching for selected perishables, ohmic heat treatments were tested to determine the lethal and efficient process conditions for quality preservation of sweet potato, potato and carrots.

The study covers the design and development of a laboratory ohmic blanching equipment, characterization of samples and evaluation of the efficacy of the blanching treatments.

The electrical conductivity dependence of ohmic heating showed that a 56-fold increase (in mS/cm range) can shorten by five times the heating period to 90 °C endpoint temperature. An increase in electric field strength by 35 % resulted to faster heating time (49 %) and steeper rate of heating (98 %). In terms of energy use, ohmic heating consumed 46 % less than conventional heating. These preliminary results showed that ohmic blanching, unlike conventional heat treatment, is responsive to both the product electrical properties and thermal process conditions.

http://www.kfreedaily.com/

http://www.harvesttotable.com/

Utilization of Coconut Water Extracted from Mature Coconut

The project is being conducted to add value to the unutilized coconut water during copra processing. Specifically, it aims to determine the appropriate harvesting, handling and extraction process; optimize inactivation of pathogenic bacteria of the coconut water by pasteurization; conduct sensory and shelf life study of pasteurized coconut water; and determine financial viability of producing coconut water beverage.

The project has already established appropriate methods and protocol in harvesting, handling, extraction of coconut water, microbial analysis. Likewise, Clean-In-Place (CIP) protocol before and after pasteurization was developed. Meanwhile, nutritional analysis, sensory evaluation and shelf-life studies of the processed coconut water are on-going.

In response to President Aquino's directive that "inclusive growth should be felt even by the poorest of the poor in the rural areas", a parallel study on the pilot testing of the village level coco water processing system developed under the project is being carried out. It is currently undergoing pilot testing in Pili, Camarines Sur. The pilot testing is implemented through the partnership of PHilMech, Department of Agriculture-Philippine Rural Development Program (DA-PRDP)—a program supported by World Bank, DA-Regional Field Office 5, Central Bicol State University of Agriculture (CBSUA) and the Provincial Local Government Unit of Camarines Sur.

The pilot processing plant contains the whole components of a village level coconut water processing center, including pre-cleaning, washing, sanitizing, extracting, pasteurizing-chilling, filling, capping, labeling and packaging. The pilot testing aims to validate the technical and socio-economic viability of the technology and consumer acceptability of the coconut water beverage. The expected outcome of the project is to empower the coconut farmers by engaging them in the operation and management of a village level coconut water processing center and at the same time increase their level of income.

Optimization of Parboiling Conditions of Local Rice Varieties

Parboiling is a hydro thermal treatment of paddy before milling. It consists of three steps: (1) Soaking of rough rice, (2) steaming of soaked rice and (3) drying of steamed rice. Parboiling changes the physical and chemical modifications in the grain, fills the void spaces and cements the cracks inside the endosperm, making the grain harder, hence, minimizing internal fissure and breakage during milling.

Eleven rice sample varieties, namely: NSIC:Rc 118 (V1), NSIC:Rc 254H (V2), NSIC 238 (V3), Selection 64 (V4), Rc 158 (V5), 75 days (V6), NSIC 216 (V7), Japonica (V8), Rc 18 (V9), PHB 77 (V10) and Rc 218 (V11) were collected from four provinces of Agusan del Sur, North Cotabato, Palawan and Oriental Mindoro. Three soaking temperature settings (40 °C, 50 °C, 60 °C) and three soaking time (1 hour, 2 hours, 3 hours) were applied followed by steaming at 121 °C for 5 minutes using autoclave. The parboiled rice was dried to a mositure content of 14 % (wb) before milling. The physical qualities of parboiled rice kernel were evaluated in terms of milling recovery, percent head rice and whiteness.

Results showed that the quality of parboiled rice was significantly affected by the parboiling process such as soaking temperature and exposure time. The suitable soaking temperature and time of the selected rice varieties to obtain the highest milling and head rice recovery were as follows: V1 (60 °C at 3 h); V2 (60 °C at 2 h); V3 (60 °C at 2 h); V4 (60 °C at 3 h); V5 (60 °C at 3 h); V6 (60 °C at 3 h); V7 (60 °C at 3 h); V8 (60 °C at 3 h); V9 (60 °C at 2 h); V10 (60 °C at 2 h) and V11 (60 °C at 3 h). Through parboiling process, the milling and head rice recovery of selected rice varieties significantly increased ($P<0.05$) from 73.24 % to 78.64 % and 79.13% to 99.54%, respectively. However, a decrease in the whiteness value from 70.56 to 59.70 was observed.

Assuming that 20 % of the country's rice production in 2013 of 18.4 M MT goes to parboiling, the industry can generate an additional gross income of about ₱17 billion, a substantial amount that could contribute in minimizing our rice importation.

Establishment of a parboiling plant in strategic locations is recommended to help the country in attaining self-sufficiency in rice.

Soaking of rough rice

Evaluation of Cooking and Nutritional Attributes of Parboiled Rice

This project was implemented to determine the cooking qualities of parboiled rice and milled rice in terms of their physico-chemical properties and nutritional contents, and consumer acceptability of parboiled rice in comparison with brown rice.

Results showed that parboiled rice requires more water for cooking ranging from 1:2.50–1:3.00 water ratio. The time of cooking is significantly ($p<0.05$) longer in parboiled rice (27.86 min) compared to milled rice (14.57 min). Likewise, water absorption (260.66 %), volume expansion (213.89 %), and grain elongation ratio (1.45) of parboiled rice were significantly ($p<0.05$) higher than the milled rice.

Moreover, the proximate compositions and nutrient content of parboiled rice including ash (1.002 %), crude fiber (0.453 %), crude fat (1.57 %), crude protein (6.17 %), calcium (5.385 %), calories (360.55 kcal), thiamine (0.20 %) and niacin (1.19 %) were significantly higher ($p<0.05$) than the mean values of milled rice.

Effect of Ethanol Vapor on the Quality of Broccoli

Broccoli *(Brassica olaracea)* is a vegetable of important economic value as well as source of health-promoting nutrient and phytochemicals (Poulton & Moller; 1993; Bahorun et.al., 2004). However, it senesces rapidly. Florets yellowing commences between 24 to 48 hours after harvest at room temperature. This results to a very short shelf-life. Therefore, searches for techniques that will maintain its quality during postharvest transport and storage condition is necessary. A recent technique known to delay postharvest senescence and deterioration of perishables fruits and vegetables is the use of ethanol vapour (Corcuff, et.al., 1996).

The present study aims to determine the bio-efficacy of ethanol vapor in extending the shelf-life and maintaining the overall quality of fresh broccoli such as organoleptic and nutritional quality. Newly harvested broccoli heads treated with 5 % ethanol were packed in oriented polypropylene bag (1040 × 1080 mm, thickness 30 µm) and stored at two different storage temperatures (17±0.3 and 22±0.2 °C). Efficacy of ethanol vapor in delaying the rapid senescence of broccoli were evaluated at five destructive sampling periods 0, 3, 5, 7 and 10 days. Ripening of ethanol-treated and untreated broccoli were evaluated using the following parameters: chlorophyll degradation, nutrient content and organoleptic quality.

Results showed that exposure of broccoli to 5 % ethanol vapor inhibited the rapid degradation of chlorophyll a and b content up to 10 days in storage. Weight loss of ethanol vapor treated broccoli was within the minimum acceptable limit of 4 % after 10 days in storage. Ethanol vapor inhibited the rapid development of bacterial soft rot and mold infection during storage, thus maintaining the acceptable visual quality up to seven days in storage. Nutritional quality of ethanol vapor treated broccoli was not affected as evidenced by the high level of ß-carotene, total phenolic and ascorbic acid content of broccoli samples after 10 days of storage.

Thus, treatment of ethanol vapor inhibited the rapid senescence of broccoli during storage by delaying the yellowing, decay and rapid reduction of important nutrients and phytochemicals. This maintains the acceptable quality of broccoli during storage.

Technical and Socioeconomic Evaluation of Non-Refrigerated Storage System for Smallholder Onion Farmers

The study assessed the technical and economic viability of non-refrigerated onion storage systems for smallholder farmers that comprise majority of the country's local producer. Non-refrigerated storage refers to storage technologies or practices that do not apply refrigeration system, which is typical in cold storage facilities, but utilizes ordinary ambient condition or higher temperature to prolong the shelf life of the product. This low-cost storage system intends to provide alternative solution to high storage cost, insufficiency of cold storage facilities and ultimately provide smallholder farmers some window of flexibility in the disposal of their produce.

Technical evaluation of the storage performance of non-refrigerated storage systems such as ambient and high temperature storages, and cold storage (as control) was conducted using Red Pinoy cultivar. Technical parameters such as percentages of physiological weight loss, sprouting, rotting percentage and marketable bulbs were recorded every 14 days interval from April 2014 to November 2014. Results revealed that percentage of physiological weight loss, rotting and sprouting increases with storage period for all storage systems with significantly higher values observed for ambient (57 %), followed by high temperature (49 %) and cold storage (24 %) in five months.

Application of profit maximization theory suggests that the optimum storage period for ambient and high temperature storage is 112 days with maximum profit of Php 176 and Php 214 per bag of 25 kg capacity, respectively. In the case of cold storage the maximum profit obtained is Php 292 per bag. Partial budget analysis between immediately selling their harvest versus storing their produce in non-refrigerated storage for 112 days suggests that a smallholder will have incremental income of Php 50 998 to Php 52 679 attributable to price increase after four months. Economic analysis of storing onion in non-refrigerated storage to address the supply requirement for 4 months after peak season versus the use of cold storage suggests that the society will be better off mainly from saved energy from cold storage operation.

While cold storage would address long term storage requirement to provide the supply during the lean months, non-ref storage can provide the medium-term storage requirement between the peak and lean periods, thereby skewed supply of onion would be more evenly distributed across the year. While the application of cold storage provides the highest returns among the storage methods, it is however, most of the time, inaccessible to smallholder farmers because of volume requirement and high storage cost. This justifies the financial and technical practicality of non-ref storage for smallholder farmers due to simplicity of this low cost technology and the relatively smaller volume of harvest they manage.

Development of Postproduction and Processing Mechanization Systems for Soybeans

This PHilMech project aimed to develop appropriate postproduction and processing systems that will address the present needs of soybean farmers and village level processors.

The technology systems were piloted in the selected areas of the country. Postharvest centers were established at Anahao Bag-o Farmers Association in Tago, Surigao del Sur, VIVA Narra MPCI in Ilagan City, Isabela and Surigao City Local Government Unit. The postharvest facilities consisted of multi-crop thresher, all weather dryer, moisture meter and PHilMech sorter/cleaner.

One of the cooperators is the Anahao Bag-o Farmers Association. It has served as PHIlMech cooperator since 2012. The provision of thresher saved the cooperator around 80 bags of soybeans from spoilage yearly. This amounted to about Php 168 000. Also, the mechanical sorter had reduced the cost of sorting/cleaning from Php 0.60/kg on manual sorting to Php 0.33/kg using the PHilMech sorter/cleaner. Mechanically sorted soybeans had an increased price of Php 3/kg.

Meanwhile, soybean processing center was established in Cabanatuan, Nueva Ecija. Processing equipment such as soybean grinder, presser, freezer, boiling pots were lent to the cooperative. The center is managed by Golden Beans and Grains Producers Cooperative (GBGPC) and the soybean processing operations are done by women. The center produces soymilk, tokwa, taho, polvoron and soy longanisa.

Another PHilMech cooperator is a member of GBGPC . His family enterprise based in Paco, Manila is processing around 10 to 12 kilograms of soybeans and producing 250 to 330 bottles of soymilk every day. Market outlets include schools, universities and offices in the area. The enterprise earns around Php 45 000 to Php 50 000 monthly from soymilk processing.

Other adopters of the technologies are the different integrated research centers under the DA and some local government units. Most of the research centers that have adopted the complete postharvest systems are producers of soybean seeds. Other research centers are also active in processing soybeans into milk, taho, tokwa, etc.

Through the pilot tests, PHilMech came-up with different viable modules which will serve as a guide in establishing soybean postharvest and processing enterprises.

Soymilk processing at Paco, Manila

Toxigenic Potential of Fungal Species from Coffee Beans in the Philippines

Green coffee beans from *Coffea arabica* in Benguet and Ifugao; *Coffea canephora* var. Robusta in Abra, Cavite and Ifugao; *Coffea liberica* and *Coffea excelsa* from Cavite were collected and assessed for the distribution of fungi with the potential to produce Ochratoxin A (OTA). The presence of fungal species was evaluated both before and after surface sterilization.

There were remarkable ecological and varietal differences in the composition of ochratoxigenic species present in these five provinces. *Aspergillus ochraceus* and *Penicillium verruculosum* were only detected from Arabica in Benguet and Ifugao whilst *A. niger* and *A. japonicus* were noted in Excelsa, Liberica and Robusta varieties from Abra, Cavite and Davao. Contamination by *Aspergillus* and *Penicillium* species was found on 59 % and 19 %, respectively, of the 57 samples from the five provinces. After disinfection with 1 % sodium hypochlorite, the levels fell to 40 % and 17 %, respectively. One thousand one hundred fifty nine isolates were identified to species level and these comprised of *Aspergillus* sections *Circumdati* (3 species), *Clavati* (1), *Flavi* (1), *Fumigati* (1), *Nigri* (2), and *Terrie* (1). Within section *Circumdati*, 67 % of *A. ochraceus* produced ochratoxin A as high as 34979 ng/g. Within section *Nigri*, 18 % of *A. niger* and 2 % of *A. japonicus* isolates produced OTA ranging from 174–34850 ng/g. Of the 12 species of *Penicillium* isolated, only *P. verruculosum* was ochratoxigenic with a maximum OTA production of 12 ng/g. *Aspergillus* and *Penicillum* species had vigorous growth in artificial media with 1.0 water activity (a_w) while there was negative growth at a_w range of 0.80–0.99.

Field Evaluation of Biocontrol Agents in Managing Crown Rot Disease of Banana

Export-driven banana cultivation, while providing social equity and financial security in the countryside, suffers considerable rejection rate because of crown rot disease caused by *Colletotrichum musae*, *Lasiodiplodia theobromae* , *Thielaviopsis paradoxa* , *Fusarium spp*. The disease is characterized by rotting of the cut tissue of the banana hand or cluster that ultimately destroys the whole commodity. The impact is most felt in organic farming while chemical farming remains subject to residue contamination and food safety issues. Two species of epiphytes, *Bacillus spp* strain DGA14 and *Trichoderma spp* strain DGA02, were tested for antagonistic effect against pathogens that cause crown rot.

To validate laboratory results, six field trials on commercial export scale were conducted along divergent farming systems, chemical farming (FEDCO-Davao City) and organic farming (Alter Trade-Dumaguete City). The trials were scheduled during the rainy season when selection pressure is at its most severe. Seven liters of candidate BCA was mixed in a plastic drum with 90 liters of tap water. Thirty-two replicates per trial were designated for each BCA. Samples were submerged for 20 minutes in the Alter Trade trials while various treatment exposures were tested in the FEDCO trials. Treatment was assessed by quarantine officers of the importing country. Crown Rot Index (0 to 7 where 0 means disease-free), Visual Quality Rating (1 to 6, where 6 denotes excellence) and Peel Color (0 to 7, where 7 means yellow) were monitored.

Results showed that regardless of treatment time, samples in the FEDCO trials showed a 100 % recovery in all three trials, 21 days after treatment (DAT), with CRI = 0, VQR = 6 and PC = 5, comparable with the standard pesticide treatment the company employs. Organically-grown bananas likewise showed a minimal rate of rejection (1.5 %) 29 DAT with average values of CRI (0.5), VQR (4.8) and PC (2.15) while control treatment resulted to 7.24 % loss in the first trial. As for the second and third Alter Trade trials, Control Check was totally deteriorated causing total loss of profit due to shipping delays whereas BCA-treated bananas suffered only 18 % rejection with a delay of five days (compared with the first trial of 29 days) in the second trial and 34 % rejection rate for 11 days delay in shipping. Moreover, the cause of rejection was largely due to production diseases like freckle caused by *Phyllosticta musarum* and anthracnose caused by *Colletotrichum gloeosporioides*. In terms of cost of treatment, BCA application is more affordable than expensive agro-chemical input.

Trial 1 quality results, washed, 10-min treatment time

TREATMENT	CROWN ROT INDEX (0 to 7)		VISUAL QUALITY (1 to 6)		PEEL COLOR (1 to 7)	
	FEDCO	ALTER TRADE	FEDCO	ALTER TRADE	FEDCO	ALTER TRADE
DGA14	0.0	0.6	6.0	5.0	5.0	5.0
DGA02	0.0	0.475	6.0	4.75	5.0	4.75
Control Check	0.0	7.0	6.0	1.0	5.0	1.0

**The control check for FEDCO uses chemical treatment while the samples from Alter trade were treated organically.*

Organically-grown Bungulan Variety 29 days after treatment applied with DGA14 (left) and DGA02 (right), Dumaguete City

Organic untreated Bungulan banana serving as Control Check under the study

Utilization of Onion Solid Waste as Feedstock for Biogas Production

Onion is one of the most important commercial vegetable crops grown in the country which has recorded a total production of 134 160 t in 2013 (BAS, 2014). However, amidst this yield, losses ranging from 45 to 65 % (BPRE, 2009; Marzan, 2005; Tecson, 1992) were reported during postproduction operations. Disposal of these agricultural by-products could create economic and environmental problems if not properly utilized. Many agricultural wastes are considered fit for anaerobic digestion as they contain high levels of easily biodegradable materials.

This research project intends to optimize the anaerobic digestion of solid onion waste and find out which pretreatment parameter produces the highest rate of biogas and biomethane. The potential of onion wastes generated at cold storage facilities and solid onion wastes discarded at the farm during harvesting such as onion leaves and unmarketable onion bulbs were tested.

Series of experiments that would determine the cost-effective pretreatment method and optimized digestion parameters were conducted. A laboratory scale batch digester was used to observe the effects of thermo-chemical pretreatment parameters such as temperature, chemical loading and treatment duration.

Preliminary results on thermal treatment showed that by exposing the onion bulb and onion leaves at 120 °C, a considerable increase in biogas yield of 63 % and 57 % were observed, respectively. The higher biogas yield in onion bulb can be attributed to its low total solids and high volatile solids which are easily degraded during anaerobic digestion. The project is already on culmination stage; consolidation and analysis of data is on-going. Initial findings implied that solid onion wastes could be a potential feedstock for the production of biogas and the optimized digestion parameters will serve as reference for the efficient conversion of these organic materials into bioenergy.

Development of a Pilot Scale Processing System for the Production of Pectin from Mango Peels

Previous study by PHilMech and ITDI has technically proven a process for the production of pharmaceutical grade pectin from mango peels under a laboratory scale (Gragasin, et al. 2011). However, these findings need field validation.

The present study aims to determine the viability of the process and acceptability of the pectin products under a pilot-scale level of operation. Two pilot sites are being established in Cebu and Bulacan. The pilot site in Cebu is being implemented in partnership with PHilMech, ProFoods International Corp., the biggest mango processor in the country and Suki Trading Corporation, a manufacturer of various agricultural and food processing machinery and equipment. On the other hand, the pilot scale in Bulacan is being established in partnership between PHilMech and Green Ops Corp, a subsidiary of MONHEIM Group of Companies that produces tropical fruit concentrate and juices and distributor of consumer products.

The pectin pilot processing plant being put up with space provided by both companies comprised of different equipment including washer, mechanical dryer, jacketed kettle, spinner/presser, pulverizer, distiller and vacuum packaging. The expected output of the pilot plant in Profoods is about 2 kg of mango pectin per batch, while Green Ops is aiming to produce a bigger output of about 8 to 10 kg of mango pectin per batch. PHilMech's partnership with these two companies is governed by a Memorandum of Agreement.

Signing of the Memorandum of Agreement between PHilMech and Green Ops Corporation for the estblishment of commercial scale pectin production.

Development of Cassava Digger

Cassava Digger Prototype tested in muddy terrain using a 90 hp tractor

Terrain at test site during and after mechanical digging

The project aimed to develop an economically sound cassava harvester that will reduce drudgery and harvesting losses through its harvesting performance.

A prototype cassava digger was developed by PHilMech in collaboration with the Agricultural Engineering Research Institute (AERI) of Thailand, the Philippines' co-member country in the Asian Food and Agriculture Cooperation Initiative (AFACI). After the completion of the first phase of the project, a commercial model of the PHilMech Cassava Digger was produced.

The PHilMech Cassava Digger is a tractor drawn implement that has addressed the present needs in mechanizing cassava harvesting. The entire assembly when hitched to the tractor uproots cassava tubers which are manually collected and its stalks cut off. The angle of the digging plate with respect to a horizontal plane is set to about 20° by adjusting the hitches. At this adjustment, the depth of dig was about 280 mm in average and enables the digger to dig an entire cassava tuber of about 200 mm deep. A 90 hp tractor was used in the tests conducted in the provinces of Quirino, Isabela, Pampanga and Bataan. From the field performance testing covering an area of about 0.5 hectare, the cassava digger reached an actual field capacity of 0.15 ha/h (1.2 ha/d) in a high weed density soil of clay loam rolling terrain and 0.42 ha/h (3.4 ha/d) on flat terrain of sandy loam soil. Depending on terrain, its digging efficiency can reached 60 %. However, it was observed that the efficiency was lower on a terrain with heavy grass density. AMTEC test conducted in Alfonso Lista Ifugao reached 86 % digging efficiency.

Based on economic studies, an additional income of Php 3100 can be gained in using the digger compared to manual harvesting because of the reduction of harvesting losses. This has a potential gross income of Php 1153.75 per hectare.

Development of Hand Tractor Attachments– Rice Transplanter and Combine Harvester

The initial prototypes of the two machines were tested in 2014 and early part of 2015. Initial results showed that the labor requirement for the mechanical transplanter is two to three man-days per hectare compared to about 20 man-days per hectare for manual transplanting. For the mini-combine harvester, the required labor is three to four man-days per hectare as compared to 16 to 20 man-days for conventional harvesting. Also, harvesting and threshing loss is reduced to 2.5 % compared to 4.5 % for conventional harvesting and threshing. The reduction in labor requirements and harvesting loss would mean an increase in the income of the farmers.

The final commercial prototypes of the two machines are now being fabricated. The developed machines would provide farmers with an alternative of using locally assembled machines which are less expensive than the commercially available transplanter and combine harvesters.

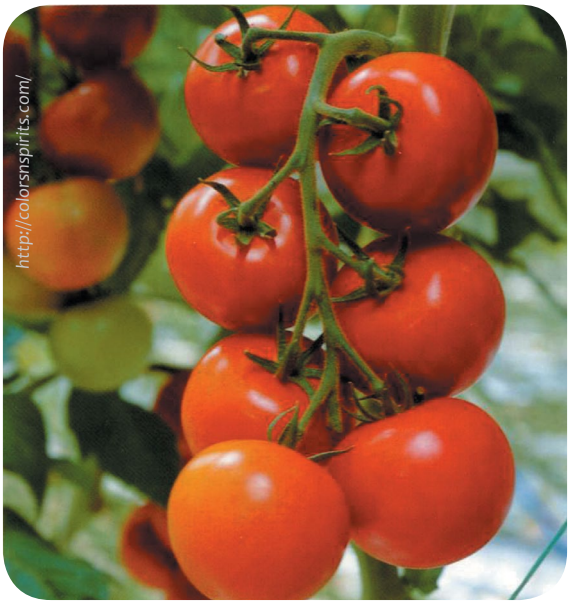
Benchmark Studies on Postharvest Handling of Major Lowland Vegetables

Lowland vegetables such as tomato, bitter gourd, sweet potato and eggplant are among the important crops being promoted by the Department of Agriculture (DA). High production and postproduction losses due to improper handling practices are among the limiting factors that hinder the growth of the lowland vegetable industry.

However, there are limited information on the specific handling system where major losses occur. It is important to know and understand the existing practices, problems and concerns of the lowland vegetable stakeholders to identify gaps and appropriate technologies that will be needed to improve the existing handling practices that could eventually reduce postharvest losses and increase supply.

The project aims to establish baseline information on the postproduction systems of lowland vegetables and to come-up with baseline data on quantitative and qualitative postharvest losses of the existing major commodity supply chains. Key informant interviews, focus group discussions, actual loss assessment and supply chain analyses of the different crops were done. The study areas include: (1) tomato- Nueva Ecija, Nueva Vizcaya, Laguna, Bukidnon; (2) eggplant- Quezon, Batangas, Pangasinan and Nueva Ecija; (3) Bittter gourd – Quezon, Nueva Ecija and Batangas; and (4) Sweet potato- Tarlac, Albay and Bataan

About 371 tomato farmers, 312 bitter gourd farmers, 202 eggplant farmers and 232 sweet potato farmers were interviewed from the major producing provinces in the Philippines. Postproduction practices of each crop were determined and established. Losses incurred from harvesting of the crops up to market retail level were determined. The results however will still be validated with the different group of farmers, processors and traders. Remaining project activities include validation of data through the conduct of stakeholders meeting, validation of existing technologies and financial study and development of postharvest processing systems.



Establishment of Benchmark Information on Postharvest and Mechanization of Selected Commodities: Shallot, Cassava, Cardava Banana and Bulb Onion (Red and Yellow)

This project aims to establish baseline information on priority high value crops as bases of providing appropriate postharvest and mechanization research and development interventions. Specifically, this project will (1) describe the market chain, the value addition activities in terms of practices and technologies as well as the values added by various stakeholders, (2) determine the magnitude of postharvest losses of the commodities under study, (3) identify the problems and constraints of the processes in producing shallots, cassava, cardava and bulb onions (red and yellow) and (4) identify R &D interventions that will address the identified problems.

Study sites include: Ilocos Region for shallots, Regions 2 and 10 for cassava, Regions 2 and 11 for Cardava banana and Region 3 for bulb onions. Framework used was value chain analysis. Focus group discussions and loss assessment trials were conducted to collect the information and data needed.

The following are the preliminary results of the project:

Shallots and Bulb onions (Red and Yellow)

In Ilocos Region, three chains were observed in selling cured and bundled onion shallots from the farmer up to the end consumer. The three routes were: farmer to the local market, farmer to the export market and traders to processor chains.

From among the actors involved in the local market chain, retailer earned more than the others while exporter and processor receive more in the chains of export and minimal processing. On the other hand, the farmer earned the least in all identified chains.

Meanwhile, postharvest losses for local and export market ranged from 1.94 % to 35.72 % and 3.74 % to 35.06 %, respectively. These losses are the result of physical and moisture loss.

In Nueva Ecija, red and yellow bulb onions are predominantly sold in the local markets. However, two chains exist at present: the fresh bulb onion sold to local market and bulb onions from the cold storage to the local market.

Among the different actors involved in the local market chain, retailer got the highest income followed by the farmer. Trader received the lowest income while the agent got a commission of Php 1/kg.

As to the postharvest losses, initial results showed that in the local market physical and moisture losses ranged from 0.33 % to 11.1 % for yellow and 1.2 % to 13 % for red bulb onions.

Cassava

Two chains were observed in selling fresh cassava tubers from the farmer up to the end consumer in Mindanao, i.e., the feed and industrial/food processing chains. While, in Luzon only the feed processing chain was observed.

Preliminary results on the value chain analysis showed that Mindanao farmer earned more than the manufacturer/processor in the industrial/food processing chain. On the other hand, trader/cooperative in Luzon received more than the farmer in the feed processing chain.

Preliminary results also showed that postharvest losses of cassava tubers for feed manufacturing ranged from 0.2 % to 4.91 %.

Cardava Banana

In Luzon, two chains were observed in selling fresh cardava banana from the farmer up to the end consumer: farmer to the market (product is fresh cardava) and farmer to the processor (product is banana chips). In Mindanao, most of the Cardava bananas were exported in different forms namely: microwavable, fresh cardava and banana chips products. United States and Canada are the present markets for microwavable product, Japan and Dubai for fresh cardava and U.S., Europe, Australia and China for banana chips.

Based on the initial results, farmers in Luzon chain which catered the local market earned the least among the chain actors while the retailers received the highest followed by the wholesaler/consolidator. However, in Mindanao export value chain analyses revealed all processor/exporters of the three export products received the highest income.

Initial results also revealed that postharvest losses incurred by Luzon cardava for wet market ranged from 2.98 % to 5.78 %. On the other hand, Mindanao microwavable cardava for export incurred postharvest losses at around 5.43 % to 24.24 %, fresh cardava for export at 0.54 % to 2.10 % and banana chips for export at 1.55 % to 12.98 %.

In Mindanao, postharvest quality losses experienced by the farmer were due to rejects in terms of size especially for the microwavable and fresh banana export which requires bigger sizes. Losses incurred by the different processors vary depending on their requirement and recoveries.

https://safepaccorporationdavao.files.wordpress.com

EXTENSION SUPPORT, EDUCATION & TRAINING SERVICES

Enhancing Entrepreneurial Capability of Postharvest and Mechanization Adopters/ Investors through the Provision of Business Development Services

Cashew-based Enterprise in Pantabangan, Nueva Ecija

The project aims to enhance the entrepreneurial capabilities of new adopters/ investors of PHilMech generated technologies and systems in managing techno-based enterprises through the provision of business development services.

In 2014, the project strengthened the capacities of the three enterprises in managing the business through business planning, technological services, and organizational development. These enterprises include: (1) Amballo South Agricultural Association (ASAA), Bagabag, N.Vizcaya for MCSTD-based enterprise, (2) Federation of RIC in Aritao, Nueva Vizcaya for MCSTD-based enterprise, and (3) the Samahang Kababaihan ng Conversion Inc.(SKIC), Pantabangan, Nueva Ecija for cashew based enterprise. The three enterprises and the Kababaihang Masigla ng Nueva Ecija (KMNE) of Quezon, Nueva Ecija were also assisted in preparing their business plans for financial and facility support. With the prepared business plan for the SKIC, they were given facility support by the Provincial DTI of Nueva Ecija.

The project also conducted profiling of four cashew processors/enterprises, 12 Multi-commodity Solar Tunnel Dryer (MCSTD)-based enterprises and four coffee-based enterprises to identify the gaps related to technologies being adopted.

The project also conducted technology briefing and training on the operation of the MCSTD for the new adopters and existing users namely: the Provincial Director of DOST-Capiz, 42 members of various barangay and Municipal Offices of LGU Aroroy, Masbate, 22 women Presidents of RIC in barangays of Aritao, 5 key officers of Gabriela Women Association in Pidigan, Abra, 38 Students of Camarines Norte College of Agriculture and Business, and University staff of Aklan State University (3 campuses).

Provision of Technical Assistance for Postharvest Enterprise Development

This project provides the needed assistance to clients who seek to start or expand an enterprise that employs mechanization, postharvest and agro-processing technologies and systems.

During the year, the project facilitated the visit of Fernando Ricemill in Talavera, Nueva Ecija to the RPC in Pangasinan. This enhanced the knowledge of the entrepreneur on the ricemilling operations. Further, the project also facilitated the visit of three staff of Benguet Cold Chain Project in Wangal, La Trinidad, Benguet to the Lyndon Tan Organic Farming in Tagaytay, Cavite. The visit enabled the staff to know the plant layout and equipment that they can use.

In 2014, the project was able to prepare several feasibility studies as follows: (1) Feasibility Study on Onion Cold Storage requested by Anak Pawis Producers Cooperative in Sto.Domingo, N.Ecija; (2)Feasibility Study on Cacao Processing as requested by Mabunga Cacao Farmers Association Umiray, Dingalan, Aurora; (3) Pre-Feasibility Study on the Establishment of a Commercial Irradiation Facility for Agricultural Food Products and Other Purposes; (4) Pre- Feasibility Study on the Establishment of a Large Scale Ricemilling Business as requested by a private group represented by Father dela Torre; (5) Feasibility Study on Pineapple Processing using MCSTD; and (6) Feasibility Study on Gabi Processing.

The Mabunga Cacao Farmers Association was assisted in accessing facility support assistance from DA-RFU III while their products were linked to market through DTI and to a private group for financial assistance.

The project also reviewed and edited the cost analysis of three equipment (combine harvester, four-wheel tractor and rice transplanter) as input to the rice mechanization program brochure being prepared by Applied Communication Division.

Orientation on minimal processing of high value vegetables for Project Management Team of Benguet Cold Chain Project at Basic Necessity, Inc. , Silang, Cavite

Turn-over of the copy of Feasibility Study on Onion Cold Storage to the Chairman of Anak Bukid Producers Cooperative

Feasibility Study on the Establishment of a Commercial Irradiation Facility for Agricultural Products and Other Purposes

The project was approved for implementation from September 2014 to June 2015, in collaboration with the following agencies: Department of Science and Technology (DOST) – Philippine Nuclear Research Institute (PNRI), Department of Trade and Industry (DTI)-Export Management Bureau (EMB), National Food Authority (NFA)-Food Development Center (FDC), University of the Philippines at Los Baños (UPLB), Department of Agriculture: Bureau of Plant Industry (BPI)- Plant Quarantine Services (PQS), Bureau of Agriculture and Fisheries Standards (BAFS), High Value Crops Development Program (HVCDP), Agribusiness and Marketing Assistance Services (AMAS) and Philippine Council for Agriculture and Fisheries (PCAF). Project funds are provided by the Bureau of Agricultural Research. The project is being implemented in line with Department of Agriculture Special Order No. 552 Series of 2013 dated 6 August 2013.

The project intends to determine the viability of a commercial irradiation facility for the treatment of agricultural products and for other purposes. Specifically, it aims to generate information for the market potential, technical and operational requirements, socio-economic impact, and financial profitability of a commercial irradiation facility.

To gather the required information for the different analyses, a series of consultation meetings with the Technical Working Group of the project had been conducted. Consultation with an International Expert on Irradiation Technology was also conducted. A Focus Group Discussion for stakeholders of the fruit industry in Mindanao was also held in November 2014. Key Informant Interview with concerned stakeholders of various industries also started.

Consultation meeting with the members of the Technical Working Group

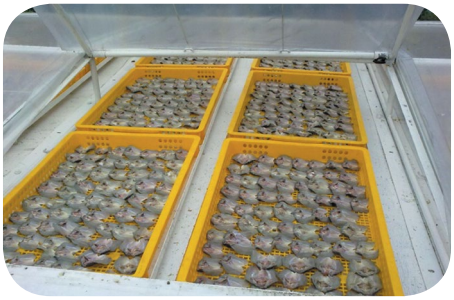
Profitability Analysis Modules of Selected MCSTD-Based Enterprises

The project aimed to develop profitability analysis modules of selected viable MCSTD - based enterprises.

The successful MCSTD-based enterprises engaged in drying and processing agricultural products were considered in the analysis. These enterprises are located in the provinces of Nueva Ecija, Pampanga, Bulacan and Marinduque. Each enterprise is different from each another in terms of organization, structure and operational scheme.

Module 1 is about the processing of selected fruits in season, selected vegetables to become dried and sweetened products and food supplement in capsule. This also produces dried young tilapia. The enterprise is run by a group of rural women utilizing two units of MCSTD. Initial investment cost was about Php 1 265 000. It had an initial income of Php 450 206.48.

Module 2 is about the processing of herbs, tomatoes, chili and soursop (guyabano) leaves. It has only a unit of MCSTD and operates three to four times a week. It is a family business. Initial investment cost was about Php 810 500. An income of about Php 169 251.84 was generated for one year.



Module 3 is about the processing of young tilapia using three units of MCSTD. The young tilapia is grown in 45 to 60 days by the entrepreneur. About nine ponds are being used in growing tilapia in this Module. Tilapia fingerlings were outsourced in this module. Initial investment cost was about Php 5 988 423.44 and a net income of Php 764 105.78 was achieved in Year 1.

Module 4 is about the processing of breadfruit, cassava, tannia and mango and using only one unit of MCSTD. This module showed processing of dried breadfruit, tannia and cassava into flour while mango is processed first before drying to become mango chutney. Flours produced are used in making baked products and crackers. Initial investment cost was about Php 2 794 142.10 and initial earning was about Php 690 706.25 in Year 1.

Industry Manpower Development Program

The Training Section of the Technology Management and Training Division (TMTD) continuously empowers and maintains a dynamic pool of experts on mechanization and postharvest technologies through its Industry Manpower Development Program. The program consists of three major projects, namely: (1) Technical Support to the Industry Manpower Development, (2) Enhancing the Technical Capability of the Industry Stakeholders on Mechanization and Postharvest Technologies, and (3) Special Project.

Technical Support to Industry Manpower Development

The Training Section conducted five batches of writeshop and series of faculty meetings for the development of training design and instructional materials. Commodity focal persons and technical experts of PHilMech partcipated. As an output of the writeshop, five training designs were developed and packaged to address the training needs of the program implementers of the Department of Agriculture-Regional Field Offices (DA-RFOs), Provincial Local Government Units (PLGUs) and other agencies.

Technical assistance on training related matters such as provision of subject matter specialists, training design development and conduct of training were also provided to the following agencies and organizations: (1) Alarcio Rice Mill based in Laoac, Pangasinan which has one of the most modern and state-of-the-art Rice Mill in the region; (2) Agricultural Rental Machine for Local Economy Development (ARMLED) a non-government organization in Bayombong, Nueva Viscaya providing support to small scale farmers to contribute in increased rice production; (3) Association of Land Bank-Assisted Cooperatives of Pangasinan (ALBACOPA) in Alcala, Pangasinan a confederation of six cooperatives with more than 600 members each who are mostly rice farmers; and the (4) Department of Agrarian Reform Region I.

In addition, the Training Section conducted the Techno Talakayan on Mechanization and Postharvest Technologies during the PHilMech 36th anniversary celebration. There were 259 participants who attended the Techno-Talakayan from various agencies such as the Department of Agriculture (DA), Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development (PCAARRD), State Universities and Colleges (SUCSs), Provincial Local Government Units (PLGUs), Municipal Local Government Units (MLGUs) nationwide and other private organizations.

To keep the industry stakeholders abreast on the recent developments, plans and programs on mechanization and postharvest technologies highlighting the commercialized and emerging technologies of PHilMech, a National Technical Conference on Mechanization and Postharvest Technologies was also conducted. There were 53 participants from different agencies/institutions, i.e., SUC's, Agriculture Training Institute (ATI), Department

of Science and Technology (DOST), Department of Trade and Industry (DTI), DA-Central Agri-Fishery Engineering Division (CAFED) and other private institutions.

Enhancing the Technical Capability of the Industry Stakeholders on Mechanization and Postharvest Technologies

This project aims to continuously strengthen the knowledge and skills of the intermediaries specifically the commodity program implementers and PHilMech Mechanization and Postharvest Specialist Network from DA-RFOs, PLGUs, technical staff from SUCs and other agencies and the farmer-leaders nationwide. For year 2014, there were 12 training courses and assessment workshop conducted, with a total of 336 participants. Training courses conducted were as follows: Skills Training Course on the Technical Evaluation of Selected Agricultural Machineries (3 batches), Assessment Workshop of Trained Participants on Rice Mechanization and Postharvest Technologies (3 batches), and Training Course on Postharvest and Mechanization for SUCs (2 batches), Skills Training Courses on Mechanization and Postharvest Technologies for DOST and other agencies (3 batches), and the Development and Harmonization of Training Design (1 batch).

Special Project

In collaboration with the Philippine Council for Agriculture and Fisheries (PCAF) formerly the National Agricultural and Fishery Council (NAFC), the project "Enhancing the Technical Capability of Farm Level Grain Center (FLGC) Beneficiaries on Mechanization & Postharvest Technologies" was conducted. It aimed to further strengthen the 35 FLGC beneficiaries (facility assistance provided by PCAF to various cooperatives and farmer organizations nationwide) by way of capability building on the proper operation and management of their FLGCs. For 2014, two batches of training courses were conducted for Luzon and Mindanao beneficiaries. Follow-up activities (coaching and mentoring) were also conducted for seven trained FLGCs. Initial results showed that that there is a marked improvement in their organization specifically in the management of their operations. The FLGCs were motivated by the additional support from the government for the rehabilitation of their facilities and additional working capital.

Intensifying the Promotion of PHilMech Generated Technologies

The project aims to accelerate the promotion of PHilMech generated technologies under commercial operation through the conduct of technology demonstration and skills training activities to prospective end-users.

The PHilMech Manual Coffee Pulper, Whole Cashew-nut Sheller, PHilMech Compact Corn Mill, Corn Planter, Cassava Digger, Belt-type Dryer and Multi-Commodity Solar Tunnel Dryer were among the technologies subjected to the commercialization process for this year. A series of technology demonstration activities were conducted nationwide to promote and enhance the awareness level of stakeholders on the features, specifications, technical and economic benefits of adopting PHilMech technology including its proper use and maintenance. There were 11 technology demonstration activities conducted in 2014 with a total of 452 participants nationwide. These activities were attended by representatives from concerned DA-RFU's, Provincial Local Government Units, Municipal Local Government Units, farmers' associations/cooperatives, processors and private prospective adaptors (Table 1).

Table 1. Technology demonstration activities conducted, per technology, 2014

Activity / Location Date conducted	No. of partici-pants	Particpants
Manual Rubber-bib Coffee Pulper		
Asipulo, Ifugao *March 4, 2014*	42	Asipulo coffee farmers organization Private individual coffee growers MLG representatives
Kiangan, Ifugao *March 5, 2014*	40	Kiangan coffee farmers organization Private individual coffee growers MLG representatives
Pila, Laguna *March 26, 2014*	37	Sta. Maria Coffee Growers and Traders Association Private coffee farmers of Pila and Cabuyao, Laguna. PLG and MLG representatives
Lipa, Batangas *March 27, 2014*	40	Malarayat Coffee Farmers Consumers Cooperative City Local Government representatives
Manual Rubber-bib Coffee Pulper and MCSTD		
Tagbina, Surigao del Sur *May 6, 2014*	45	Uguban Multipurpose Cooperative DA-RFU representatives PLG and MLG representatives
Del Carmen, Surigao del Norte *May 8, 2014*	40	Quezon Peoples Organization Barangay officials DA-RFU representatives PLG and MLG representatives
PHilMech Compact Corn Mill and Cassava Digger		
Boac, Marinduque *June 4, 2014*	28	Marinduque State College Representatives DA-RFU representatives PLG and MLG representatives
PHilMech Compact Corn Mill and Corn Planter		
Cataingan, Masbate *October 2, 2014*	66	Corn farmer clusters from the various barangay MLG representatives
PHilMech Cassava Digger and Belt-type Dryer		
PHilMech and Isabela *October 7, 2014*	36	DA-RFU 5 Agri-Pinoy Corn Program extension workers and focal persons from the different provincial and municipal local government units
PHilMech Cashew-nut Sheller and MCSTD		
Jordan, Guimaras *July 30, 2014*	31	Kasoy for Life Organization Farmers and processors associations from the various municipalities of Guimaras PLG and MLG representatives
Lumbia, Cagayan de Oro *November 20, 2014*	47	Best Agricultural Products Processing Cooperative MLG representatives

MLG: Municipal Local Government *PLG: Provincial Local Government*

PHilMech Industrial Promotion Program

The Technology Management and Training Division implements the PHilMech Industrial Promotion Program (PIPP) to accelerate the sustainable utilization and commercialization of PHilMech generated technologies. The local agricultural machinery manufacturing sector is tapped in the fabrication and commercialization of PHilMech generated mechanization and postharvest technologies

A Technology Licensing Protocol was established for a systematic and uniform procedure for technology transfer and licensing that equally serve the ends of intellectual property protection and technology promotion. The said protocol involves the following: (1) submission of letter of intent, (2) plant inspection, (3) issuance of technical drawings, (4) prototype fabrication, and (5) issuance of license to manufacture.

For the year 2014, eight manufacturers fora were conducted nationwide. There were 13 manufacturers who signified intent to apply for license. Eight License to Manufacture certificates were issued to manufacturers who have complied with all the requirements under the PHilMech Licensing Protocol.

Fabrication shop evaluation/assessment

Conduct of agricultural machinery manufacturers forum

Technical Support to Intellectual Property Rights

The Technical Support to Intellectual Property Rights Project under the Technology Management and Training Division ensures the protection of Intellectual Property Rights (IPR) and copyright of various technologies and/or materials developed by PHilMech staff through compliance to the Intellectual Property Code of the Philippines or RA 8293.

For the year 2014, one utility model was registered; three utility model applications submitted; and four copyrights were registered.

Relative to IPR protection, an "In-House Training on Philippine Technology Transfer Act and Technology Disclosure and Basic Patent Drafting" was conducted last April 29-30, 2014 at the PHilMech Training Hall. Project leaders and researchers enhanced their knowledge on the policies governing intellectual properties in the Philippines, the importance of integrating IP management in the R & D process and application of IP management tools and concepts in R & D undertakings. This was met with positive feedbacks from the participants.

Utility Model Registration		
Date Issued	Title	Registration Number
May 21, 2014	Pharmaceutical Grade Pectin from Mango Peels	2-2013-000466

Utility Model Application		
Date Filed	Title	Application Number
April 24, 2014	Tractor Drawn Cassava Digger	2-2015-201
May 23, 2014	Multi Fuel Auto-Fed Biomass Furnace for Grain Dryers	2-2014-328
May 23, 2014	Depulping Drum	2-2014-329

Copyright Registration		
Title	Registration Number	Class of Work
Supply Chain Improvement of Arabica Coffee in the Cordillera Region	B2014-26	B
Pests and Pesticide Use in Eggplant Production in Central Luzon	B2014-27	B
Biomass Utilization as Biofiller for Biocomposite Materials Development	B2014-28	B
Establishment of Agricultural Tramlines for Upland Agriculture in the Philippines	B2014-29	B

Applied Communication Program

To extend PHilMech generated technologies and systems, the Applied Communication Division of PHilMech packages and disseminates information, education and communication (IEC) materials. These IEC materials in different media formats reach various industry stakeholders like the policy and decision makers, academe, farmers' groups and associations, small-scale entrepreneurs, intermediaries like the regional agricultural engineers, information officers, and other end-users.

Two sections of ACD have accomplished the vital tasks of IEC production and dissemination. These include the Science and Technology Information and Packaging Section (STIPS) and the Science and Technology Information Dissemination Section (STIDS). Through communication projects implemented by the sections, alongside with the Office of the Division Chief, 32 kinds of IEC materials were produced, totalling 90 205 copies. The major final outputs of ACD in 2014 are shown in Table 1.

The ACD-STIPS has implemented four communication projects to accomplish the following objectives: (1) to increase general awareness on postharvest and mechanization; (2) to publish journals and other technical publications; (3) to process document and package success stories on postharvest and mechanization; and (4) to develop easy-to-access IEC materials on postharvest and mechanization.

Among the popular publications produced by ACD-STIPS include newsletters, comics, magazines, leaflets and PHilMech notes. Technical publications include journal, technical bulletin, and technology bulletin.

For audio-visual materials, the ACD-STIPS produced three videos and 400 digitized IEC materials.

The PHilMech website is another popular medium also used by STIPS to disseminate postharvest and mechanization information.

Table 1. IEC materials developed and disseminated by ACD in 2014

Section Projects	IEC Materials	No. of copies/ prodn	Target audience
STIPS			
Creating Awareness on Postharvest and Mechanization	• PHilMech Newsletter (quarterly issue) • Annual Report • PHilMech leaflet • Infokit • Agri-Magazine features • Website news • Facebook • Twitter	12 000 (3000/issue) 1000 5000 1000 10 15 91 73	PHilMech Speciass Network, SCUs, information officers, PhilMech visitors and exhibit viewers, internet users
Publishing PHilMech Journal and Other Technical Publications	• Postharvest Mechanization Journal • Technical Bulletins – Ex-Ante Analysis for the Development of Brown Rice Just-In-Time Hulling Technology – Utilization of Mango Peels as Source of Pectin • Technology Bulletin (MCSTD)	1000 2000 (1000) (1000) 1000	SCU librarians, academe, researchers
Process Documentation and Packaging of PHilMech Success Stories	• Gintong Tuklas Komiks (Lasap ng Tagumpay) • Anihan Magazine • Video Documentary, Teknoprenyur (Ikatlong Yugto)	3000 1000 1	Farmer's groups, small-scale entrepreneurs, information officers and he media
Developing Easy-to-Access IEC Materials on Postharvest and Mechanization	• PHilMech Information Notes • Digitized IEC materials • Uploaded materials at the PHilMech website	1200 400 11	FITS, LGUs, SCUs, information officers, E-learning enrollees
STIDS			
DSC for Postharvest and Mechanization Technologies	• Technology Leaflet – Soybean – Coffee • Technology brochure (PHilMech HVCC technologies) • Technology kit (with 10 technology flyers) • Advertisements	 2000 2000 3000 7000 6	Farmers, trainers and extension workers

Communication Support for Rice Mechanization Program	• Rice Mechanization Bulletin – Angat Ani Tomo 3 Blg 1 – Angat Ani Tomo 3 Blg 2 – Angat Ani Tomo 3 Blg 3 – Angat Ani Tomo 3 Blg 4 • Technology brochure • Technology Calendar • Factsheets (e-copy)	40 000 (10 000) (10 000) (10 000) (10 000) 2500 5000 4 sets	Rice Mech program implementers and recipients
Public Awareness for Postharvest and Mechanization Technologies	• Billboard • Exhibit Materials • Technology banners	2 6 70	General public, visitors, exhibit viewers
Communication Support for the Organic Agriculture	• Program jingle • Promotional materials	1 2 sets	OA program implementers & recipients
Localized Communication Campaign in Support to Rice Mechanization Program	• Workshop-seminar kit	4 sets	RFO communication staff
Office of the Division Chief			
Enhancing the Agricultural Extension Delivery System of Postharvest and Mechanzation through the Stae Colleges and Universities and the Techno Gabay Program	• School-on-the Air Modules – Postharvest handling of horticultral crops – Corn Postproduction System – Mycotoxin in corn • Postharvest Sections • Technology Forum	3 350 grad. 380 grad. 251 grad. 6 757 particcipants	Farmers, extension workers SCUs

Table 2. Visitors of PHilMech in 2014

Batches	Total No. of Visitors	Types of Visitors				
		Farmers/ Fisherfolk	Faculty and Students	LGU officials/ staff	Private/ NGO	Foreigners
91	2058	1155	560	147	100	96

Outside queries are also answered through this website. The ACD-STIPS also taps social networking sites like Facebook and Twitter to share PHilMech information and services. A total of 91 posts have been developed/shared in Facebook while 73 tweets on Twitter.

Meanwhile, the ACD-STIDS conducted six communication projects to increase awareness and interest on postharvest and mechanization. Target audiences for these projects include program implementers, recipients of the technologies and other stakeholders of the industry.

For the year, STIDS has participated in 18 agricultural trade fairs and exhibits to showcase technologies, accomplishments and on-going researches and projects of PHilMech. Crowd drawer were documented during the National Science and Technology Week, BAR exhibit, Corn Congress and Agri-Link. Exhibit visitors made inquiries, sought technical assistance and voiced out comments.

The STIDS has also maintained its Visitors' Bureau to address interests of potential clientele. Last year, the bureau used informative videos and educational presentations to brief 91 batches or 2,058 farmers, foreigners, policy makers and students.

Likewise, STIDS has updated its holding of books and subscriptions for its scientific literature services (SLS) to serve knowledge needs of researchers. For the year, SLS added 23 books to its holdings and subscribed to 16 journals/magazines. SLS served 1225 users.

Lastly, STIDS assisted the Office of the Director IV in tailoring publicity efforts for the agency's programs and accomplishments. Last year, media people national and local has noticed and gave good coverage on the new technologies PHilMech has been implementing.

The Office of the Division Chief also implemented a project entitled, "Enhancing the Agricultural Extension Delivery System of Postharvest and Mechanzation through the State Colleges and Universities and the Techno Gabay Program." Here, technology fora, school-on-the-air, and the establishment of postharvest sections at the SCUs were some of the major activities conducted.

In 2014, technology fora were conducted in collaboration with the Aklan State University (ASU), Don Mariano Marcos Memorial State University (DMMMSU), University of Southeastern Philippines (USeP), and the Central Mindanao University (CMU). A total of 200 individuals participated in the technology forum in ASU, 25 in DMMMSU, 380 in USeP and 132 in CMU.

Postharvest sections were also set up in these abovementioned SCUs including other universities like Romblon State University (RSU), the Misamis Oriental State Colleges of Agriculture and Technology (MOSCAT) and the USeP.

Moreover, a School-on-the-Air (SOA) on the Postharvest Handling of Horticultural Crops was conducted in collaboration with the Benguet State University. This produced 350 graduates. The SOA on Corn Postproduction System was also conducted at MOSCAT producing 380 graduates. Meanwhile, a SOA on Mycotoxins in Corn was also conducted at the Central Mindanao University, producing 251 graduates.

POSTHARVEST DEVELOPMENT & MECHANIZATION SERVICES

Rice Mechanization and Postharvest Program

Sta. Lucia Young Farm Service Provider of Zaragaoza, Nueva Ecija

The PHilMech, through its Agri-Infra Coordinating Unit (AICU) spearheads the implementation of the DA Rice Mechanization and Postharvest Program together with the DA-Regional Field Offices (DA-RFOs), National Irrigation Association (NIA), Local Government Units (LGUs), and other agencies, with strong partnership with the private sector and farmers' organizations. The program aims to: (1) enable rice farmers to increase their access and use of appropriate production and postproduction systems as mitigation for climate change; and (2) realize added income for farmers of at least 15 % from efficient production activities, drying and milling operations.

For the past year, the program had assisted numerous farmers' organizations to have their own farming equipment. On-farm machines such as shallow tube well, hand tractor, four-wheel tractor, drum seeder, combine harvester, thresher, rice reaper and seed cleaner were provided to them through counter-parting scheme. Off-farm facilities like mechanical dryers and modern rice mills are also part of the program.

Aside from project leadership and monitoring activities, the DA Rice Mechanization and Postharvest Program Secretariat at AICU provides also technical and administrative tasks under the different activities of the program. Some of these include the (1) conduct of workshop for the crafting of the Mechanization and Postharvest Masterplan, (2) facilitate the conduct of meetings of various Technical Working Groups, (3) serve as subject matter specialists and resource person to seminars and conferences, and (4) evaluation of nominees for the 2013 Rice Achievers' Award.

Sustainability of the Mechanization and Postharvest Facilities/ Equipment Distributed Nationwide

PHilMech, in partnership with the DA-RFOs and the LGUs undertake the sustainability program with the ultimate goal of ensuring the functionality and utilization of the postharvest facilities distributed nationwide.

This year, the team conducted 34 batches of assessment meetings and technical orientations among the partner-beneficiaries of the Rice Mechanization Program. These meeting and orientations focused on the management of the combine harvester, four-wheel tractor, rice reaper, rice transplanter and rice mill. The activities aimed to evaluate and assess the functionality and utilization of the facilities as well as refresh the recipients on their accountability to operate, maintain, and improve utilization of the facilities.

Also, under this project was the conduct of Skills Training Course on the Operation and Management of Mechanized Rice Transplanting. Four batches of this training were conducted in 2014; two batches in Luzon and one batch each for Visayas and Mindanao.

Skills Training Course on the Operation and Management of Mechanized Rice Transplanting in Nueva Ecija, Laguna, Aklan and Davao City (clockwise)

Establishment of Agricultural Tramlines for Upland Agriculture in the Philippines

New design of the agricultural tramline system

The difference between good and better price of produce is quality.

One of the problems encountered by farmers in rural areas, especially those in hilly and mountainous regions, is marketing of produce with its optimum profit. Many of these regions are hard to reach as they are separated by rivers and with no roads. They transport their produce by carrying on their back by foot, others use sled being pulled by a carabao or cow and some cross rivers. With these modes, produce were damaged and only small portion were sold to market, not with the price as ideal as the produce were freshly harvested.

Thus, Philippine Center for Postharvest Development and Mechanization developed the agricultural tramline to facilitate transport of farm produce and at the same time minimize production losses. Agricultural Tramline Sytem (ATS) is one of the safest, cheap, and fast transport system of farm products and agricultural inputs from the mountainous areas to the production area or nearest road network. Aside from this, it is easy to maintain, it reduces hauling time and cost.

Six units of tramline have been completed and turned over to farmer groups and LGUs in 2014. These new units have unique features and improved design. For greater safety on the operation, sizes of cables were increased, the track cable was doubled, reinforcements and structures were increased in size and tramline carriers were enhanced. Additional safety features such as rubber bumpers and emergency engine stop mechanism were also included in the stations.

Prior to the turn-over of the completed tramlines, technical trainings for operators and recipients were conducted. Proper management and maintenance of the facility were emphasized among the technology users. Organizational and financial management were also part of the training given to the recipients.

Initially, the projects were turned over to the Local Government Unit and later, they will facilitate the turn-over to the farmers' organization. Monitoring of the completed units will be supervised by the Local Government Units. Information, education and communication materials on the agricultural tramline and other related postharvest and mechanization technologies were also given to the recipients.

The ATS, literally, now serves as the bridge for farm inputs in upland agricultural areas to market farmers' produce with minimized losses while maintaining best quality, hence, obtaining optimum profit.

Provision of Postharvest Facility in Support to the National Organic Agriculture Program

The National Organic Agriculture Program (NOAP) through Executive Order 481 recognizes the potential of organic agriculture in enhancing the value-adding component of agricultural exports and local consumption of products. It aims to establish strong interest in promoting organic agriculture with the support from government on research, development and extension (RDE) activities.

The Philippine Center for Postharvest Development and Mechanization (PHilMech), as a lead agency in providing continuing research for postharvest technologies, was tasked to validate and evaluate organizations; document project activities; conduct trainings needed; provide technical assistance; provide testing, distribution and inspection of postharvest facilities; and conduct monitoring activities.

This project is being implemented by PHilMech in collaboration with the Department of Agriculture – Regional Field Office (DA-RFOs) and Local Government Units (LGUs) in support to NOAP. Assistance to peoples' organization (POs), nongovernment organizations (NGOs) and other stakeholders will also be extended.

Compact corn mill

Paddy huller

The projects' main objective is to improve the postharvest operations in the organic agriculture sector through the establishment of appropriate and efficient postharvest facilities and equipment.

The following are the accomplishments of the project in 2014:

- Delivered and installed 15 units of paddy huller nationwide;
- Delivered 1 unit of PHilMech-design Corn Mill; and
- Conducted 15 batches of on-site training of recipients on the operation, maintenance and management of the facilities.

PHilMech continues to lead and support the National Organic Agriculture Program through research and improvement of postharvest facilities to further develop the organic agriculture in the country.

Establishment of Modern Integrated Rice Processing Complexes in the Philippines

The Korea International Cooperating Agency- Rice Processing Complex project is a complete package for the farmers to address their problems on the lack of postharvest facilities and working capital as well as weak management. This project intends to capacitate the farmers through their organizations to operate and manage the RPCs.

In 2014, the DA conducted strategic and business planning and training orientation on the RPC systems and procedures. These trainings were participated in by officers and board of directors of the Farmers Organization (FO) qualified to operate and manage these RPCs.

These activities are aimed at educating the farmer leaders on the systems and procedures inside the RPC business operation and prepare them for the eventual transfer of the operation and management to their organization. Likewise, workshops were conducted to evaluate the operation and resolve problems by each RPC. In this period, each RPC is able to share its experiences and good practices to other RPCs.

The operation and management of the Pangasinan RPC was transferred the partnership of the ALBACOPA Federation of Cooperatives (ALBACOPA) and Pangasinan Federation of Irrigators Association (PFIA) on September 29, 2014. It was attended by about 250 farmers of Pangasinan. However last December 15, 2014, the ALBACOPA resigned as FO operator. The operation and management of the Bohol RPC was transferred to the Bohol Farmers Multi-Purpose Cooperative (BOFAMCO) on November 7, 2014 attended by about 200 farmers from Bohol. Qualified FOs in Iloilo and Davao del Sur are currently completing their requirements.

SUPPORT TO RESEARCH, DEVELOPMENT & EXTENSION

Harmonized Agricultural and Fisheries Research, Development and Extension Agenda

For the year 2014, the Planning, Management and Information Technology Division (PMITD), through its Planning and Project Development Section, has actively conducted validation workshops for the purpose of coming up with relevant researchable areas consistent with the strategic directions of the agency. Conduct of these activities is also in support of the newly enacted law, RA 10601, also known as the Agricultural and Fisheries Mechanization Law or the AFMech Law.

RA 10601 was passed into law on June 5, 2013. This law covers the entire gamut of agricultural and fisheries mechanization from conceptualization, technology development, extension, promotion, distribution, supply, assembly, manufacturing, regulation, use, operation and maintenance of agricultural and fishery tools, machinery, equipment and infrastructures. In the said law, PHilMech's mandate was expanded to include leadership and coordination of all agencies and local government units involved in agricultural and fishery mechanization research programs and projects. Also, PHilMech in partnership with the University of the Philippines in Los Baños, Agricultural Mechanization Development Program (UPLB-AMDP) shall also harmonize the Research, Development and Extension (RDE) of Higher Education Institutions (HEIs) in the country.

Thus, in June 2014, PHilMech conducted the first organizational workshop for the establishment of the Agricultural and Fishery Mechanization Research, Development and Extension Network, also known as the AFMechRDEN. The AFMechRDEN, as specified in the law, consists of educational institutions, LGUs, non-government institutions and the recognized and well-established associations of agricultural and fishery machinery assemblers, manfacturers and distributors, agricultural engineers, famers and fisherfolk. The said workshop was conducted to finalize the membership of the said network, formulate guidelines for the network operations and formulate the RDE planning framework. One major workshop output was the completion of the guidelines and procedures for the establishment and operations of the network. In addition, the strategic directions for the RDE Agenda were also formulated. The AFMechRDEN envisions a "unified and strengthened Agricultural and Fisheries Mechanization Research, Development and Extension for food sufficiency, economic prosperity and global competitiveness."

Also, as part of the regular planning activities of the agency and as an input to the RDE Agenda specified under the AFMech Law, three island-wide workshops were conducted. These workshops aimed to validate the directions, issues and researchable areas of the key commodities of the agency. PHilMech identified the following commodities as priority: rice; corn and cassava; cacao; coffee, cashew and soybeans; onion and vegetables; fruits (banana and mango); and fisheries.

The year 2014 has indeed been a busy year for PMITD, taking cognizance of its key role in crafting a sound Research, Development and Extension Agenda that could serve as compass in the conceptualization of suitable, germane and high impact projects deemed necessary in the development of agriculture and fishery sector.

Monitoring and Evaluation of Agency Programs, Projects and Activities

Monitoring and Evaluation (M& E) plays a vital role in the efficient and effective implementation of a certain program, project or activity. It aims to measure and assess the performance of a specific program or project to achieve the desired results. Likewise, it serves as a tool of the management in making the necessary decisions that lead to the improvement of project implementation.

The Evaluation and Management Services Section (EMSS) of the Planning, Management and Information Technology Division is tasked to conduct and implement the M&E activities of the agency. Basically, the M&E function of EMSS includes three major activities: 1) The Detailed M&E Activities; 2) The Annual Agency In-House Research and Development Review; and 3) The Midstream Agency Performance and Budget Review.

Detailed M&E Activities primarily includes progress monitoring and on-site monitoring/ field validation activities of both on-going and completed projects. This comprises monthly gathering/ collection of accomplishment reports from project implementers, and preparation of M&E reports for submission to the management and other concerned units and agencies of the Department of Agriculture. Reports that are submitted regularly were the Agency's Budget Accountability Report/ Physical Report of Operations (Quarterly) and Highlights of Accomplishments (Annual, Semestral and Quarterly).

Also, on-site monitoring/field validation is being undertaken to ensure that project activities were implemented as planned. This activity usually involves interview of recipients/cooperators and actual observation of on-going activities of the project. For 2014, various projects, were monitored in different locations nationwide, which include the Utilization of Coconut Water Extracted from Matured Coconut, Design and Development

Project monitoring activity

of a Cassava Harvester - Phase 1: Development of the Cassava Digger, Enhancing Agricultural Extension Delivery System of Postharvest & Mechanization Through the State Colleges and Universities (SCUs) and the Techno Gabay Program, Development of Pilot-Scale Fully Fluidized Bed Drying System for High Moisture Paddy, Paddy Huller, Agricultural Tramline System and Flatbed Dryer.

In May 2014, the Annual Agency In-House Research and Development Review was conducted. This activity specifically aims to evaluate the extent of accomplishments of PHilMech R and D projects, its significant outputs, potential contributions and the manner of project implementation. For the period covered, a total of 21 R D & E projects (20 completed and 1 on-going/continuing) were presented and evaluated.

In line with the policy of the Department of Budget and Management (DBM) on performance-based budgeting, PHilMech conducted the Midstream Agency Performance and Budget Review. This review was undertaken to determine if the project's actual accomplishments (physical and financial) are consistent with the submitted plans/targets. Project accomplishments were presented and assessed per division based on the approved Physical and Financial Plan (PFP). Discussion of issues/ concerns on project implementation and formulation of decisions were also done. The result of this activity serves as the basis of DBM for additional releases and as input in the evaluation of the agency's budget proposal during budget preparation.

2014 Agency In-house Research, Development and Extension Review

Information and Communications Technology at PHilMech

WFSR UACS Adaptation

The Financial Management Information System (WFSR) has played a major role in assisting the Finance Division of PHilMech in budget preparation, management, execution and financial reporting. In the implementation of UACS (Unified Account Code Structure), the WFSR has been updated to adapt to the new accounting code classification framework, making sure that all financial data in the budgeting, accounting, auditing, and cash management conform to the new codes.

Online DTR System

In the advent of the internet, online system development gained importance. As one of the core system that supports the administrative functions of PHilMEch the online Daily Time Record system has been developed. It allows employees of PHilMech to access their time records through the internet. Other functionalities includes the ability to create their own travel order, leaves and passout. These encoded records are automatically reflected on their time records ensuring accurate and consistent time logs.

Online Record Management System

Different communications from different regions in the country often floods PHilMech and the Liason Office in Manila, problem in organizing and keeping track of these letters arises. The online record management system has been developed to answer this problem. It records and keeps track of the incoming communications of the agency. It is also designed as a web application, thus access through the internet is possible giving authorized users access in viewing and in providing necessary actions.

Improvement of Daily Operations Through the Continued Enhancement of Information Systems

Employees of PHilMech often face a multitude of daily tasks. The notable one is the requesting of vehicles for their official travels. Often employees are not aware if the vehicle they are requesting are subjected for preventive maintenance, and later on be confronted of problems of finding another vehicle. The Vehicle Information Monitoring System (VIMS) has been enhanced to counter this problem by notifying requisitioners if the vehicle they want to request will be undergoing its preventive maintenance before they even make a request on the system, thus finding a working vehicle easy for employees. This automatic notification of maintenance makes use of mileage readings from actual trip tickets entered by assigned staffs. There are different preventive maintenance profiles recorded for each vehicle to inform requisitioners about the maintenance status of the vehicle they are requesting including the current mileage of the vehicle that caused the notification.

Administrative Support

The Administrative Division is one of the most vital support units in PHilMech. It consists of different sections namely, the Building Maintenance and Transport Services Section, the Human Resource Management Section and the Procurement and Property Section. The Cashiering Unit and Storage Unit also form part of the Administrative Division.

In 2014, the Procurement and Property Section (PPS), which acts as Secretariat to the Bids and Awards Committee (BAC), conducted 14 successful public biddings.

The Human Resource Management Section (HRMS) provided the manpower boost geared at ensuring work productivity and efficiency through the various lined up activities.

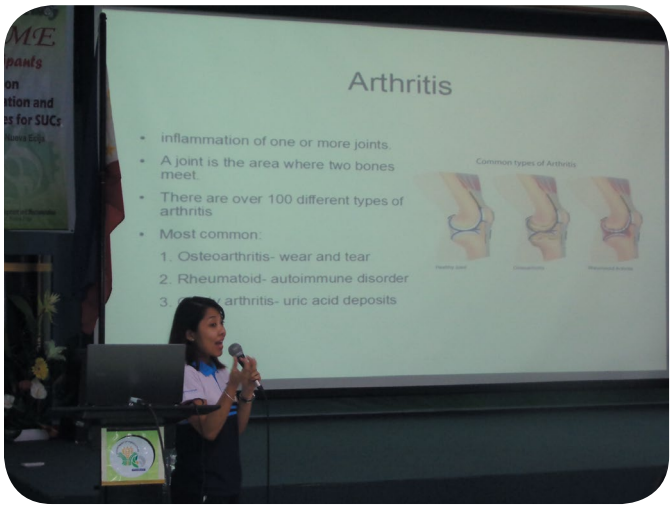
The HRMS was instrumental to the successful conduct of in-house trainings that broadened the knowledge of employees as well as enhanced their skills. There were three in-house trainings and seminars conducted during the year: (1) Seminar on Application of Statistics on Postharvest and Mechanization Research; (2) Seminar on "Cancer Biomarker and Plant Natural Products Discovery; and (3) Training on the Philippine Technology Transfer Act and Technology Disclosure and Basic Patent Drafting.

To ensure a healthy workforce, HRMS conducted health and wellness activities during the year. During the National Women's Month Celebration, a Seminar on "HPV Detection and Cancer Prevention" was conducted. The activity created awareness on the precautionary measures and early diagnosis which could reduce incidence of mortality from cervical and certain cancers. Moreover, in collaboration with the Gender and Development Focal Unit of PHilMech, the staff participated in the "Run for Women's Education".

In support to the celebration of the 114th Anniversary of the Philippine Civil Service, the PHilMech employees and staff joined other participants from Nueva Ecija in the R.A.C.E. to Serve Fun Run, organized by the CSC Nueva Ecija Field Office and Nueva Ecija Council of Personnel Officers.

As part of the PHilMech's Employee Wellness Program, a seminar on the health of joints, muscles and bones was conducted. The participants were encouraged to give attention to their lifestyle that should consist of healthy diet, regular exercise and good posture to avoid rheumatism, arthritis, gout and back pains.

A Seminar on Physical Fitness was also conducted, where participants were briefed on the benefits of exercise and physical fitness. After the lecture, the participants joined the "Zumbathon," a dance marathon where all the participants who endured the one-and-a-half (1 ½) hour non-stop dancing were given prizes and certificates.



Wellness Seminar

Moreover, in collaboration with the PHilMech GAD Focal Unit, the AD- HRMS revived the operation of the Summer Day Care Program. There were 14 kids who enrolled. The Day Care Program is part of the GAD activities which provides support system/ services to ease the burden of PHilMech working parents.

In line with the Manpower Development Program of the AD- HRMS, selected employees participated to various local trainings. Others attended a number of trainings abroad funded by different international organizations.

Moreover, four PHilMech scholars finished their master's and doctorate program in 2014. Two have doctorate degrees in Rural Development and Economics. Two have master's degrees in Environmental Engineering and Business Administration.

The AD-HRMS also facilitated the preparation and conduct of employee-related activities during the celebration of the Munoz Charter Anniversary, Women's Month, PHilMech's 36th Anniversary, Employees' Day, World Food Day, PHilMech Tower Lighting and Childrens' Christmas Party.

Zumbathon is a dance marathon where all the participants endured the one-and -a half hour non-stop dancing

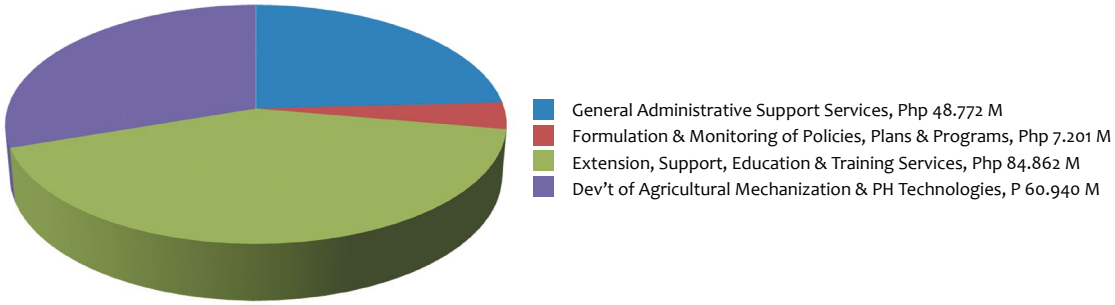
Financial Resources

For CY 2014, PHilMech had a total budget of P 201.775 million. Of this amount, Php 201.613 million was used for the implementation of the agency's current year's programs, projects and activities. Remaining balance of P 0.162 million was carried over as continuing appropriation from the 2013 unobligated balances. Obligations incurred for the year totaled P 193.341 million. This was 95.82% of the available allotment.

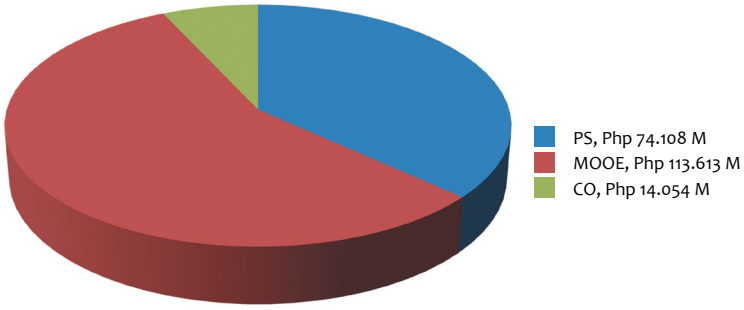
The agency also received Php 9.211 million from other government agencies as trust receipts. The funds were used for the implementation of research projects and acquisition of postharvest facilities.

FUND SOURCES	PROJECT TITLE	AMOUNT
Bureau of Agricultural Research	• Agency In-house Review	Php 50 000.00
	• Occurrence of Ochratoxin A in Philippine Cacao Beans and Cacao Products	1 350 000.00
	• Enhancing the Reasearch Capability of Postharvest Pathology and Mycology Laboratories of PHilMech through the Acquisition of Scientific Equipment	1 000 000.00
	• Enhancing the Reasearch Capability of Bioprocess Engineering Research Laboratory of PHilMech through the Acquisition of Scientific Equipment	1 000 000.00
	• Pilot Testing Integrated Soybean Production - Processing Technologies towards Accelerating the Development of the Local Soybean Industry in the Philippines	1 500 000.00
	• Feasibility Study on the Establishment of a Commercial Irradiation Facility for Agricultural Products and Other Purposes	2 238 650.00
Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development	• Development of Village-Level Rice Mill with Impeller Huller	987 267.00
	• Retrofitting of a Compact Rice Mill for Brown Rice Production	401 992.00
	• Design and Development of Hand Tractor Attachments	467 821.00
Metals Industry Research and Development Center	• Retrofitting of a Compact Rice Mill for Brown Rice Production	215 530.00
	TOTAL	**Php 9 211 260.00**

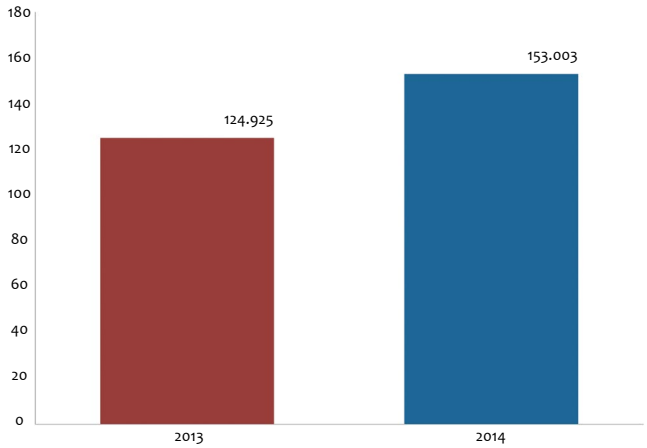
The graph below shows the distribution of Php 201.775 Million budget which covers the operational requirements of the programs, projects and activities (PPA's) of the agency.



The figure below illustrates the distribution of budget by allotment class – Personal Services, Maintenance and Other Operating Expenses and Capital Outlays.



Below is the comparative budget for Major Final Output (MFO) 1 for Technical and Support Services for 2013 & 2014.



LIST OF PROJECT IMPLEMENTERS

Research and Development

Development of Fluidized Bed Dryer for Complete Drying of High Moisture Paddy
R.J.Pontawe, N.T. Asuncion, R.B. Villacorte, R.C. Martinez

Development of Probe Meter for Moisture Detection of Selected Grains
A.C. Joaquin, ME.V. Ramos, R.P. Gregorio, R.C. Martinez

Development of Village Level Rice Mill with Impeller Huller
M. Gragasin, J. Illustrisimo, R.P. Gregorio

Pilot Testing of PHilMech Compact Corn Mill
M. Gragasin, J. Illustrisimo, I. Salapare

Improvement and Field Testing of the Mechanized Onion Sorter
RJ.P. Macaranas, ME.V. Ramos, R.C. Nodora Jr, R.C. Martinez

Ohmic Blanching of Selected Vegetables
JJ.M. delaTorre, O.A. Capariño

Utilization of Coconut Water Extracted from Mature Coconut
O.A. Capariño, K.S. Soliven, R.L. Bingabing, JJ. M. dela Torre

Optimization of Parboiling Conditions of Local Rice Varieties
A.M. Tuates Jr, SM.A. Villota, A.R. Ligisan, O.A. Caparino

Evaluation of Cooking Qualities and Sensory Attributes of Parboiled Rice
SM. A. Villota, A.M. Tuates Jr, O.A. Capariño, A.E. Badua, R.R. Paz

Effect of Ethanol Vapor on the Quality of Broccoli
M.V. dela Cruz , JL.P. Baligad, M.A. Acda

Technical and Socioeconomic Evaluation of Non-Refrigerated Storage System for Smallholder Onion Farmers
R.G. Idago, R.SM. Dela Cruz, D.R. Miranda

Development of Postproduction and Processing Mechanization Systems for Soybeans
MC.R. Antolin, C.F. Neric Jr, R.SM. Dela Cruz

Toxigenic Potential of Fungal Species from Coffee Beans in the Philippines
D.G. Alvindia, M.F. de Guzman, M.A. Acda

Field Evaluation of Biocontrol Agents in Managing Crown Rot Disease of Banana
E.Z. Davalos, D.G. Alvindia, M.A. Acda, M.F. de Guzman

Utilization of Onion Solid Waste as Feedstock for Biogas Production
A.R. Ligisan, A.M. Tuates, O.A. Capariño

Development of a Pilot Scale Processing System for the Production of Pectin from Mango Peels
MC.B. Gragasin, O.A. Capariño, A.R. Ligisan, D. Ognayon

Development of Cassava Digger
RJ.P. Macaranas, ME. V. Ramos, R.C. Nodora Jr, R.C. Martinez, TM. Q. Ancheta

Development of Hand Tractor Attachment– Rice Transplanter and Combine Harvester
R.L. Bingabing, R.C. Martinez, D.V. Mateo, R.J.P. Macaranas, PV.SJ. Capiral, F.L. Mercado, J.C. Barayuga

Benchmark Studies on Postharvest Handling of Major Lowland Vegetable
MC.R. Antolin, E.D. Flores

Establishment of Benchmark Information on Postharvest and Mechanization of Selected Commodities: Shallot, Cassava, Cardava Banana and Bulb Onion (Red and Yellow)
G.B. Calica, J.P.B. Conlu, K.R. Lingbawan, J.T. Ceynas ,R.SM. Dela Cruz

Extension Support, Education and Training Services

Enhancing Entrepreneurial Capability of PH & Mechanization Adopters/Investors through the Provision of Business Development Services
P.C. Castillo, K.M. Mercado, G.M. Tolentino

Provision of Technical Assistance for Postharvest Enterprise Development
P.C. Castillo, R.B. Daligcon, G.M. Tolentino

Feasibility Study on the Establishment of a Commercial Irradiation Facility for Agricultural Products and Other Purposes
G.O. Mallo, P.C. Castillo, G.M. Tolentino, R.L. Bingabing, MRD.B. Negrite, R.A. Comia

Profitability Analysis Modules of Selected MCSTD-Based Enterprises
P.C. Castillo, K.M. Mercado, G.M. Tolentino

Industry Manpower Development Program
E.T. Cayabyab, H.R. Calica, M.M. Pascual, M.V. Pascua, AM.A. Cajucom, J.S. Garabiles

Intensifying the Promotion of PHilMech Generated Technologies
R.O. Vereña, E. T. Cayabyab, V.O. Bolcio Jr

PHilMech Industrial Promotion Program
E.T. Cayabyab, E.C. Ablaza, MV. B. Castro

Technical Support to Intellectual Property Rights
E.T. Cayabyab, E.C. Ablaza, MFL.D. Magpantay

Applied Communication Program
R.P. Estigoy, M.B. Gonzalez, BG.S. Magararu, I.DC. Davalos, A.V. Hipolito, D.T. Esteves, J.R. Aguilar, PEP.C. Castro, M.L. Jose, GM.Z. Carganilla, JM. G. Subaba, A.P. Bermudez, R. de Guzman, J. Gaspar, V.B. Caliguiran, C. G. Nartatez

Postharvest and Mechanization Development Services

Rice Mechanization and Postharvest Program
A.E. Badua, C.C. Balajadia, R.M. Hermoso, DD.T. Julian, D. Jamora, E.B. Testa, MV.B. Castro, MC. Aragon, KG.R. Torres, L. Bautista, AD.V. Mangaoil, M.L. Collado, R. Soriano, R.R. Parica, A.A. Gavino, D. Labrador, M. Ariño, N. Bengosta, R. Areno, JP. Acero, R. Amistad, B. Mentolaroc, L. Diolanto, B. Dimas, R. Adarna, J. Neri

Sustainability of the Mechanization and Postharvest Facilities/Equipment Distributed Nationwide
A.E. Badua, R. Marquez, J. de Galicia, N. Sebastian, C.C. Balajadia, R.M. Hermoso, DD.T. Julian, D. Jamora, E.B. Testa, M.L. Collado, R. Soriano, R.R. Parica, A.A. Gavino, D. Labrador, M. Ariño, N. Bengosta, R. Areno, JP. Acero, R. Amistad, B. Mentolaroc, L. Diolanto, B. Dimas, R. Adarna, J. Neri

Establishment of Agricultural Tramlines for Upland Agriculture in the Philippines
R.R. Paz, A.E. Badua, B.S. Tesorero, A. Calmada, R. Pabilonia, M. Botas

Postharvest Facility Support to the National Organic Agriculture Program
R.R. Paz, A.E. Badua, MC.H. Olito, B.S. Tesorero, N. Sebastian, R.R. Parica, C.C. Balajadia, R.M. Hermoso, DD.T. Julian, D. Jamora, E.B. Testa, M.L. Collado, R. Soriano, A.A. Gavino, D. Labrador, M. Ariño, N. Bengosta, R. Areno, JP. Acero, R. Amistad, B. Mentolaroc, L. Diolanto, B. Dimas, R. Adarna, J. Neri

Establishment of Modern Integrated Rice Processing Complexes in the Philippines
G.M. Tolentino, VE.B. Camaso, AM.S. Galvez

Support to Research, Development and Extension

Harmonized Agricultural and Fisheries Research, Development and Extension Agenda
N.A. Pasalo, O.L. Cancer, D.A. Briones, E.F. Santiago, MA.C. Cordova, J.P. Santiago

Monitoring and Evaluation of Agency Programs, Projects and Activities
N.A. Pasalo, V.M. Barlis, E.S. Estigoy, H.G. Tomas, Z.J. Barza

Information and Communications Technology at PHilMech
N.A. Pasalo, B.T. Belonio, E.V. Circa, M.C. Villar, E.S. Ligisan, JA.B. Lagmay, A.R. de Vera, JC.M. Villanueva, J.T. Carbonel

Administrative Support
R.F. Concepcion, D.B. Ligon, J.A. Foronda, L.A. Idago, L.dS. Ramos, C.M. Villanueva, RA. L. Morota, E.S. Corpuz, MV.S. Tamani, C.S. Encarnacion, R.B. Ontong, A.G. De Guzman, G.P. Panuyas, A.Q. Aquino, P.D. Cardinoza, F.E. Dela Cruz, S.DC. Joson, R.F. Ramos, C.B. Tan, E.C. Tumampo, JC.V. Samaniego, R.M. Cayog, F.G. Dator, F.M.P. Flores, G.R. Pasardan

Financial Resources
RS.R. Reyes, R.S. Ortiz, J.N. Dela Cruz, M.R. Dizo, J.C. Ballado, MT.T. Diño, A.A. Tuates, J.A. Parugrug, AD.C. Garcia, G.M. Miguel, A.D. Bautista

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