



**DOST-ITDI**

**INDUSTRIAL  
TECHNOLOGY  
DEVELOPMENT  
INSTITUTE**

**DEPARTMENT OF SCIENCE AND TECHNOLOGY**



**...EMPOWERING MSMEs  
with Innovative  
Systems & Facilities**





The **Industrial Technology Development Institute (ITDI)** laid the groundwork for S&T in the country. Today, it is one of the DOST's R&D agencies and undertakes multidisciplinary industrial R&D, technical services, and knowledge translation or technology transfer/commercialization. ITDI harnesses know-how in new technology and product innovation and, through the years, has emerged as a credible and reliable industry and government partner in accelerating growth and development in the country.

#### **VISION**

Excellence in propelling development as provider of technologies and services for industry

#### **MISSION**

To make local industries globally competitive

#### **MANDATE**

- ◀ Conduct R&D to generate new knowledge and technologies
  - ◀ Undertake knowledge translation or technology transfer/commercialization
- ◀ Provide technical services, tests, and analyses
  - ◀ Establish, develop, and maintain national units of measure to provide international traceability

# ITDI 2017 ANNUAL REPORT

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## Message

*DOST Secretary 2016 to present*

  
FORTUNATO T. DE LA PEÑA

This year is especially meaningful for ITDI as it shored up growth and improved the productivity of its people and the agency.

As an R&D institute, having three of its researchers conferred the Scientist Rank in the Scientific Career System is no easy feat. I would like to congratulate them as it raises the bar for excellence in scientific inquiry among the RDIs.

It is a rewarding experience to have steered ITDI as it took decisive steps in transformation - in terms of moving into a diversified portfolio of technologies for multiple industries. Its new and clearly defined strategic direction and focus is the best way to create lasting value for a great number of stakeholders including its work force.

As the country faces several challenges such as energy constraints and climate change, ITDI as the current research leader for industries in the public sector, is in a continuing state of transformation to increase innovative competencies and capture higher growth in attractive end-markets. I am confident that ITDI will continue to rise to the challenge.

*Mabuhay!*



## Message

*ITDI Director 2015 to 2017*

  
MARIA PATRICIA V. AZANZA, PhD.

We are pleased to present to our valued stakeholders the 2017 Annual Report of Accomplishments of the Industrial Technology Development Institute (ITDI). As we look back with pride and gratitude at what ITDI has achieved in all three fronts of its mandate – R&D, Technical Services, and Technology Transfer, the year 2017 was quite a fruitful year. We would like to highlight some of these accomplishments as we recognize the various funding agencies, partners, and collaborators of ITDI that helped us achieve our targets for this year.

Foremost, the ITDI strengthened its R&D efforts in providing enhanced technical assistance to industry particularly the MSMEs, the backbone of our economy. The FIC (Food Innovation Center) project has significantly made a dent especially in the food sector where regional FICs are now fully capacitated enabling each one to develop 10,000 food concepts per year and convert these into product prototypes that are ideal for market sampling.

Our Food Processing Division (FPD) - Pilot Plant also acquired its License to Operate (LTO) from the Food and Drug Administration (FDA) as food manufacturer of multi-products. With this LTO, the FPD where the FIC Main is lodged provides assurance to the MSMEs of its compliance with GMP and other requirements.

As FIC lead, ITDI hosted the FIC ASEAN seminar-workshop and engaged delegates from member-states of the ASEAN to share best practices on the establishment and operation of FICs. We also initiated the establishment of the Inno-Hub, a modular multi-industry innovation center for bigger trial production of various products, which will soon be available to the industry.

Enhancement of facilities and services of the ITDI National Metrology Laboratory (NML) including augmentation of manpower commenced in 2017. In particular, the renovation of calibration rooms for laboratory equipment and standards kicked off in July 2017 to ensure appropriate environmental conditions in performing accurate calibrations and measurements. In addition to the existing laboratories on physical metrology, two more laboratories – Metrology in Chemistry (MiC) and Metrology in Biology (MiB) will soon be established. Expansion of facilities for the MiC and MiB shall start early next year. All these efforts aim to strengthen maintenance of the national measurement standards for physical, biological and chemical measurements as well as ensure international traceability of our national measurements in all fields. ITDI is also pushing forward the bill *“An Act Modernizing the National Measurement System of the Philippines, Appropriating Funds Therefore and for Other Purposes”* to support the NML’s transition into the country’s National Metrology Institute or NMI.

R&D initiatives of the institute are also directed towards harnessing the use of locally available materials for advanced applications in various industries. Among these include the use of our natural fiber like abaca, which is known to be one of the abundant and strongest natural fibers in the country. In 2017, ITDI started the fabrication of thermoplastic abaca composite for the belly part of an UAV (Unmanned Aerial Vehicle) or “drone” in collaboration with FEATI University and the PhilFIDA (Philippine Fiber Development Authority). Abaca fiber-reinforced composite was also used for an

e-bike roof using the vacuum assisted resin transfer molding (VARTM) or resin infusion process, an innovative technique in fabricating abaca-fiber reinforced composite in a more complex structure. Nanotechnology was also employed to produce materials from our local minerals such as nanozeolite molecular sieve for CO<sub>2</sub> capture in boilers to reduce greenhouse gas emissions, and a sorbent material for heavy metal removal from wastewater.

Through its Disaster Preparedness Program, the ITDI has been socially responsive to the basic needs of Filipinos like food and water in disaster-stricken areas. In 2017, it deployed developed products from its R&D, among which were 132 units of low cost rainwater collection system, 650 units of portable water filters, and 5,320 pouches of ready-to-eat (RTE) disaster-relief foods.

With the heightened technology transfer program of the Department, the ITDI introduced in 2017 process innovations relative to its technology transfer initiatives. ITDI launched its Technology Offerings, an innovative pre-commercialization strategy aimed to boost the transfer or uptake of technologies developed from R&D to the production sector. This is one of the activities under the PCIEERD-funded project - Pilot Implementation of ITDI's Pre-Commercialization Tools/Strategies for Effective Transfer and Commercialization of Generated Technologies and Intellectual Properties that will run till early next year. Significant developments resulted from these offerings from which 56 clients signified interest to adopt some of the ITDI technologies and follow up activities to consummate transfer are now underway.

The year 2018 may bring about a new leadership but nonetheless ITDI shall continue to deliver its mission with fervor and rise above the challenges.

*Mabuhay!*

# 2017-18 ITDI Technology Offering



INDUSTRIAL  
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DEPARTMENT OF SCIENCE AND TECHNOLOGY



PHILIPPINE COUNCIL FOR INDUSTRY, ENERGY & EMERGING  
TECHNOLOGY RESEARCH & DEVELOPMENT

15 NOV 2017  
**Food**  
Technologies

6 DEC 2017  
**Health &  
WELLNESS**

16 JAN 2018  
**GREEN  
ENGINEERING**

15 FEB 2018  
**ADVANCED  
TECHNOLOGIES**



# HIGHLIGHTS OF 2017

The major research efforts of ITDI for 2017 focused on providing assistance to MSMEs. Each Regional FIC is now capacitated to conceptualize as much as 10,000 concepts/year and convert these into prototypes for market sampling. The modular multi-function innovation center is also being established for upscaled production (100-kg volume capacities) to address the clamor for bigger trial production facilities. Adjunct to MSMEs' Innovation Centers is the enhancement of metrology facilities and services to reinforce the maintenance of the national measurement standards for physical, biological, and chemical measurements. ITDI is also pushing forward the bill "An Act Modernizing the National Measurement System of the Philippines, Appropriating Funds Therefore and for Other Purposes" to support the NMI future establishment.

The pilot testing of a fast innovative approach as Technology Offerings is championed by ITDI to help adopters acquire technologies via the quicker mode

requiring less documents and attractive technology bundles at competitive costs.

The national social service efforts of ITDI for 2017 came in the form of timely disaster response including the deployment of rainwater collection system and nanozeolite portable water filtration systems for heavy metals and, 1<sup>st</sup> to 3<sup>rd</sup> stage relief foods in areas with manmade and natural disasters.

The ITDI received a number of recognition and awards





# ACCOMPLISHMENTS

for 2017, both at the international and national levels. OneLab project received an innovation award for government services. At the international level, recognition came from US-ERA and SEARCA. Applied research awards and individual conferment of achievement awards for staff were also recognized.

**A**lso during the year, three leading ITDI researchers were conferred the rank of Scientist I by the Civil Service Commission (CSC) and Scientific Career Council (SCC), NAST (National Academy of Science and Technology).

**A**s part of the Philippine Chairmanship of the ASEAN Summit, the DOST through the ITDI hosted two ASEAN conferences in October 2017. One focused on engaging delegates from member-states of the ASEAN to share best practices on the establishment and operation of food innovation centers (FICs). Another conference highlighted the packaging achievement of ASEAN member-states

through scientific and technological interventions. These events auspiciously coincided with the 50th Founding Anniversary of the ASEAN.

## NANOTECHNOLOGY

This program focuses on processing and developing naturally occurring raw materials into nanomaterials like nanozeolite molecular sieve and nanocoatings that can be designed and/or fabricated for various applications.

### Nanocoatings

#### Automotive Acrylic Paints for Military Vehicles

The expertise and technical capability of ITDI-DOST has been tapped by the Philippine Army (PA) to establish a uniform green paint coating in all PA Mobility Assets thru the evaluation of the weathering resistance of commercial automotive acrylic paint. This activity ensures the most suitable and superior performance coating for the mobility assets of the national army.



## Nanozeolites Molecular Sieve

### Carbon Dioxide (CO<sub>2</sub>) Capture System in Boilers

Field testing of ITDI-developed nanozeolite sorbent was conducted at Dumaguete City Slaughter House (DCSH), Bajumpandan, Dumaguete City. Test results showed 0.4-0.7% decrease in CO<sub>2</sub> emissions from 30 Bhp diesel-fired boilers which were installed with nanozeolite-CO<sub>2</sub> capture system.

This specific use of nanozeolite sorbent for CO<sub>2</sub> capture is techno-economic viable and environment-friendly. Its application allows for the reuse of the recovered CO<sub>2</sub> by the industry while, at the same time, reducing its greenhouse gas emissions.



### Sorbent Material for Heavy Metal Removal from Wastewater

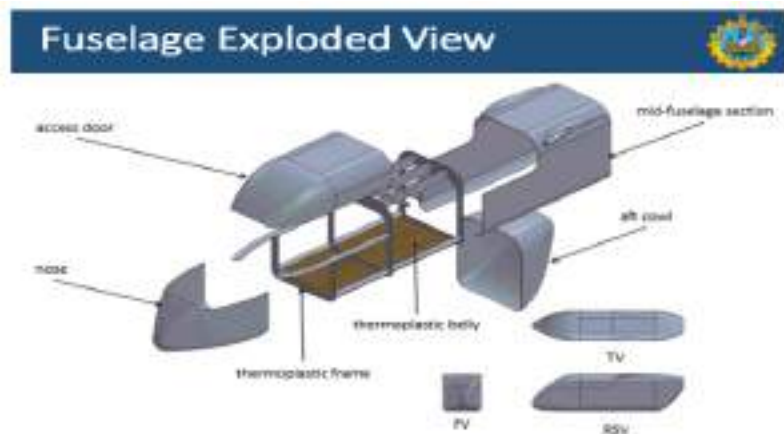
A cost-effective nanomaterial with the capability to treat heavy metal-laden wastewater was produced from locally available zeolite. This developed sorbent material exhibits high removal efficiency that can reach up to 99% targeting specific heavy metals like copper (Cu), lead (Pb), nickel (Ni) and zinc (Zn). The treated wastewater can be reused for manufacturing operation or released back into the environment.



# ABACA FIBER-REINFORCED COMPOSITE

## Airframe for a Medium-Range, Short Take-Off and Landing Unmanned Aerial Vehicle (UAV)

UAV, popularly called "drone", is an aircraft without a human pilot aboard. Aside from military applications, the use of UAVs has now expanded to commercial, agricultural, scientific, and recreational applications. This project is spearheaded by FEATI University, in collaboration with ITDI-DOST and the Philippine Fiber Development Authority (PhilFIDA). ITDI-DOST will fabricate the thermoplastic abaca composites for the belly part. The project team is set to release two prototypes of the UAV in April 2018.



## E-Bike Roof using VARTM Molding of Abaca Fiber-Reinforced Composite

Vacuum Assisted Resin Transfer Molding (VARTM) or resin infusion process is an innovative technique in fabricating abaca fiber-reinforced composite in a more complex structure like e-bike roof. The technology uses abaca fibers which are abundant and environment-friendly. The material is also lightweight and has low heat conductivity, which improves fuel efficiency and protects passengers and drivers from the sun's heat.



# ASSISTANCE TO MSMEs

This program provides various assistance and technical services to micro, small, and medium enterprises (MSMEs) to help increase their productivity and competitiveness.

## Food Innovation Centers

Food innovation centers (FICs) are established in strategic locations in the country to provide the food sector the necessary facilities and services critical to the development of competitive food products.

### Regional Prototyping Facilities

Forty-five units of food processing equipment (FPE) have been deployed to regional FICs. Five out of eight targeted FICs (Regions 1, 3, 5, 13 and CAR) have already been trained with regard to operations, maintenance, and troubleshooting of the DOST-developed FPEs.

The Food Processing Division (FPD) - Pilot Plant acquired the LICENSE TO OPERATE (LTO) from the Food and Drug Administration (FDA), with License Number, LTO-3000001149936 valid until April 21, 2019. The license was issued to FPD as Food Manufacturer of Multi-Products. Pertinent documents were complied with pertaining to the application as contained in FDA-AO No. 2016-0003, "Guidelines on the Unified Licensing Requirements and Procedures of the Food and Drug Administration". With this LTO, the FPD where the FIC Main is lodged provides assurance to the MSMEs of its compliance with GMP and other requirements.



**Bicol Regional Food Innovation and Commercialization Center (BRFICC)**





## Upscaled Modular Multi-Industry Processing Center

The Modular Innovation Center is the core R&D facility of ITDI for advanced scale up researches on food and nutraceutical products using usual by-products of manufacturing operations as starting materials. New innovative products on food ingredients, beauty nutritional supplements as well as development of improved efficient processes will be catered by the center using generic modular equipment with multi-function/multi-application. These equipment can be retrofitted to different manufacturing lines including the use of automation process control and upscaling to pilot capacity production with materials handling support equipment. Industries can use the center for developing new product, product equivalent, product variances, and product reintroduction.

This year, a consultative meeting with the food manufacturing industries dubbed as *Kapihan para sa Industriya* was held on April 18, 2017 at the Advanced Device and Materials Testing Laboratory (ADMATEL) Conference room. A total of 16 partner industries from the food sector signified their interest to use the center.

# Enhanced Metrology Facilities and Services

## Physical Metrology

In the five-year framework of modernizing the National Metrology Laboratory to cover relevant measurement fields needed by the country, enhancement of metrology facilities and services including augmentation of manpower commenced in 2017. Six measurement areas were prioritized: Mass, Density, Volume, Length, Humidity and Temperature.

Calibration rooms for laboratory equipment and standards were renovated starting July 2017 to ensure appropriate environmental conditions in performing accurate calibrations and measurements.

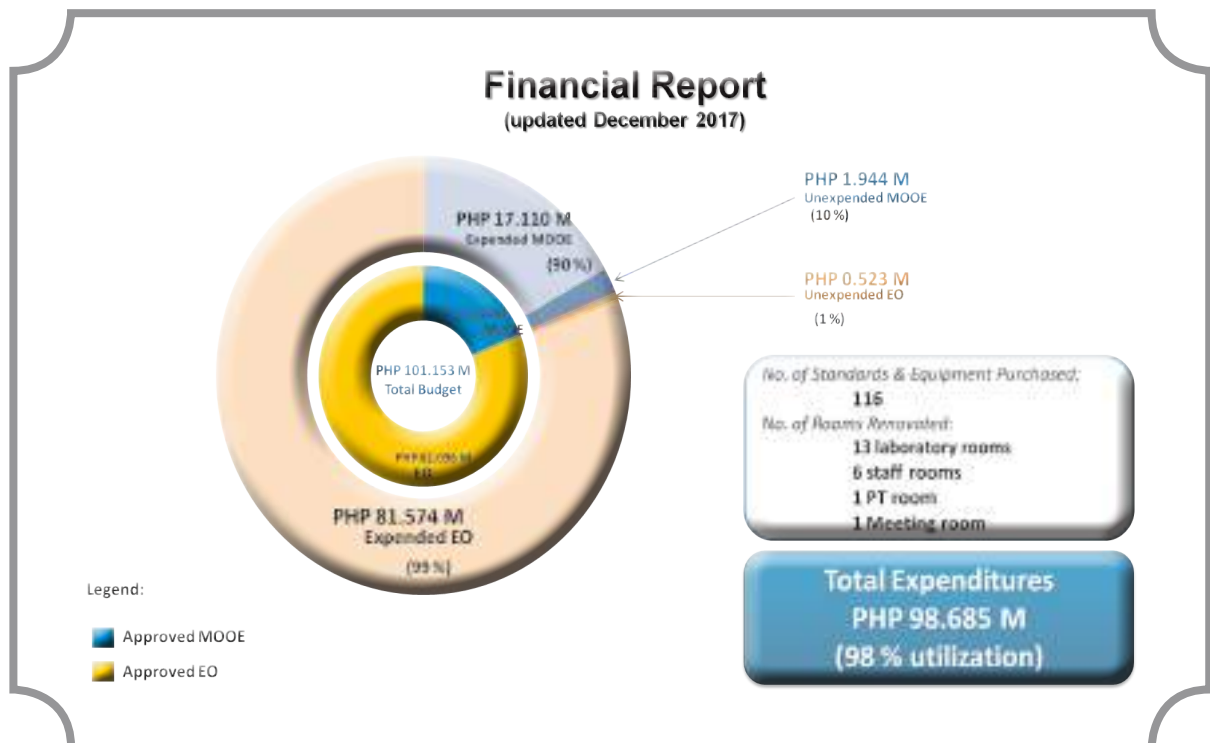


Figure 1. Financial report

## Renovated Calibration Rooms



## Renovated Staff Room & Meeting Room







# Activities and Accomplishments

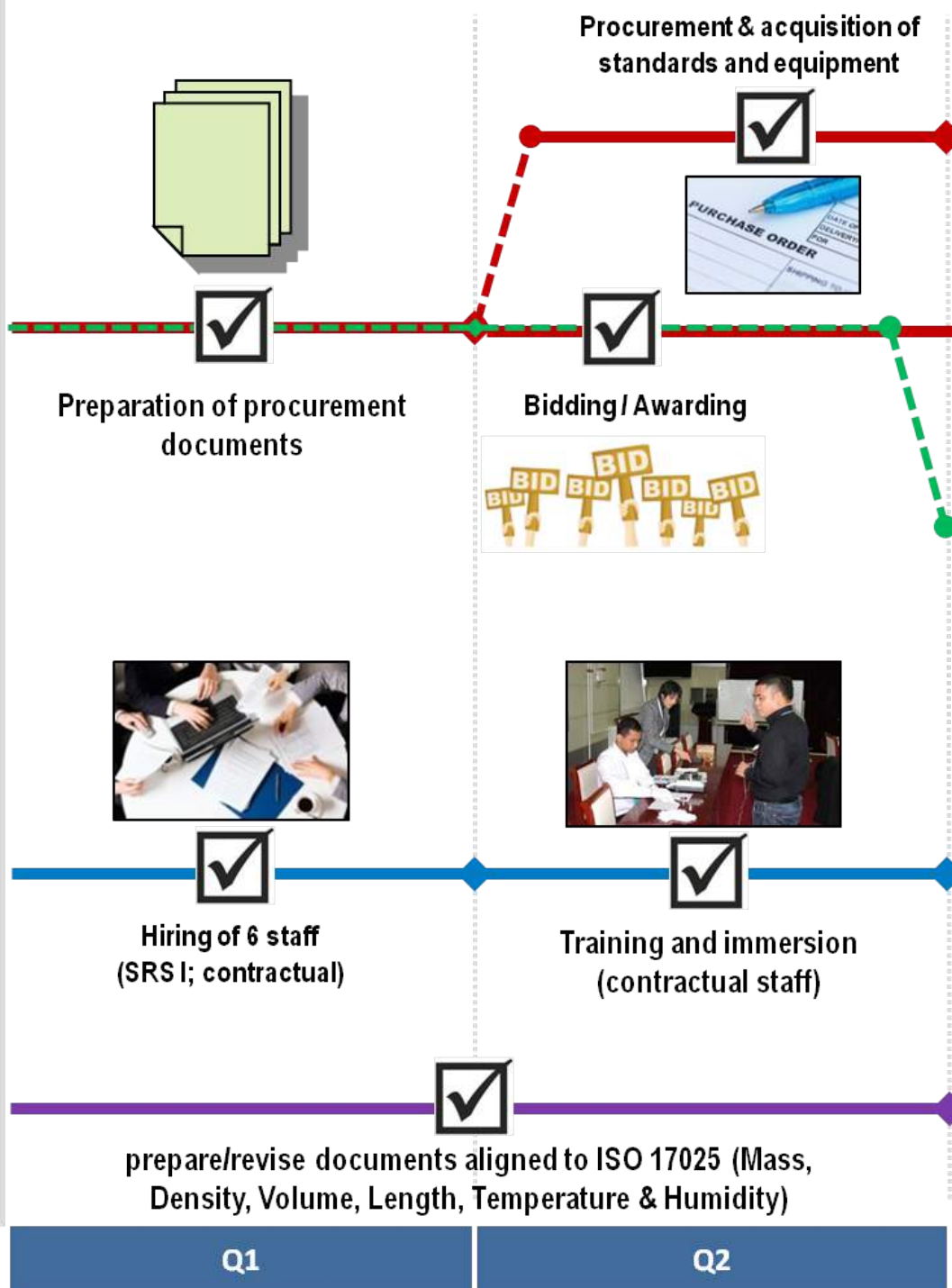
## Objectives

*To retool existing laboratories; to replace worn-out and aged equipment; to acquire additional equipment for new and/or upgraded services; equipment modernization*

*To have proper accommodations for laboratory equipment; to provide proper environmental conditions for performing accurate measurements and calibrations*

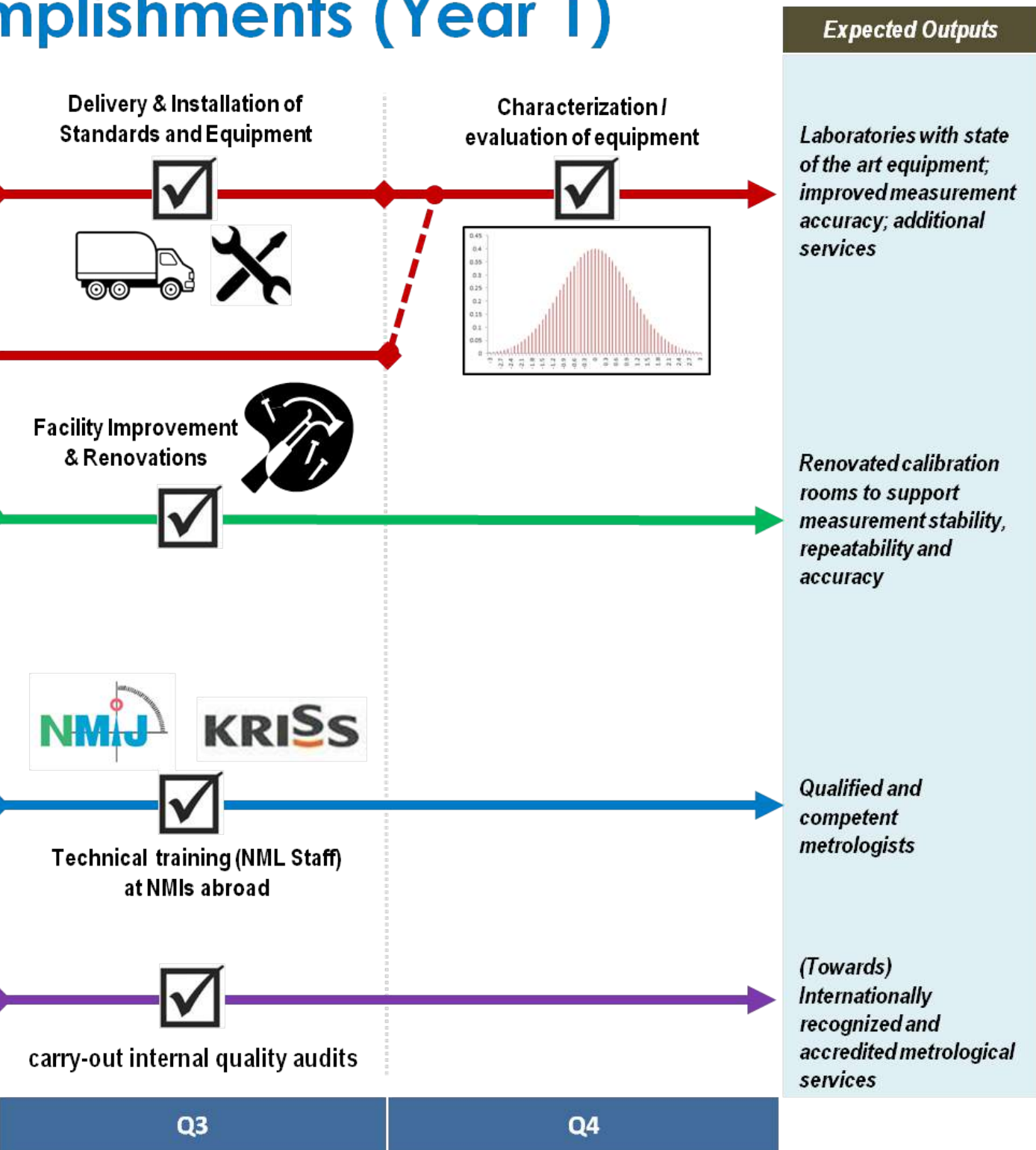
*To develop qualified and competent metrologists*

*To have calibration and measurement services internationally recognized*



The NML is now supported with additional six (6) Science Research Specialists designated and trained in their respective laboratories and are now conducting calibration services for clients. Manpower development plan particularly for local and foreign training courses have been crafted.

# Accomplishments (Year 1)



In preparation for having the calibration and measurement services internationally recognized, preparations and revisions already commenced for the laboratory quality manuals, work instructions, technical procedures, among others for ISO 17025 accreditation in the fields of Mass, Density, Volume, Length, Pressure, Temperature, and Humidity.

## Metrology in Chemistry and Biology

To keep pace with the global interest in food metrology, ITDI started the development of standardized measurement procedure that would enable fast sampling methods and traceability of food contaminants through the Metrology program. ITDI focused on the development and validation of reference methods and proficiency test materials essential for the characterization of contaminants in food and water matrices.

Through the Metrology in Biology project under the program, proficiency test schemes for detection of microorganisms in milk fish and octopus were already developed and conducted in the STD microbiology laboratory. For Metrology in Chemistry, the analysis of benzoic acid in banana ketchup and purity assessment of benzoic acid and histamine were carried out. Primary methods for determination of concentrations of inorganic trace elements such as calcium, copper, zinc, lead, cadmium and iron in food and water matrices were developed and validated. Meanwhile, sulfite analysis in dried mango and mango puree was already studied.



# Modernizing the National Measurement System through Legislation

The Industrial Technology Development Institute is leading the revision of the law on metrology with the aim of ratifying a new legislation that will modernize the national measurement system of the Philippines. This new legislation will replace Republic Act 9236, otherwise known as the “National Metrology Act of 2003,” to meet the ever-evolving demands for accurate and credible measurements. Metrology plays a key role in scientific and technological innovation, and provides fundamental support for environment protection, health, safety, law enforcement and basis for fair trade indomestic and international market.



| 2016 | 1 <sup>st</sup> Quarter 2017 | 2 <sup>nd</sup> Quarter 2017 | 3 <sup>rd</sup> Quarter 2017 | 4 <sup>th</sup> Quarter 2017 |
|------|------------------------------|------------------------------|------------------------------|------------------------------|
|------|------------------------------|------------------------------|------------------------------|------------------------------|

House Bills (3578, 3717, 4059, 4320, 4368) on revising Republic Act 9236 were filed at the Bills and Index Division of the House of Representatives (HoR). (September & November 2016, HoR)



The HoR’s Committee on Science and Technology (HoR-COST) created the Technical Working Group (TWG) to work on a substitute bill for House Bills 3578, 3717, 4059, 4320, and 4368. (6 February 2017, Quezon City)

ITDI briefed the HoR-COST on metrology and proposed revision of Republic Act 9236. (7 March 2017, HoR)

ITDI presented the proposed revision of Republic Act 9236 to DOST Officials and staff of the HoR during the DOST S&T Legislative Forum. (11 March 2017, La Union)

The TWG drafted the 1st version of the substitute bill. (27 March 2017, ITDI)



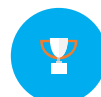
An advance copy of the final draft of the substitute bill was submitted to the TWG. (25 April 2017)

The first public hearing on the substitute bill, organized by ITDI with DOST Regional Office 7 and the HoR-COST, was conducted. (4 May 2017, Dausi, Bohol)



ITDI revised the 1st version based on the comments from the first public hearing and endorsed the 2nd version of the substitute bill to DOST through Department Legislative Liaison Office (DLLO). (14 August 2017)

ITDI officially endorsed the final draft of the substitute bill to HoR through the DLLO. (6 September 2017)



IHoR-COST approved the substitute bill (5 December 2017, HoR)

ITDI presented the substitute bill to DOST Officials and staff of the Senate during the second DOST S&T Legislative Forum. (18-19 December 2017, Tanay, Rizal)



# Innovation in Pre-Commercialization Activities

These are interrelated activities to facilitate systems for the conduct of technology audit, financial valuation, market validation, pitching, and negotiations with possible technology adopters through the technology offering platform with the end goal of successful commercialization of technology innovations.

Consultation/  
Negotiations  
with Prospective  
Clients



# OneLab IT-Based Referral System

OneLab integrates the services of participating laboratories at a single touch point.



- ◀ Two laboratories in the ASEAN joined the network
- ◀ 11 new tests and 38 new services were made available in 2017 to include the following:
  - ◀ arsenic in water
  - ◀ lead
  - ◀ water activity
  - ◀ fatty acid
  - ◀ pencil hardness test
  - ◀ push-pull test
  - ◀ pork DNA detection
  - ◀ crude protein
  - ◀ calibration of LIG and thermometers,
  - ◀ calibration of enclosures (ovens & climatic chambers)
  - ◀ calibration of bimetallic thermometers (analog).



# DISASTER PREPAREDNESS

This program facilitates the development of innovative technologies that address basic needs of Filipinos like food, water, and transport in disaster-stricken areas.

## Low Cost Rainwater Collection System and Portable Water Filter

To address availability of clean water, a rainwater collection system was developed that can store up to 1 cubic meter for non-potable domestic use. A total of 132 units (modular and pillow-type) were deployed in Manila, Quezon City, Taguig, Laguna, Rizal, Nueva Ecija, Mt. Province and Mindanao. Furthermore, 650 units of developed ceramic water filter were also deployed in barangays and communities in said localities.

In June 2017, through the Research Development Center Army Support Command of the Philippine Army, 21 units were distributed in Marawi.





## 1<sup>st</sup> to 3<sup>rd</sup> Stage Relief Foods



Ready-to-eat (RTE) disaster relief foods in retort pouches were developed for consumption in disaster-stricken areas with limited water, electricity, gas, and necessary utensils to open and prepare packaged goods. These RTE relief foods are as follows:



- ◀ Chicken *arroz caldo* (1<sup>st</sup> stage)
- ◀ Smoked fish rice meal and packaged *monay* (2<sup>nd</sup> stage)
- ◀ Cassava in light syrup and boiled sweet potato (3<sup>rd</sup> stage)



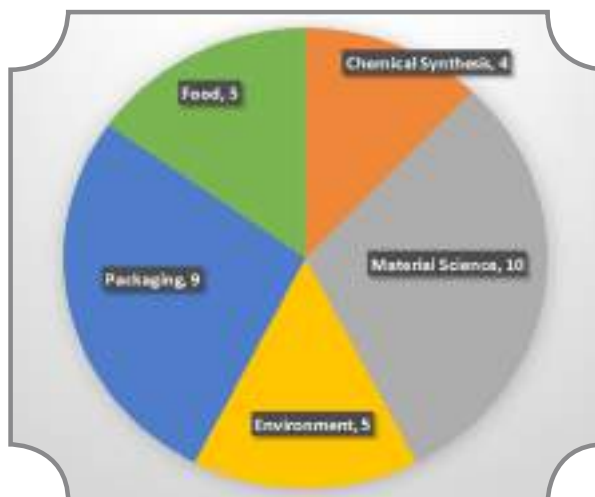
A total of 2,000 pouches of RTE chicken arroz caldo were deployed to evacuees during the Marawi siege while 3,320 pouches of RTE smoked fish rice meal were given to fire victims in Cebu City.



Deployment of RTE Chicken *Arroz Caldo* in Marawi & RTE Smoked Fish Rice Meal in Cebu

# 2017 R&D COMPLETED PROJECTS

A total of 33 R&D projects for 2017 have been completed. Of these projects, 24 are regular or GAA-funded and 9 are GIA or externally-funded delving in various fields including food, packaging, environment, material science, and chemical synthesis.



**Table 1. List of 2017 Completed Projects**

**Figure 2. 2017 Completed projects classified by field of study**

| PROJECT TITLE   | PROJECT LEADER              |
|---|-----------------------------|
| Aerobic Treatment of Anaerobically Pre-digested Swine Wastewater using Activated Sludge and Subsequent Polishing Using Biological Filters/Trickling Filter System | R. Retamar                  |
| Application of Anaerobic Digestion for Household Biodegradable Waste in Kawit, Cavite 9 Alveo-PBE Project)  | D. Herrera                  |
| Application of Retort Packaging Technology in the Development of Disaster Mitigation/ Relief Foods Phase 2 ( root crop based products)                            | G. Noceja                   |
| Application Studies of Nanozeolite in Water/Wastewater Treatment  | C. Gacho                    |
| Characterization of Zeolite Film and Application for Packaging of Fresh (delayed ripening) and Processed (shelf life extension) Mango and Banana                  | D. Tañafranca / A. Basbasan |
| Comparative Analysis of Cushion Performance of Handmade Pulp Moulds vs Common Cushioning Materials in the Philippines   | F. Victoria                 |
| Development of Beverages for Disaster Situation Study 1: Complete Survival on Meal Replacement Beverages (MRB) as Emergency Food                                  | L. Montevirgen              |
| Development of Beverages for Disaster Situation Study 2: Development of Isotonic Drinks for Disaster Situations   | M. Evaristo                 |

| <b>PROJECT TITLE</b>   | <b>PROJECT LEADER</b> |
|--|-----------------------|
| Development, Characterization and Performance Evaluation of Polymeric Separation Membrane for Industrial Application Using Local Materials (Phase 1)   | B. Basilia            |
| Development of a Compact Wastewater Treatment System Enhanced with Bio-Augmentation Technology for Quick Service Restaurants (QSR)   | R. Delos Reyes        |
| Development and Deployment of Low Cost Modular Type Rainwater Collection   | B. Basilia            |
| Development of Fiber Composites  | M. Paglicawan         |
| Development of Generic Packaging and Technology for Selected Food Products of FICs and MSMEs in the Regions  | D. Tañafranca         |
| Deployment and Impact Assessment of Developed Disaster Relief Projects (GAD project)   | MD. Villasenor        |
| Effect of Using Modified Cassava Starch on the Rheological Properties of Selected Food Systems   | ME. Falco             |
| Enhancing the Competitiveness of Fresh Fruits and Semi-Processed Agricultural Products through the Application of Appropriate & Sustainable Packaging (JICA project)   | D. Tañafranca         |
| Evaluation of Acetaldehyde Content in Different Brands of PET-bottled Drinking Water   | J. Diaz               |
| Evaluation of Zeolite-Coated Plastic Films as Food Packaging   | J. Diaz               |
| Field testing of Nanozeolite-based CO <sub>2</sub> Capture System and Purification System for Fuel Grade Ethanol in the Industry<br>Study 1: Performance Testing of Scale Up Purification System for Ethanol Dehydration and Regeneration of Zeolite Molecular Sieve | C. de Vera            |
| Field testing of Nanozeolite-based CO <sub>2</sub> Capture System and Purification System for Fuel Grade Ethanol in the Industry<br>Study 2: Field Testing of Nano Zeolite Sorbent in Diesel-fired Boiler System   | A. Bawagan            |
| Field Testing of Nanozeolite in Molecular Sieve/Membrane Technologies<br>Study 1: Performance Testing of Purification System for Ethanol Dehydration and Regeneration of Zeolite Molecular Sieve   | C. De Vera            |
| Household and Community-based Filters for Metal in Waters  | R. Esguerra           |
| Industrial and Medical Applications of Natural Cellulosic Materials  | P. de Yro             |
| Integration of Testing Services for Rubber and Rubber-based Products   | A. Senica             |

| PROJECT TITLE  | PROJECT LEADER             |
|--|----------------------------|
| Isolation, Purification and Identification (Phenotyping and Genotyping) of Microbial Succession of Philippine Traditional Fermented Foods<br>Stidy 3: Data Mining of Previous Biotechnology R&D Outputs Related to Local Food Processing | F. Coronado                |
| Microbial-Based Technologies for the Rehabilitation of Heavy Metal-Contaminated Wastewater from Mining Site  | C. Gacho                   |
| Modification of Locally Produced Nanosilica for Industrial Hydrophobic Nanocoatings  | J. Celorico                |
| Nanoencapsulation of Herbal Drugs in Hydrogels and Matured Coconut Water as Health Supplement for Musculoskeletal System: Development and Scale-Up Production  | E. Manongsong              |
| Package Development of Bakery Product and Field Testing Study of RTE Smoked Fish Rice Meal and Sweet Potato as Disaster/ Relief Foods (Phase 1)  | D. Tañafranca              |
| Production of Resistant Starch from Cassava for Dietary Applications   | C. Bulan /<br>M. Carandang |
| Risk Profiling of Contaminants in Bottled <i>Tuyo</i>  | C. Bihis                   |
| Roll-out of DOST-Developed Food Processing Equipment to the Regions  | N. Florendo                |
| Scale-Up Production and Application of Studies of Nano Precipitated Calcium Carbonate  | E. Ongo                    |
| Shelf Life Extension of Bakery Products as Relief/Mitigation and Combat Foods Through the Application of Appropriate Packaging Technology  | L. Montevirgen             |
| Southeast Asian Atmospheric Corrosion Exposure Study (SEA-ACES) of Steels, Electronics Equipment and Components in Philippine Marine Environment (Year 3) - NIMS Japan   | A. Monsada                 |
| Surface Modification of Nanozeolite for Water and Wastewater Applications  | J. Celorico                |
| Sustainability of Advanced Device and Materials Testing Laboratory (ADMATEL) for the Semiconductor, Electronics and Other Industries Phase 6 (Operations of ADMATEL)   | A. Monsada                 |
| Treatment of Modified Starch Processing and Post-Consumer Polymeric Wastes   | F. Coronado                |
| Upgrading and Enhancing the Capacity of the Packaging Technology Division in Packaging Research and Innovation (Year 1)  | D. Tañafranca              |
| Utilization of Rice Milling By-Products for the Production of Oil, Syrup (as Food & Industrial Sweetener) and High-Protein Powder  | N. Ambagan                 |

# TECHNICAL SERVICES

In addition to research and development activities of the Institute, ITDI also provides its industry stakeholders with various technical service interventions thru: a) testing and analyses by the Standards and Testing Division (STD), b) calibration by the National Metrology Laboratory (NML), c) other specialized technical services (e.g., environmental technology verification or ETV), and d) testing services by its Advanced Device & Materials Testing Laboratory (ADMATEL).

Income generated from these technical services contributes to funds reverted to the national coffers as part of government revenues. This year, ITDI increased its income by more than 4% (Php 0.3M) from its record last year. In terms of number of customers served, there was a significant increase of almost 36%, a clear manifestation of continued confidence of stakeholders in the test results of ITDI laboratories.

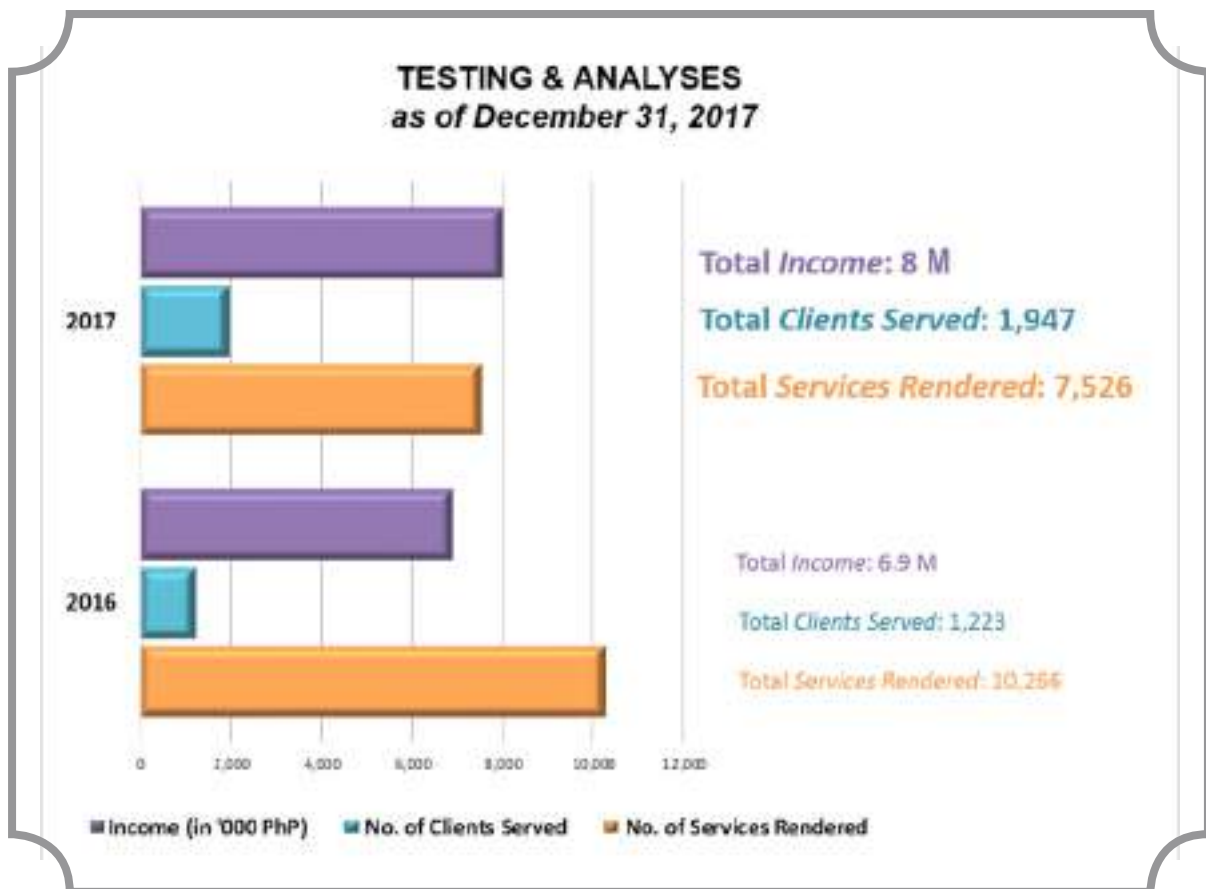
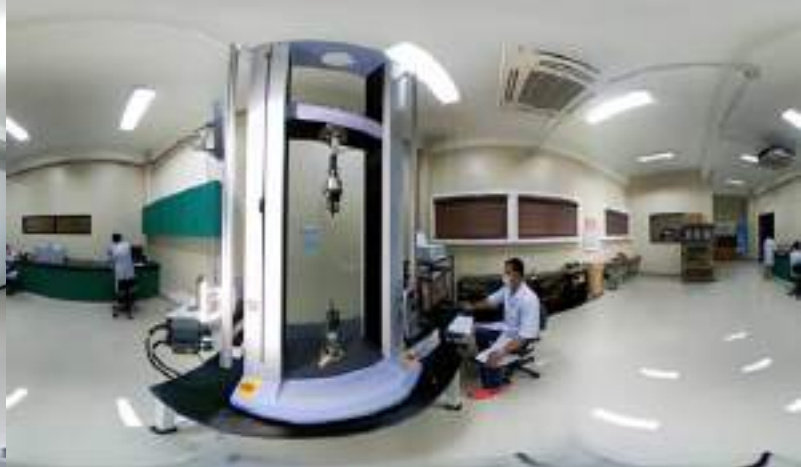


Figure 3. Income from testing and analyses



With the completion of the STD project titled, *“Integration of Testing Services for Rubber and Rubber-based Products”*, its services are projected to increase because the Physical and Performance Testing Laboratory now offers high-end analytical testing for rubber and rubber-based products. New testing services were offered this year, which are first in the country and already accredited under the ISO/IEC 17025:2005 standard.

As to the ongoing enhancement of the metrology facilities to serve better its customers in the long-term, the prospect of a temporary downturn in services to clients as well as income generation was anticipated. Nevertheless, the services of the NML are projected to increase and even surpass its previous records as it moves towards its institutionalization as a National Metrology Institute.



Figure 4. Income from calibration

ITDI continued to provide other specialized technical services to industry and other stakeholders with an increase of more than 7% in services rendered to clients and almost 7% in income generated. The increase was recorded largely for specialized test and analysis, followed by use of facilities of ITDI, and development of label design.

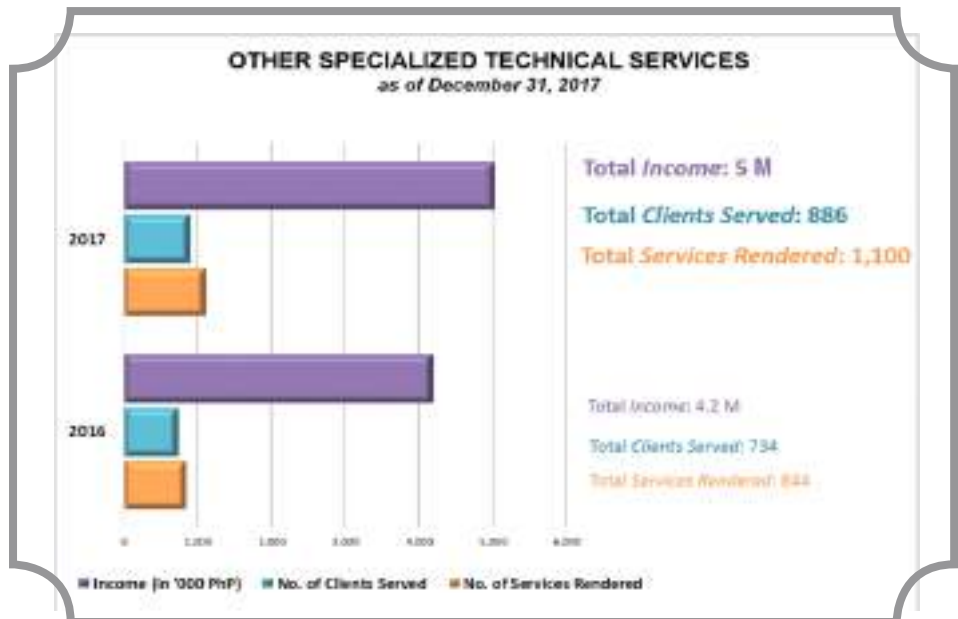


Figure 5. Income from other specialized technical services

The Advanced Device and Materials Testing Laboratory (ADMATEL) continued to soar high in 2017 with the addition of 52 new local and international customers to its patron list, most of them coming from the academia and the semiconductor and electronics industry. As a result of its aggressive promotion, enhanced services, and operational innovation, ADMATEL posted significant increases in income by almost 25% (PhP 3.3 M), in clients served by 35% (102), and total services rendered by almost 21% (119).

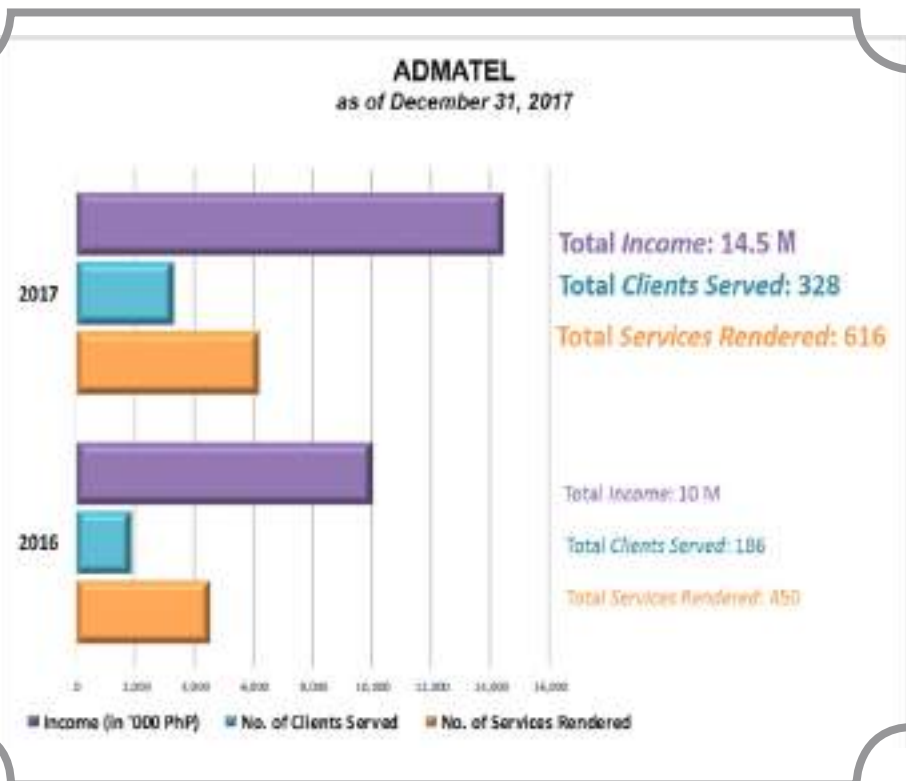


Figure 6. Income from ADMATEL

Top services availed in ADMATEL include Focus Ion Beam-FESEM (FIB-FESEM), Fourier Transform Infrared Spectroscopy (FTIR) and Differential Scanning Calorimetry (DSC).

# TECHNOLOGY TRANSFER SERVICES

Significant milestones in pursuit of technology transfer were realized in 2017. ITDI actively participated in DOST programs for the eventual transfer of technologies and services especially in the regions. While aggressively contributing to the programs, ITDI at the same time launched its project - Pilot Implementation of ITDI's Pre-Commercialization Tools/Strategies for Effective Transfer and Commercialization of Generated Technologies and Intellectual Properties during the last quarter of the year, through the 2017 ITDI Technology Offering that will run till early next year. The project is funded by PCIEERD (Philippine Council for Industry, Energy, and Emerging Research and Development) with a total of PhP 4.2M financial grant.

The 2017 Technology Offering is a five-part series focusing on five technology clusters and was open to the public on a first come first served basis, with technology cost appropriated at discounted rates just for the day's event. Conceived as an innovative pre-commercialization strategy, the offerings aim to boost the transfer or uptake of technologies resulting from R&D (research and development) to the production sector. From the first three technology offering events conducted in the last quarter of the year, 271 clients from the industry sector attended and of these, 56 signified interest to adopt some of the ITDI technologies and follow up activities to consummate transfer are now underway (Table 2). Meanwhile, 32 others demonstrated interest to have collaborative R&D in various areas.

Alongside its technology offerings, ITDI was among the major participants in the DOST Technology Transfer Days being mounted by TAPI in the regions. Of those conducted during the year, about 41 potential adopters of ITDI technologies were listed (Table 3).

## 2017-18 ITDI Technology Offering



DOST-ITDI

INDUSTRIAL  
TECHNOLOGY  
DEVELOPMENT  
INSTITUTE

DEPARTMENT OF SCIENCE AND TECHNOLOGY



PHILIPPINE COUNCIL FOR INDUSTRY, ENERGY & EMERGING  
TECHNOLOGY RESEARCH & DEVELOPMENT



Department of Science and Technology  
Industrial Technology  
Development Institute (ITDI)  
Metals Industry Research  
Development Center (MIRDC)

6 December 2017

Titanium Building  
Metals Industry Research Development Center  
MIRDC Complex, Gaisano Annex, Marikina, Taguig City



Food Innovation  
SUMMIT



15 NOV 2017  
**Food**  
Technologies



2017  
**Health & WELLNESS**



16 JAN 2018  
**GREEN**  
ENGINEERING



2018  
**ADVANCED**  
TECHNOLOGIES



**C**  
Innovation Center  
MIT



**Table 2. 2017 Technology Offering summary**

| Date  | October 12, 2017  | November 15, 2017   | December 6, 2017   |
|---|---|---|--|
| Venue   | Titanium Auditorium, MIRDC  | FNRI Auditorium   | FNRI Auditorium  |
| Theme   | FIC Technologies  | Other Food Technologies   | Health and Wellness  |
| Featured Technologies                                     | Spray Drying<br>Vacuum Frying<br>Freeze Drying<br>Thermal Processing<br>Drum Drying                           | Chocolate Liquor in bar<br>Cacao roaster equipment design<br>RTD Coconut Milk<br>Food Colorant from <i>Monascus purpureus</i><br>RTE <i>Arroz Caldo</i><br>Blast frozen Durian                          | Hard Carrageenan Capsules<br>Dietary Fiber from <i>Calamansi</i> Wastes<br>Salt Iodization Machine<br>Novel Slimming Agent in a Fat Burner Cream<br>Natural-Analgesic Balm<br>MOSYMU Anti-Diabetic Natural Health Supplement   |
| <b>ATTENDANCE</b><br>(Total)<br>Industry                  | 204<br>10   | 161<br>96   | 135<br>70  |
| <b>OUTPUTS</b><br>Potential Adopters / Term Sheets Signed | 15<br>2 / Spray Drying<br>5 / Vacuum Frying<br>1 / Freeze Drying<br>2 / Thermal Processing<br>5 / Drum Drying | 24<br>4 / Chocolate Liquor in bar<br>1 / Cacao Roaster Equipment Design<br>3 / RTD Coconut Milk<br>3 / Food Colorant from <i>Monascus Purpureus</i><br>7 / RTE <i>Arroz Caldo</i><br>6 / Nipa Sap Sugar | 17<br>1 / Hard Carrageenan Capsules<br>3 / Dietary Fiber from <i>Calamansi</i> Wastes<br>1 / Salt Iodization Machine<br>2 / Novel Slimming Agent in a Fat Burner Cream<br>3 / Natural-Analgesic Balm<br>3 / MOSYMU Anti-Diabetic Natural Health Supplement<br>4 / *Combined Natural Analgesic + Slimming Cream |

**Table 3. Term sheets signed @ Regional Technology Transfer Days**

| Date  | Aug. 24, 2017   | Sep. 8, 2017  | Oct. 27, 2017   | Dec. 11, 2017  |
|---|---|---|---|--|
| Venue   | Isabela   | Cagayan De Oro  | Iloilo  | Pampanga   |
| OUTPUTS                                       |   |   |   |  |
| <b>Potential Adopters/ Term Sheets Signed</b> | <b>7</b><br>1 / Chocolate Liquor in Bar (DOST <i>Tablea</i> )<br>1 / Water Retort Chili Oil<br>2 / Vacuum-fried Carrots<br>1 / Freeze-dried Avocado<br>1 / Drum-dried Mango<br>1 / Tablea | <b>22</b><br>1 / BIOCHAR<br>4 / Mango Flakes<br>4 / Calamansi Oil Extractor<br>6 / RTE <i>Arroz Caldo</i><br>1 / Salt Iodization Machine<br>1 / Salt Was Machine<br>3 / Tablea<br>1 / Fish Dryer<br>1 / Vacuum Frying | <b>6</b><br>2 / RTE <i>Arroz Caldo</i><br>3 / RTE Banana Slices & Rolls<br>1 / Emergency Food Reserve (EFR) made from Cassava, <i>Malunggay</i> , <i>Camote</i> , and <i>Monggo</i> | <b>6</b><br>3 / Vacuum-fried Products<br>1 / DOST <i>Tablea</i><br>1 / EFR<br>1 / Spray-dried Products |

Likewise, memoranda of agreement for technology transfer with seven clients were already finalized while nine out of ten requests for FOB (Fairness Opinion Board) assessment of proposed technology transfer transactions were issued a Fairness Opinion Report, five of which are now up for Technology Licensing Agreement (TLA).



During the year, four technologies were also processed for adoption by nine entities as follows:

**Table 4. Adopted technologies**

| Technology            | Region    | Client   |
|-----------------------|-----------|--|
| Vinegar Acetator kit  | NCR       | DIELLES APIARY & MEADERY INC.<br>23 Lavander St., Ruby Park Victoria Homes, Tunasan, Muntilupa City                      |
|                       | IV-A      | Yakap at Halik Multi Purpose Cooperative, Brgy. Walay, Padre Burgos, Quezon  |
| Bioreactor            | III<br>IX | Municipality of General Tinio, Nueva Ecija<br>LGU-Siocon, Zamboanga del Norte<br>LGU-Olutanga, Sibugay, Zamboanga        |
| Plastic Densifier     | IX        | LGU-Ramon Magsaysay, Zamboanga, Zamboanga del Sur<br>LGU-Dimatalig, Zamboanga del Sur<br>LGU-Siocon, Zamboanga del Norte |
| Salt Iodizing Machine | IX        | Zamboanga Market Stall Operators, Inc.<br>New Veterans Avenue, Zamboanga, Zamboanga del Sur                              |

ITDI's project on HITS: Roll-Out Of DOST-Developed Food Processing Equipment to the Regions also culminated in 2017 with the FIC Summit wherein all the stakeholders from the 17 assisted FICs were gathered and shared feedback on the project and its implementation. Overall, the project met its objectives and was able to assist all 17 Regions and their FIC through equipment deployment, food processing trainings, and consultancy for FIC site construction/renovation.

It was also credited to having contributed in the development and protection of 10 IPRs and in shaping partnerships with enterprises and other development catalysts, such as the Department of Trade and Industry, Manufacturers Association of the Philippines, Philippine Chamber of Commerce, Food and Drug Administration, Department of Agriculture, various chapters of the Food Processors Association, and about 69 technology adopters.





To further boost technology transfer, other pre-commercialization support programs were also implemented through proposal-driven projects that generated a total fund of Php 2.5M. These funds were used in staging exhibits with industry partners such as IFEX (International Food Exhibition), Negosyo Center Convention, 27th Taipei International Food Show, all with DTI; the NSTW and regional (RSTW); and other industry groups and the academe. From all of these events, potential adopters and partners were generated.



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Consultative dialogues were also conducted with the MAP (Management Association of the Philippines, Agribusiness and Countryside Development Foundation, Inc.), and the various stakeholders of ITDI's soon-to-be established, Innovation Hub; where ITDI programs, technologies, and services were presented to gain insights from the industry and validate their relevance to the sector.





Along with these, other modes of S&T communication and channels were continuously tapped; resulting to increased stakeholder engagements. During the year, the following were produced, facilitated and/or staged: 92 print/online media releases, 85 radio/TV guestings, 44 radio plugs, 4 online streaming of events, 43 technology fliers, 83 technology posters, 17 exhibits, 34 publications, 5 AVPs, 23 study tours. The institute also seized the promise of social media and used the new platform for S&T communication with 112 posts, accelerating engagements with various clients. In addition, approximately 9,000 copies of different types of IEC materials were disseminated, and three new media linkages were established.



These initiatives were further strengthened by providing trainings and technical assistance to impart new knowledge or skills and help improve processes towards increasing quality and overall productivity. A total of 98 trainings focusing on calibration and livelihood technologies were conducted with 1,819 participants coming from various sectors; generating a total income of PHP 960,113.66. Meanwhile, 14 clients from different regions received technical assistance to address their various technological needs involving salt production, energy audit/assessment, wastewater treatment, waste management, food processing equipment, and packaging, among others.



## 3 RESEARCHERS CONFERRED SCIENTIST 1 RANK

The Civil Service Commission (CSC) and Scientific Career Council (SCC), NAST (National Academy of Science and Technology) officially conferred last April 26, 2017 the Scientist 1 Rank to three researchers from ITDI, namely; Dr. Annabelle V. Briones, Deputy Director for Research and Development; Dr. Rosalinda C. Torres, Standards and Testing Division Chief; and Dr. Marissa A. Paglicawan, Advanced Materials Section Head-Materials Science Division.

The three new ITDI scientists along with two others from PNRI took their oath during the investiture ceremony held on June 19, 2017 at Luxent Hotel in Quezon City.

With their conferment, ITDI now has 11 scientists in its roster, with an earlier batch already retired from service.



# ASEAN CONFERENCES





Department of Science and Technology  
INDUSTRIAL TECHNOLOGY  
DEVELOPMENT INSTITUTE

# SEMINAR-WORKSHOP ON BEST PRACTICES OF ESTABLISHMENT & OPERATION OF FOOD INNOVATION CENTER (FIC) AMONG ASEAN MEMBER STATES (AMS)

16-17 October 2017

Acacia Hotel  
Alabang, Muntinlupa City  
FIC Main-ITDI, Bicutan  
Taguig City, PHILIPPINES



## Seminar- Workshop on Best Practices of Establishment and Operation of Food Innovation Center among ASEAN Member States

Delegates from member-states of the Association of South East Asian Nations (ASEAN) gathered in Manila on October 16-17, 2017 to share best practices on the establishment and operation of food innovation centers (FICs). FICs offer facilities for food processing and testing and often include technical assistance for marketing, business development, and regulation compliance.

This two-day seminar-workshop was organized by the DOST-ITDI as part of the Philippine Chairmanship of the ASEAN Summit. The occasion coincided with the celebration of a historic milestone of the ASEAN – its 50th Founding Anniversary. DOST Undersecretary for Research and Development Dr. Rowena Cristina L. Guevara welcomed the delegates and participants, while Science Secretary Fortunato T. De la Peña delivered the keynote address. Resource speakers from Indonesia, Malaysia, Singapore, Thailand, and the Philippines shared their experiences in the establishment and operation of their respective FICs to other delegates from Brunei Darussalam, Cambodia, Lao PDR, Myanmar, and Vietnam.

A study tour to the Philippines's main FIC at DOST-ITDI completed the learning experience of the participants. With this initiative, it is envisioned that more collaborative efforts will be forged in the immediate future to realize a people-oriented and people-centered ASEAN and an innovation-driven economy with deep science, technology and innovation enculturation.



## ASEAN Packaging Conference

The Packaging Technology Division successfully implemented the ASEAN Packaging Conference (APC) held last October 26-27, 2017 at the Sofitel Philippine Plaza Manila. The event is part of the many activities for the celebration of 50th foundation of ASEAN which the Philippines is hosting. The APC was the first to be conducted in ASEAN with 20 speakers from ASEAN member countries, Japan and South Korea. Secretary Fortunato De La Peña delivered the keynote message to about 270 participants highlighting the packaging achievements in ASEAN through scientific and technological innovation.



**Sec. De La Peña and USec. Guevara together with the conference speakers.**



# INTELLECTUAL PROPERTIES

The ITDI has applied 14 technologies as utility models (UM) for this year and these are expected to add up to the growing list of IPRs of the Institute. These technologies find applications mainly on the development of food coloring and technological/equipment support to local cacao industry and durian fruit packaging.

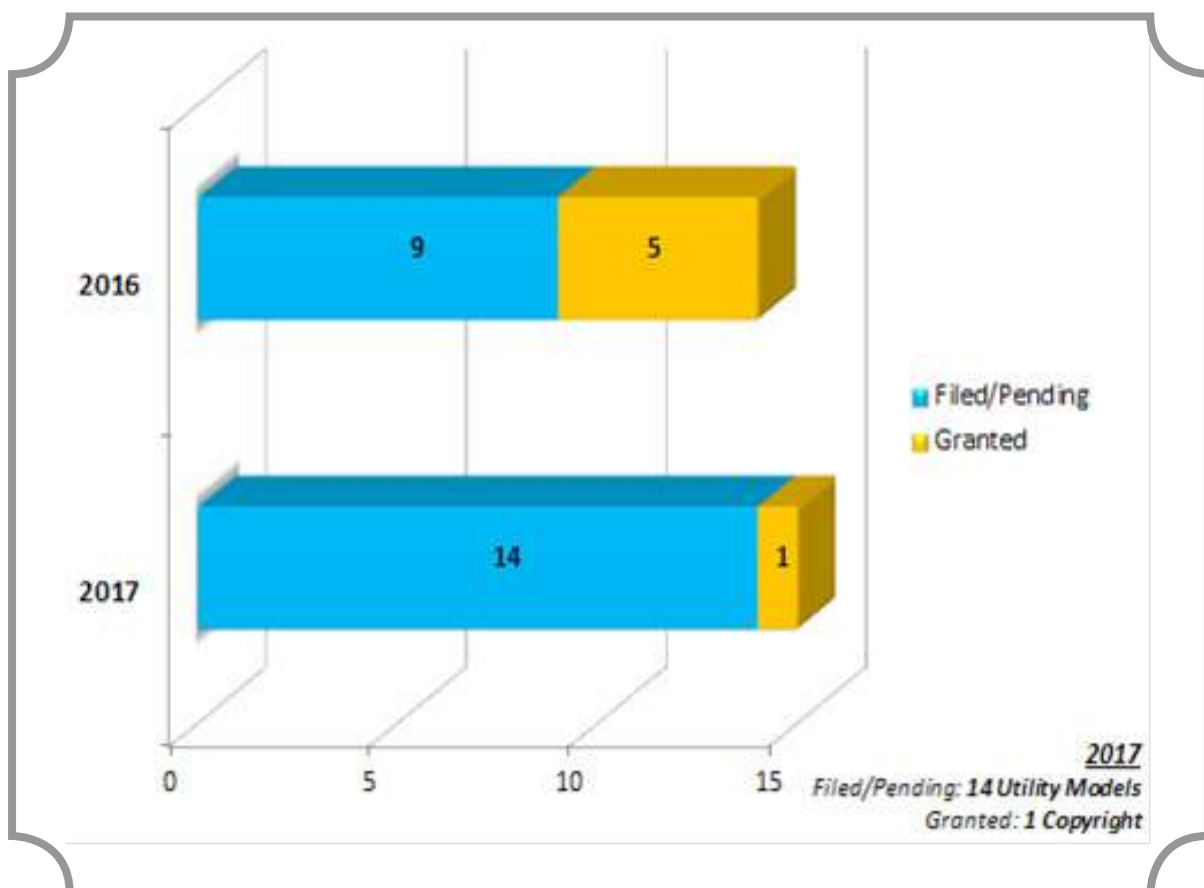


Figure 7. 2016-2017 IPR Trend

**Table 5. List of 2017 ITDI IPs granted/pending**

| No. | Title/Description of Intellectual Property   | Registry No.<br>(Application No.) | Type      |
|-----|--|-----------------------------------|-----------|
| 1   | <b>GRANTED</b><br>ITDI-DOST Dual Drum Composting Technology Manual                               | A2017-812                         | Copyright |
|     | <b>FILED/PENDING</b>   |                                   |           |
| 1   | Food Coloring from <i>Tiesa</i>  | 2-2017-050124                     | UM        |
| 2   | Food Coloring from <i>Tiesa</i>  | 2-2017-050125                     | UM        |
| 3   | Process of Preparing Food Coloring from <i>Tiesa</i>   | 2-2017-050126                     | UM        |
| 4   | Process of Purifying Crude Extract of <i>Tiesa</i>   | 2-2017-050127                     | UM        |
| 5   | Maltodextrin as Carrier in Preparing Food Coloring from <i>Tiesa</i>                             | 2-2017-050128                     | UM        |
| 6   | Emulsifier Mixture as Carrier in Preparing Food Coloring from <i>Tiesa</i>                       | 2-2017-050129                     | UM        |
| 7   | Cornstarch as Carrier in Preparing Food Coloring from <i>Tiesa</i>                               | 2-2017-050130                     | UM        |
| 8   | Sunflower Oil as Carrier in Preparing Food Coloring from <i>Tiesa</i>                            | 2-2017-050131                     | UM        |
| 9   | Technology Support for the Upgrading of Local <i>Cacao</i> and Cocoa Industry: Grinder           | 2-2017-00006                      | UM        |
| 10  | Technology Support for the Upgrading of Local <i>Cacao</i> and Cocoa Industry: Tempering Machine | 2-2017-00007                      | UM        |
| 11  | Technology Support for the Upgrading of Local <i>Cacao</i> and Cocoa Industry: Roaster           | 2-2017-00008                      | UM        |
| 12  | Technology Support for the Upgrading of Local <i>Cacao</i> and Cocoa Industry: Desheller/ Winner | 2-2017-00009                      | UM        |
| 13  | Method of Packaging to Keep the Strong Flavor and Aroma of Frozen Durian During Storage          | 2-2017-050090                     | UM        |
| 14  | Method of Packaging to Keep the Strong Flavor and Aroma of Frozen Durian During Storage          | 2-2017-050091/2                   | UM        |

**Table 6. List of ITDI IPs In-process (for filing)**

| No. | Title/Description of Intellectual Property   |
|-----|--|
| 1   | Portable Two Drum Composter for Biodegradable Solid Waste  |
| 2   | Method for the Production of Spray Dried Food Grade Bile from Ruminant Livestock                   |
| 3   | Method for the Production of Pork Blood Stew Dry Mix Utilizing Spray Dried Whole Edible Blood      |
| 4   | Packaging System to Extend the Freshness and Shelf Life of Pork <i>Lechon</i>                      |
| 5   | Low Cost Modular and Foldable Rainwater Collection System Using Local Materials                    |
| 6   | Design of Below Ground Modular Rainwater Collector Using Local Materials                           |
| 7   | Point-of-Use Water Treatment Utilizing Candle Type Ceramic Filter with Nano Anti-Microbial Coating |
| 8   | Method of Processing Local Nano Zeolite Materials into Pellets for Industrial Adsorbents           |
| 9   | Method of Producing Nano Zeolite Materials from Local Deposits in Pangasinan                       |
| 10  | Chewable Tablet from Fruit   |
| 11  | Composite Materials from Abaca Fiber and Thermoset Resin   |
| 12  | Method for the Production of Spray Dried Food Grade Bile from Ruminant Livestock                   |
| 13  | Method for the Production of Pork Blood Stew Dry Mix Utilizing Spray-Dried Whole Edible            |
| 14  | Portable Two Drum Composter for Biodegradable Solid Waste  |
| 15  | Trademark: Pack of Hope  |
| 16  | Trademark: Mighty <i>Kamote</i>  |
| 17  | Process for the Preparation of Canned Coconut Cream Based Taro Dish ( <i>Laing</i> )               |
| 18  | Packaging System to Extend the Freshness and Shelf Life of Pork <i>Lechon</i>                      |

# PAPERS / PUBLICATIONS PRESENTED

## PAPERS PRESENTED

### **Bioplastics from Blends of Renewable Polymers and Local Nanomaterials**

Marissa A. Paglicawan, Blessie A. Basilia, Ma. Teresa V. Navarro, Brigida A. Visaya, Persia Ada N. de Yro and Carlo S. Emolaga, 78th PICHE Convention on February 21-26, 2017, Philippines

#### *Abstract*

*The use of renewable resources and locally-produced nanomaterials in the production of bioplastics can provide realistic solutions for environmental problems and sustainability. Materials derived from renewable resources do not only help in reducing solid waste problems but also in minimizing carbon dioxide emissions and dependence on fossil resources.*

*Oxidized cassava starch was reinforced with nanoparticles such as halloysite nanotube (HNT), Nanozeolite, and nanoprecipitated calcium carbonate to enhance the processability and improve the mechanical, thermal, and barrier properties of the bionanocomposite. The oxidized cassava starch nanocomposite was blended with polylactic acid (PLA) using the conventional plastic processing equipment to produce materials with enhanced strength and water resistance. Cassava starch is a widely available natural resource while PLA is a biodegradable thermoplastic made from renewable resources. The locally-produced nanomaterials are also derived from materials that occur naturally and are proven to give adequate results in the improvement of biopolymer properties even at low filler concentration.*

### **Utilization of local Materials: Solutions to Philippine Development in Science and Technology**

Blessie A. Basilia, Marissa A. Paglicawan, Carlo S. Emolaga, Josefina R. Celorico, Ma. Teresa V. Navarro, Edmar P. Casa, Rosemarie B. Antinopo, Brigida A. Visaya and Persia Ada de Yro, NRCP Annual Scientific Conference & 84th General Membership Assembly, March 22, 2017, Philippines

#### *Abstract*

*Innovations in Science and Technology are essential drivers of development. These innovations however must not only improve the quality of life of man but his environment as well. This means that scientific and that scientific and technological advances must not lead to dehumanization of man and the destruction of the environment, as observed in some cases. To ensure equitable use of technology in providing solutions to the needs of many Filipinos, the DOST- Industrial Technology Development Institute (DOST-ITDI) developed technologies that utilize the abundant local raw materials while helping protect the environment. Biodegradable nanocomposites from various starch sources and locally-produced nanomaterials have been developed for biodegradable packaging materials. A lightweight abaca fiber-reinforced composite roof is also undergoing field-testing to evaluate its effect on fuel efficiency and its heat dissipation capability. This natural fiber reinforced composite is an environment friendly alternative to fiberglass. A portable ceramic water filter made from local red clay had been proven effective in providing potable water to places where safe drinking water is hard to find. A locally-produced nanoprecipitated calcium carbonate was also used to reinforce the plastic container for rainwater collection system. This reinforced water collection system can withstand high water pressure, ensuring large amounts of water stored at a longer period of time. These technologies aim to empower the Filipino by creating job opportunities, providing low-cost materials, and promoting sustainable development.*

### **Preparation and Characterization of Acid-Hydrolyzed Starch**

Marissa A. Paglicawan, Carlo S. Emolaga, Aurelio L. Cardozo, Rosemarie B. Antinopo, Ma. Teresa V. Navarro and Blessie A. Basilia, 66th Annual Convention of the Philippine Association for the Advancement of Science and Technology and International Symposium on Research Translation; Translating research into policy and practice, September 19-20, 2017, Philippines

#### *Abstract*

*Starch is one of the most abundant biopolymers produced by many plants. In recent years, starch has become a topic of intensive research efforts because of its potential applications and availability. Thus, this study mainly focused on the preliminary procedure on the synthesis of starch nanocrystals. One of the common method of synthesizing starch nanoparticles/nanocrystals is via acid hydrolysis which can isolate the crystalline region of the starch to obtain nanoparticles/nanocrystals. Parameters such as type of acid, acid concentration and hydrolysis time were taken into account. The different hydrolyzed samples were characterized using different analytical techniques to determine the effect of parameters on the properties of starch nanocrystals.*

### **Fabrication and Characterization of Abaca-Glass Fiber Epoxy Hybrid Composites**

Marissa A. Paglicawan, et.al, 2nd South East Asia, Japan Conference on Composite Materials, August 6 to 9, 2017, Japan.

#### *Abstract*

*This work presents the physical properties, mechanical properties and water uptake behaviour of abaca composites. The composites were prepared by vacuum assisted resin transfer molding. The effects of alkali treatment, laying up arrangements and inclusion of glass fiber on abaca composites were investigated. The tensile and flexural properties of composites significantly improved when both untreated and treated abaca fabric was sandwiched in glass fiber. The mechanical properties of the composites were dependent on the fiber volume fraction. Mechanical properties of the composites were reduced due to the failure mechanism of the composites such as debonding, delamination, potholes, voids, and fiber misalignment. Such failure mechanism was observed in microscopic level using SEM. Also, the water uptake of the composites was reduced with alkali treatment and inclusion of glass fiber. Water uptake results were correlated with the images from optical microscope and micro-cracks were observed on the surface of pure abaca composites. Micro-cracks indicate that abaca fiber absorbs water and swell. Also, TG-DTG Analysis shows an improvement with the degradation temperature of the composites due to the inclusion of glass fiber.*

### **Trichoderma Species Best Heavy Metal-Tolerant Fungi from Mine Tailings in Itogon, Benguet**

Myra L. Tansengco, Judith Tejano, Fe Coronado, Carmel Gacho, Joven Barcelo, NAST Annual Convention, July 13-13, 2017, Philippines

#### *Abstract*

*Waste from mining industries contains various heavy metals that can pollute the environment. Bioremediation using potential microorganisms can help in eliminating these heavy metal contaminants. This study aims to isolate and identify indigenous heavy metal-resistant fungi from the premier mining town in Itogon, Benguet. Water samples were collected from six mine tailing sites in Itogon. Water analysis by atomic absorption spectroscopy showed the presence of chromium (Cr), copper (Cu), lead (Pb), zinc (Zn), and nickel (Ni). Isolation of fungi was done by serial dilution and spread plate techniques using potato dextrose agar (PDA) with 20 ppm of individual heavy metal. Fungal growth was tested on PDA amended with mixture of five heavy metals. Identification of selected isolates was done through DNA sequencing using universal fungal primers. DNA sequences were aligned using Clustal W Multiple Alignment application, and then compared in GenBank by nucleotide BLAST search. Highest fungal population was observed*

applied in site 1 with  $2.5 \times 10^3$  to  $5.4 \times 10^5$  CFU/ml on PDA with heavy metals. Fungal population on PDA plates alone ranged from  $3.1 \times 10^1$  to  $9.5 \times 10^3$  CFU/ml. Of the 29 isolated fungi, four species (coded as F1, F2, F3, and F4) were selected that showed full mycelial colonization on PDA with heavy metal mixture. All four isolates have wide pH tolerance (pH 5 to 9) and can grow well at 25 and 30 °C. Selected isolates all belong to genus *Trichoderma*. Sequences of F1, F2, F3, and F4 showed high similarity to *T. virens*, *T. harzianum*, *T. saturnisporum*, and *T. gamsii*, respectively. Growth tolerance on PDA with 0, 200, 400, 600, 800, and 1000 ppm of individual heavy metal indicated the following trend: *T. virens* > *T. harzianum* > *T. gamsii* > *T. saturnisporum*. Results indicated that the *Trichoderma* isolates can tolerate high levels of Cr and Pb while tolerance to Cu, Zn, and Ni was species specific.

## Microbial-based Technologies for the Rehabilitation of Heavy Metal-Contaminated Wastewater from Mining Site

Joven R. Barcelo, Parallel Technical Sessions, 78th PIChE National Convention, Cagayan de Oro City, February 23, 2017

### Abstract

The study primarily aims to develop a cost-effective treatment system that would be able to remediate abandoned mine sites. Water and soil samples were collected from selected mining sites owned by Benguet Corporation in Itogon, Benguet and were analyzed for their heavy metal content, specifically chromium (Cr), copper (Cu), zinc (Zn), nickel (Ni), and lead (Pb). Microorganisms thriving in the wastewater were then isolated and screened. The isolates were selected based on their survivability in media with increasing heavy metal content.

In the process, four (4) out of fifty (50) bacterial isolates were found to survive in media with 100 ppm concentration of the five heavy metals and were identified as strains of *Acenitobacter* sp., *Bacillus cereus* and *Bacillus toyonensis*. On the other hand, four (4) fungal isolates were also selected due to their resistance to increased heavy metal concentration of up to 100 ppm and were identified as species of *Trichoderma virens*, *Trichoderma harzianum*, *Trichoderma saturnisporum*, and *Trichoderma gamsii*. Lastly, five (5) yeast isolates were also found to exhibit the highest resistance to increased heavy metal concentration of up to 100 ppm and are currently undergoing the process of identification.

These selected best isolates are now being tested for their removal efficiencies both on a batch and continuous basis for use in the design and operation of a biological treatment system.

## Impact of Inorganic Nanofillers on the Morphology, Chemical and Crystal Structures of Poly(Vinylidene Fluoride)-Based Flat Sheet Membranes

Edmar P. Casa, Lumen C. Milo, Alvin Kim M. Collera, Mar Christian O. Que, Marianito T. Margarito, Brigida A. Visaya and Blessie A. Basilia. 1st International Conference on Advanced Materials ("Materia Manila 2017"), October 23-24, 2017, Philippines

### Abstract

Pristine PVDF and nanocomposite (PVDF/MMT and PVDF/HNT) membranes were prepared using combination of solution dispersion and non-solvent induced phase separation technique. The effects of nanofiller loadings (3%, 5%, 7%, 9% and 11% w/w) and inorganic filler types, nanoclay (MMT) and halloysite nanotubes (HNT), on the membrane properties were investigated. The membranes were characterized by the use of X-ray diffraction (XRD), Fourier Transform Infrared spectroscopy (FTIR), and Atomic Force Microscopy (AFM). Results showed that membrane morphology and chemical compositions differs depending on the filler type and concentration. By increasing the filler concentration in the mixture, the viscosity of the dope also increases. XRD diffractograms of the composite membranes revealed that the nanofillers were intercalated onto the polymer matrix successfully. The surface 3D AFM images showed that the maximum mean roughness of 41.87 nm and 63.28 nm were observed corresponding to 5% MMT and 7% HNT, respectively. Introduction of filler have significant change in the surface morphologies compared to the pristine membrane. FTIR spectra of hybrid PVDF/MMT membrane showed shifting of strong absorption bands from 3000 to 3700  $\text{cm}^{-1}$ , 1600 to 1700  $\text{cm}^{-1}$  and 1000 to 1100  $\text{cm}^{-1}$  (PVDF/

MMT) while PVDF/HNT membrane shifting of intense bands were observed in 1600 to 1700  $\text{cm}^{-1}$  and 1000 to 1100  $\text{cm}^{-1}$  only. Depending on filler type and loading, there was an effect on the morphological, chemical and crystal structures that could lead to a more functional membrane for various applications.

### **A Polyvinylidene Fluoride Nanocomposites: Effect of Sodium Modified Montmorillonite and Halloysite Nanotube Addition on the Mechanical and Surface Properties of Flat Sheet Membranes**

Mar Christian O. Que, Carina G. Conde, Rebecca T. Surnit, Persia Ada N. de Yro, Alvin Kim M. Collera, Lumen C. Milo, Ruth R. Aquino, Edmar P. Casa, Blessie A. Basilia. 2017 ASEAN Conference on Advanced Functional Materials and Nanotechnology. October 19-21, 2017, Philippines

#### *Abstract*

*The effect of the addition of sodium modified montmorillonite and halloysite nanotube to polyvinylidene fluoride flat sheet membranes prepared via phase inversion method were evaluated. Transmission electron microscopy with energy dispersive spectrometer, X-ray diffraction, fourier transform infrared spectroscopy, and cation exchange capacity analysis of the Na-MMT and HNT were performed. Notable results from the modified Na-MMT were as follows: Sodium content of 0.7 wt%, d-spacing of 1.5 nm in the crystalline structure, and CEC value of 84 meq/100g. The mechanical properties, morphology, surface chemistry and hydrophilicity of the Na-MMT/PVDF flat sheet membrane and HNT/PVDF flat sheet membrane were evaluated and the results showed that they have superior mechanical properties (tensile strength of 241 MPa and 274 MPa for Na-MMT/PVDF and HNT/PVDF respectively) compared to that of the pristine PVDF flat membrane (tensile strength of 199 MPa). Na-MMT and HNT are hydrophilic nanoparticles that were preferentially deposited near the surface of the membrane during the phase inversion process, exposing more functional groups on the surface (-OH) and rendering the membrane hydrophilic (static contact angle of 81°, 69°, and 71° for PVDF, Na-MMT/PVDF and HNT/PVDF respectively). In addition to this, there was a significant improvement in the membrane surface roughness results from surface roughness of 10.04nm for PVDF to surface roughness of 1.60 nm and 1.34 nm for Na-MMT/PVDF and HNT/PVDF respectively. The use of inexpensive, natural clay filler with suitable surface chemistry and modified physical properties proved effective in improving existing PVDF flat sheet membranes to be used as filters in water and wastewater treatment.*

### **Antioxidant Activity of Some Philippine Medicinal Plants**

Dr. Rosalinda C. Torres, Consortium on the Development of Functional Food based on Antioxidants among ASEAN Members, September 13-15, 2017, Bangkok International Trade and Exhibition Center (BITEC), Bangkok, Thailand

#### *Abstract*

*Insufficient levels of antioxidants, or inhibition of the antioxidant enzymes, cause oxidative stress which contributes to the development of a wide range of diseases including Alzheimer's disease, Parkinson's disease, diabetes, rheumatoid arthritis and neurodegeneration in motor neuron diseases. Due to the importance of natural antioxidants in the prevention of these diseases, this study was undertaken. The collected plant materials namely *Fragaria vesca* (strawberry), *Solanum melongena* (eggplant), *Nephelium lappaceum* (rambutan), *Mangifera indica* (mango), *Antidesma bunius* (bignay), *Basella rubra* (alugbati) *Garcinia mangostana* (mangosteen), *Syzygium cumini* (duhat), *Dioscorea alata* (ube), *Citrus grandis* (suha), *Annona muricata* (guyabano) and *Curcuma longa* (turmeric) were extracted using 95% EtOH. The total phenolic content of the plant extracts was tested by Folin-Ciocalteu method. Flavonoid content of the plant was determined by qualitative phytochemical analysis. The study also developed a natural-based antioxidant health supplement product in the form of capsule and syrup from a combination of at least three (3) plant materials that exhibited the most promising antioxidant activity.*

*Results suggest that *N. lappaceum* peels exhibited the highest antioxidant activity with 40.70% total phenolics expressed as gallic acid followed by *G. mangostana* pericarp at 29.00%, and *S. cumini* fruit at*

14.30%. These indicated the presence of flavonoids in all the plant samples. . TLC profile exhibited different chromatogram indicating uniqueness of the plant materials' bioactive constituents with *G. mangostana* exhibiting the most number of components in the chromatogram. Antioxidant health supplements in capsule and in syrup were developed using a combination of two (2) to three (3) plant extracts. The formulated products exhibited very promising antioxidant activities.

### **Larvicidal, Ovicidal and Adulticidal Studies on Philippine Medicinal Plants against Dengue and Zika Vector, *Aedes aegypti***

Dr. Rosalinda C. Torres, Annual Scientific Meeting and 11th Scientific Forum of the Philippine Association of Career Scientists, September 28, 2017, Acacia Hotel, Alabang, Muntinlupa City.

#### *Abstract*

*The larvicidal, ovicidal and adulticidal activities of extracts from Philippine plants collected in different places were evaluated in view of developing an alternative measure to control the spread of Dengue and Zika virus in the country. More than 100 plant materials were subjected to larvicidal, ovicidal and adulticidal activities following the WHO protocol. Among the plant materials studied, both the alcohol and hexane extracts of *Anacardium occidentale* (cashew) shell waste from Palawan showed lethal toxicities against *Aedes aegypti* at LD50 of 3.29 mg/L and LD50 of 7.31 mg/L, respectively. The hexane extract from *Citrus grandis* (suha) peels from Davao showed the most lethal activity at only 1.11 mg/L LD50. However, the alcohol extract exhibited moderate activity. The initial test on Knockdown effect of Suha peels (Nenita) hexane extract on adult female *Aedes aegypti* mosquitoes showed that a volume of 0.1mL of 1% solution sprayed on mosquitoes inside a 12cmx12cmx12cm plastic container produced 50% mosquito knockdown within 13.43 minutes and 90% knockdown within 28.14 minutes. The test mosquitoes mortality is 100% after 24h. The suha hexane extract also exhibited strong ovicidal activity at 13.84 mg/L LD50 against *Aedes aegypti* eggs.*

### **Philippine Medicinal Plants Against Dengue and Zika Vector, *Aedes aegypti***

Dr. Rosalinda C. Torres, 32nd Philippine Chemistry Congress, May 31, 2017, Asturias Hotel, Puerto Princesa City, Palawan

#### *Abstract*

*Dengue is the most rapidly emerging disease today and is caused by one of four arthropode-borne flaviviruses (DENV-1,-2, -3, or -4). Incidence has increased 30-fold over the last 50 years. Zika virus is caused by a virus transmitted primarily by *Aedes* mosquitoes (WHO, 2017). However, we are still dependent on chemical pesticides and larvicides which have manifested harmful effects even to non-target organisms (Yang, et al., 2002). The project was therefore aimed to develop the vector control measures that are acceptable to the populace, cost effective, and more importantly, safe for the environment.*

*In this study, among all the samples tested, the following plant extracts exhibited significant larvicidal activity; *Anacardium occidentale* (cashew) shell waste from Palawan; *Citrus grandis* (suha) peels from Davao; *Garcinia mangostana* (mangosteen) pericarp and crown from Davao; *Annona muricata* (guyabano) leaves from Albay, Tarlac, Davao Oriental, Negros Oriental (Bayawan), Antique, Quezon and Pangasinan; and seeds from Camarines Sur (Naga) and Quezon; *Persea americana* (avocado) seeds from Negros Or. (Bayawan), Iloilo, Batangas, and Mindoro; peels from Negros Or. (Bayawan) and Mindoro; and pulp from Mindoro, Pangasinan, and Davao. The initial test on Knockdown effect of Suha peels (Nenita) hexane extract on adult female *Aedes aegypti* mosquitoes showed that a volume of 0.1mL of 1% solution sprayed on mosquitoes inside a 12cmx12cmx12cm plastic container produced 50% mosquito knockdown within 13.43 minutes and 90% knockdown within 28.14 minutes. The test mosquitoes mortality is 100% after 24h.*



## Verification of Test Method for the Analysis of Arsenic in Drinking Water

Admer Rey C. Dablio, Ruth L. Damian, Isaiah E. Ubando, Emma D. Tayag, Rosario T. Fuertes, and Rodney C. Salazar, 46th Annual Convention of the Kapisanang Kimika ng Pilipinas on September 6-7, 2017, Philippines

### Abstract

Detailed in-house method verification was conducted to the test method for the determination of total recoverable Arsenic in water by Hydride Vapor Generation – Flame Atomic Absorption Spectrophotometry which is based on the standard method for the examination of water and wastewater 3114 B. Linearity of the calibration curve for the analytical instrumentation was assessed by Residual Plot Analysis and data were fitted by ordinary least-squares method. Linear range was determined to be at 0.5-20 µg/L. Instrument Detection Limit (IDL), Method Detection Limit (MDL), and Method Quantitation Limit (MQL) were established by analysis of calibration and method blanks and were found to be 0.046 µg/L, 0.095 µg/L, and 0.317 µg/L respectively. Repeatability of the test method was assessed through the use of three (3) levels of spiked samples, 2 µg/L for low, 6 µg/L for medium, and 12 µg/L for high, which resulted to percent relative standard deviation (% RSD) of 15.66, 9.88 and 3.72% respectively. All these precision results were within the value of intralaboratory precision estimated by the Horwitz function. Method accuracy was determined by analysis of a Certified Reference Material (CRM) for Trace Metals provided by the United States Environmental Research Associate (US ERA), an ISO Guide 34:2009 accredited reference material producer. Thirteen data were evaluated resulting to a measured value of 834 µg/L, with a certified value of 823 µg/L. Resulting data were within 95% confidence interval of the supplier's certified value and computed laboratory and method bias was at 1.62%. Further accuracy determination was determined by participation to a Proficiency Testing program for metals in water supply for drinking water organized on 06 February to 23 March 2017 by US ERA. The method obtained a satisfactory z-score of 0.377, with a relative recovery of 101%.

## PUBLICATIONS

### Fabrication of a Mini Multi-Fixed-Point Cell for the Calibration of Industrial Platinum Resistance Thermometers

Monalisa Ragay-Enot, et.al., Scientific Journal: Measurement Science and Technology  
Volume: 28 (2017), United Kingdom

### Abstract

A mini multi-fixed-point cell (length 118 mm, diameter 33 mm) containing three materials (In–Zn eutectic (mass fraction 3.8% Zn), Sn and Pb) in a single crucible was designed and fabricated for the easy and economical fixed-point calibration of industrial platinum resistance thermometers (IPRTs) for use in industrial temperature measurements. The melting and freezing behaviors of the metals were investigated and the phase transition temperatures were determined using a commercial dry-block calibrator. Results showed that the melting plateaus are generally easy to realize and are reproducible, flatter and of longer duration. On the other hand, the freezing process is generally difficult, especially for Sn, due to the high supercooling required to initiate freezing. The observed melting temperatures at optimum set conditions were 143.11 °C (In–Zn), 231.70 °C (Sn) and 327.15 °C (Pb) with expanded uncertainties ( $k = 2$ ) of 0.12 °C, 0.10 °C and 0.13 °C, respectively. This multi-fixed-point cell can be treated as a sole reference temperature-generating system. Based on the results, the realization of melting points of the mini multi-fixed-point cell can be recommended for the direct calibration of IPRTs in industrial applications without the need for a reference thermometer.

## **Performance Characterization of Capacitance Diaphragm Gauges with Different Diaphragm Materials Below 10% of Full Capacity**

M. Salazar, et.al., MAPAN-Journal of Metrology Society of India DOI 10.1007/ s12647-017-0220-x, 2017, India

### *Abstract*

*The capacitance diaphragm gauge (CDG) is one of the most accurate transfer standards for use in atmospheric to medium vacuum regions. Currently, it is practical to cover a wide range of measurements with the least amount of equipment possible. In this study, one CDG with a metal membrane and two CDGs with a ceramic membrane are characterized through calibrations using a reference standard, in this case a force-balanced piston gauge (FPG) system, through repeated measurements ranging from 500 Pa to 13.3 kPa, below 10% of their full capacities (133 kPa). Performance characterizations such as repeatability, long-term instability and zero-pressure instability assessments were conducted. According to repeatability and long-term instability measurements of 133 kPa CDGs tested below 10% of their full-scale (FS) capacities, the metal membrane CDG was found to be somewhat superior compared to the ceramic membrane CDG due to the inherent material stiffness of this type of CDG. However, the difference was negligible, and both membrane-type CDGs could be used at 3 kPa (about 2% of the FS). The responses to heater effects and the results of the zero-pressure instability tests were also evaluated and presented. As shown from these results, the zero-pressure instability is of major concern for the metal membrane CDG, while it has little effect for the ceramic membrane CDG. CDGs in either case have their own advantages and can be used depending on the user's discretion.*

## **Isolation and Characterization of Heavy Metals-Resistant Bacteria from Contaminated Wastewater in Mine Tailings of Itogon, Benguet Philippines**

Fe F. Coronado, Carmel C. Gacho, Myra L. Tansengco, Joven R. Barcelo, *Advances in Biology and Biomedicine*, Volume 4 – Issue 1, September 21, 2017, Philippines

### *Abstract*

*Heavy metals resistant bacteria were obtained from wastewater samples in mining sites of Itogon, Benguet, Philippines. The isolates were cultured in a medium with different concentrations of copper (Cu), chromium (Cr), nickel (Ni), zinc (Zn) and lead (Pb). Out of the 150 initial isolates, the 4 isolates, which survived in each 100 ppm of Zn, Cr, Pb, and Ni exhibited high metal resistance and were identified at the Philippine Genome Center (UP Diliman, Quezon City, Philippines) as isolates A). *Acinetobacter sp. junii*, B). *Acinetobacter sp. tandoii*, C). *Bacillus cereus*, D). *Bacillus toyonensis*. Sample digestion with HCl showed higher heavy metal reduction results compared with the undigested, thus suggesting that acid treatment gave better extraction of metal components prior to Atomic Absorption Spectroscopy. Biosorption of heavy metals were highest in 75 ppm of lead. Results showed that the isolate *Bacillus toyonensis* can reduce lead by 92.43 % in 5 days at room temperature.*

# LOCAL & INTERNATIONAL COLLABORATIONS

## LOCAL

| Name of Institutions/Organizations   | Nature of Collaboration              |
|--|--------------------------------------|
| DENR-Environmental Management Bureau   | Technical Assessor                   |
| Greenstone Pharmaceuticals   | Capacity Building                    |
| Integrated Chemists of the Philippines (ICP)   | Board of Director                    |
| Manly Plastics, Incorporated   | Research & Development Collaboration |
| Metro Manila Health Research and Development Consortium  | Network                              |
| National Security Council-Strategic Trade Management Committee of the Department of Trade and Industry | Network / Technical Cooperation      |
| Philippine Accreditation Bureau (PAB)<br>Department of Trade and Industry                              | Technical Expert / Assessor          |
| Philippine Association for Laboratory Animal Science (PALAS)   | Board of Director                    |
| Philippine Association of Career Scientists  | Member                               |
| Philippine College of Laboratory Animal Medicine (PCLAM)   | Board of Director                    |
| Philippines Network of Microbial Culture Collection & World Federation of Culture Collections          | Board of Director                    |
| PHLRUBBER  | Network / Technical Cooperation      |
| Philippine Rubber Industries Association (PRIA)  | Network / Technical Cooperation      |
| Philippine Society for Microbiology  | Board of Director                    |
| Progreen Agricorp, Inc.  | Research & Development Collaboration |
| Research Development Center (RDC)<br>Army Support Command (ASCOM), Philippine Army                     | Research & Development Collaboration |
| St. Joseph Farmers Association   | Research & Development Collaboration |
| Technical Committees of the Bureau of Product Standards (BPS), Department of Trade and Industry        | Technical Expert                     |
| Technical Working Group on the 2017 Philippine National Standards for Drinking Water                   | Technical Expert                     |

## INTERNATIONAL

| Name of Institutions/Organizations  | Nature of Collaboration                               |
|---|---|
| Adam Mickiewicz University, Poland  | Technical Cooperation/<br>Capacity Building           |
| ANF Society   | Auditor   |
| ASEAN Consultative Committee for Standards and Quality-Rubber-Based Product Working Group (ACCSQ-RBPWG)   | Network /<br>Technical Cooperation                    |
| ASEAN Consultative Committee on Standards and Quality (ACCSQ)   | Technical Cooperation/<br>Capacity Building           |
| ASEAN Experts Group on Metrology (ASEAN EGM)  | Technical Cooperation/<br>Capacity Building           |
| ASEAN Sub Committee on Food Science and Technology (ASCFST)   | Focal Person for the<br>Philippines                   |
| Asia Nano Forum (ANF)   | Tech. Cooperation/Network<br>R&D Collaboration        |
| Asia Pacific Economic Cooperation Virtual Center  | Collaboration   |
| Asia Pacific Legal Metrology Forum (APLMF)  | Technical Cooperation/<br>Capacity Building           |
| Asia Pacific Metrology Programme (APMP)   | Technical Cooperation/<br>Capacity Building           |
| Asian Packaging Network (APN)   | Board of Director                                     |
| Bureau of Standards, Kenya  | Technical Cooperation/<br>Capacity Building           |
| Committee of Asian Standardization for Photocatalytic Materials and Products  | Technical/Philippine<br>Representative/Member         |
| <i>Conférence générale des poids et mesures</i> – CGPM (General Conference on Weights and Measures), France   | Membership of the Phil. as<br>an Assoc. State of CGPM |
| Department of Chemistry/KIMIA, Malaysia   | Technical Cooperation/<br>Capacity Building           |
| Erasmus Mundus Program - Excellence in Analytical Chemistry   | Technical Cooperation/<br>Capacity Building           |
| ETV Korea: ETV on Upflow Filtration Technology  | ETV Collaboration/Coop.                               |
| European Commission - Joint Research Centre (JRC)   | Technical Cooperation/<br>Capacity Building           |
| German Federal Ministry for Economic Cooperation and Development (BMZ) / <i>Physikalisch-Technische Bundesanstalt</i> (PTB) – National Metrology Institute of Germany | Technical Cooperation                                 |
| Health Sciences Authority (HSA), Singapore  | Technical Cooperation/<br>Capacity Building           |
| Institute for Global Environmental Strategies, Japan  | Network /<br>Technical Consultations                  |
| International Association of Packaging Research Institutes (IAPRI), United Kingdom  | Member  |

| <b>Name of Institutions/Organizations</b>   | <b>Nature of Collaboration</b>                                  |
|---|---|
| International Bureau of Weights and Measures (BIPM)   | Technical Cooperation/<br>Capacity Building                     |
| International Organization of Legal Metrology   | Technical Cooperation/<br>Capacity Building                     |
| International Safe Transit Association (ISTA)<br>Asia Pacific, USA                                | Board of Director   |
| International Working Group ETV   | ETV Collaboration /<br>Cooperation                              |
| Japan International Cooperation Agency (JICA)   | Technical Cooperation/<br>Capacity Building                     |
| Korea Environmental Industry and Technology Institute<br>(KEITI)                                  | ETV Collaboration / Coop. /<br>Co-Verification                  |
| Korea Institute of Materials Science (KIMS)   | Research and Development<br>Collaboration                       |
| Korea Research Institute of Standards and Science<br>(KRISS), South Korea                         | Expert Advice, Training<br>and M.S. in Metrology<br>Scholarship |
| LGC, United Kingdom   | Technical Cooperation/<br>Capacity Building                     |
| Limerick Institute of Technology, Ireland   | Technical Cooperation/<br>Capacity Building                     |
| Lithuanian Police Forensic Science Center, Lithuania  | Technical Cooperation/<br>Capacity Building                     |
| Loughborough University, U.K.   | Capacity Building.  |
| Marie Curie-Sklodowska University, Poland   | Technical Cooperation/<br>Capacity Building                     |
| Measurements Standard Laboratory (MSL), New Zealand   | Network/Potential Tech.<br>Coop./Capacity Building              |
| Mitsubishi Research Institute, Japan  | Network   |
| Nanosafety Committee of ANF   | Member  |
| Nanyang Polytechnic & Temasek Foundation, Singapore   | Capacity Building   |
| National Accreditation Body of Germany (DAkkS)  | Technical Cooperation/<br>Capacity Building                     |
| National Institute of Metrology, China  | Technical Cooperation/<br>Capacity Building                     |
| National Institute for Materials Science (NMIS), Japan  | Research and Development  |
| National Institute of Metrology, Thailand (NIMT)  | Technical Cooperation/<br>Capacity Building                     |
| National Metrology Centre, Singapore  | Technical Cooperation/<br>Capacity Building                     |
| National Metrology Institute of Australia (NMIA)  | Technical Cooperation   |
| National Metrology Institute of South Africa (NMISA)  | Technical Cooperation/<br>Capacity Building                     |
| National Metrology Laboratory-Scientific and Industrial<br>Research Institute of Malaysia (SIRIM) | Technical Cooperation/<br>Capacity Building                     |

| Name of Institutions/Organizations   | Nature of Collaboration                     |
|--|---|
| National Research Council, Canada  | Technical Cooperation/<br>Capacity Building |
| Ohio State University, Department Of Food Science and<br>Technology, USA     | Capacity Building                           |
| Research Center for Calibration, Instrumentation and<br>Metrology, Indonesia | Technical Cooperation/<br>Capacity Building |
| The FOODBOWL, New Zealand Food Innovation Network<br>(NZFIN)                 | Network/Potential<br>Technical Cooperation  |
| University of Leeds, U.K.  | Capacity Building                           |
| University of Lyon, France   | Technical Cooperation/<br>Capacity Building |
| University of Tartu, Estonia   | Technical Cooperation/<br>Capacity Building |
| University of Warsaw, Poland   | Technical Cooperation/<br>Capacity Building |
| Vietnam Metrology Institute (VMI)  | Technical Cooperation/<br>Capacity Building |
| World Data Federation of Culture Collection                                  | Member                                      |

# AWARDS

**OneLab**  
Innovation Award for  
Government Service  
Benita and Catalino Yap  
Foundation



## Standards and Testing Division (STD)

Certificate of Laboratory  
Excellence for Proficiency  
Testing Performance  
US-ERA

- ❖ Microbiology Section,
- ❖ Biological Laboratory;
- ❖ Inorganic Chemistry Section,
- ❖ Chemistry Laboratory



**Dr. Maria Patricia V. Azanza**

**Julian Banzon  
Outstanding R&D  
Award**

National Academy of Science and Technology (NAST)

**DOST International  
Publication Award**

National Academy of Science and Technology (NAST)

*"Shelf-stable Dried Okara from the Wet By-product of Philippine Soybean Curd Processing"*

*"Staling Control in Philippine Yeast Bread (Pandesal) Using Hydrocolloids and Emulsifiers"*

*"Hydrocolloids and Emulsifiers"*

**Applied Research Award**

**Gregorio Y. Zara Award**

International Symposium on Research Translation  
66th Annual Convention

Philippine Association for the Advancement of Science and Technology (PhilAAST)

Philippine Association for the Advancement of Science and Technology (PhilAAST)



**Dr. Rosalinda C. Torres  
Alicia G. Garbo  
Rikkamae Zinca Marie  
L. Walde**

**DOST International  
Publication Award**

National Academy of Science and Technology (NAST)

*"Larvicidal Activity of Anacardium occidentale Against Aedes aegypti"*

Philippine Journal of Science  
2015, 144 (2): 101-105







**Dr. Annabelle V. Briones**  
**12 Outstanding Filipino Researchers**

National Research Council of the Philippines

**NRCP Achievement Award for Chemical Sciences**

National Research Council of the Philippines

**Plaque of Recognition Exemplary Balingasagon LGU-Balingasag, Misamis Oriental**

**Rikkamae Zinca Marie L. Walde**  
**Carmelita O. Manalo**  
**Dr. Rosalinda C. Torres**  
**Alicia G. Garbo**

**First Prize Winner Professional Category**

International Symposium and 8th Annual Scientific Convention, Metro Manila Health Research and Development Consortium (MMHRDC)

*"Characterization and Larvicidal Toxicity of Annona muricata (Guyabano) Against the Dengue and Zika Vector, Aedes aegypti"*





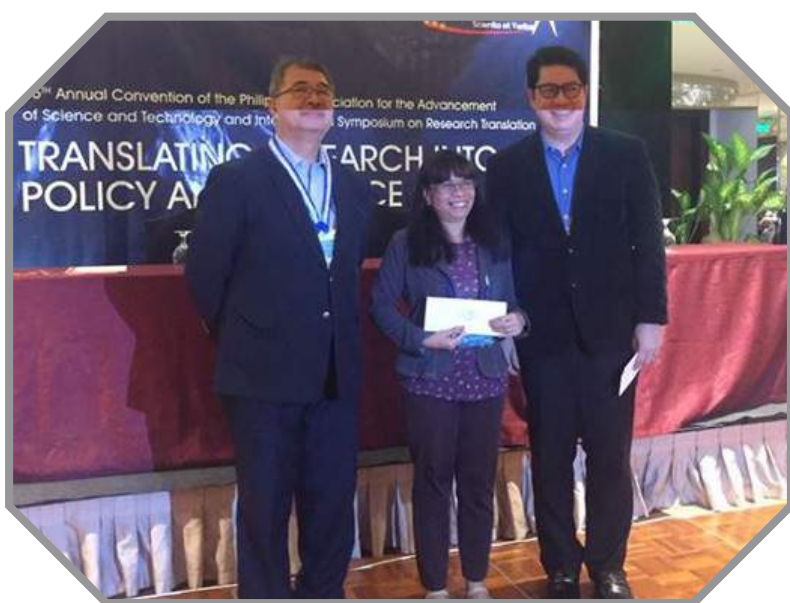
**Dr. Blessie A. Basilia**  
**Best Poster Award**

Philippine Institute of  
 Chemical Engineers (PICHE)  
*"Influence of Thermal Treatment on  
 the Microstructure and Mechanical  
 Strength of Lead-free Solder and  
 Under Bump Metallization of a  
 Wafer Level Chip Scale Package"*

**Dr. Myra L. Tansengco**

**Best Poster Award**  
**Biology Education and Environmental Category**

BIOTA Annual Conference  
 Biology Teachers Association of the Philippines, Inc. (BIOTA)  
*"Waste Characterization in a Government Research Institution and  
 Development of Motorized Composter"*



**Dr. Marissa A. Paglicawan,**  
**Carlo S. Emolaga**  
**Aurelio L. Cardozo,**  
**Rosemarie B. Antinopo**  
**Ma. Teresa V. Navarro,**  
**Dr. Blessie A. Basilia**  
**2nd Place, Poster**  
**Presentation**

International Symposium on  
 Research Translation  
 66th Annual Convention  
 Philippine Association for the  
 Advancement of Science and  
 Technology (PhiAAST)  
*"Preparation and Characterization  
 of Acid-Hydrolyzed Starch"*



**Dr. Benilda Ebarvia, Sharlene Cabanilla, Aaron Dacuya, Alma Cruz, Alleni Tongson, Cyril Cortez Kim Christopher Aganda, Natividad Mamplata**  
**3rd Best Poster Award**

IMEKOFODDS (TC23) 3rd International Conference  
 "Metrology Promoting Standardization and Harmonization  
 in Food and Nutrition", October 1-4, 2017, Greece  
*"Matrix Reference Materials Development for Food Safety Application  
 in Philippine Products"*



**Mar Christian O. Que, Dr. Persia Ada N. de Yro, Alvin Kim M. Collera, Lumen C. Milo, Edmar P. Casa, Dr. Blessie A. Basilia**  
**3rd Place**

**Best Scientific Oral Presentation**  
 2017 ASEAN-Conference on Advanced Functional Materials & Nanotechnology  
*"Polyvinylidene Fluoride Nanocomposites: Effect of Sodium Modified Montmorillonite and Halloysite Nanotube Addition on the Mechanical and Surface Properties of Flat Sheet Membranes"*



**Dr. Blessie A. Basilia**  
 2017 DOST Grantee  
 Patent/Utility Model  
 Registration Award  
 Technology Application  
 Research Institute (TAPI)  
*"Process for Producing Nanoclays  
 for Polymer Nanocomposites "*

**Dr. Marissa A. Paglicawan**  
 2017 DOST Grantee  
 Patent/Utility Model  
 Registration Award  
 Technology Application  
 Research Institute (TAPI)  
*"Process for Producing Biodegradable  
 Composition Comprising Thermoplastic  
 Nanocomposite and Polylactic Acid"  
 "Biodegradable Composition  
 Comprising Thermoplastic  
 Nanocomposite and Polylactic Acid  
 and Process for Producing Thereof"*



**Dr. Blessie A. Basilia,  
 Ma. Teresa V. Navarro,  
 Rosemarie B. Antinopo  
 Brigida A. Visaya**  
 2017 DOST Grantee  
 Patent/Utility Model  
 Registration Award  
 Technology Application  
 Research Institute (TAPI)  
*"Polycaprolactone-Carrageenan  
 Nanofibrous Blends for Tissue  
 Engineering and Process for  
 Producing Thereof"*

**Dr. Marissa A. Paglicawan, Dr. Blessie A. Basilia,  
 Ma. Teresa V. Navarro, Carlo S. Emolaga, Delmar  
 Marasigan, Rosito Cerbito**  
 Regional Winner,  
 Outstanding Utility Model Category  
 2017 Regional Invention Contest and Exhibits DOST-NCR  
*"Renewable Resource-based Biodegradable Thermoplastic"*

**Dr. Blessie A. Basilia,  
 Ner C. Rodriguez**  
 2017 DOST Utility  
 Model Registration  
 Award  
 Technology Application  
 Research Institute (TAPI)  
*"Method of Using Montmorillonite  
 Functionalized Fiber"*



**Dr. Ma. Cristina Gragasin**  
**Dr. Rosalinda C. Torres**  
**Aileen R. Ligisan**  
**Romulo R. Estrella**  
**Finalist Amy IP Awards**  
 Intellectual Property Office  
 Philippines Chamber of  
 Commerce  
*"Pharmaceutical Grade Pectin  
 From Mango Peels"*

**Daisy Tañafra**  
**Flordeliza Loberiano**  
**Dane Balanon**  
**Vicente Casas**  
**Philstar Awards Finalist**  
 Packaging Institute of the  
 Philippines (PIP)  
 October 27, 2017  
 Sofitel Philippine Plaza  
*"Multi-layer High Packaging  
 Technology for Frozen Durian"*



# ISO CERTIFICATION

## ITDI Embraces ISO 9001:2015 Risk-Based QMS

*"We are committed to help local industries become globally competitive by producing appropriate technologies and services.*

*We shall continually improve our QMS to come up with conformity of products and services that would meet customer expectations within applicable and regulatory requirements".*

This is ITDI's quality policy and the institute has committed to adopt ISO 9001:2005 for its continual improvement on serving its customers.

ISO 9001:2015 - Quality Management Systems (QMS) adopts risk-based thinking for effective management by minimizing or eliminating the risks and maximizing the benefits gained from opportunities. ITDI embraced this new standard after transitioning from the old version, which is ISO 9001:2008.

The certifying body, TUV Rhineland, awarded to ITDI the ISO 9001:2015 Certification on May 8, 2017, which is valid until May 7, 2020. The scope of certification covers (a) research and development in the areas of chemicals, energy, environment, biotechnology, food processing, materials science, and packaging technology, and b) training and technical services.

ITDI joins a family of entities that complies with the international standard and adds credibility to its processes towards customer satisfaction.





**The ITDI ExeCom receiving the ISO 9001:2015 Certification from Mr. Tristan Arwen G. Loweres, Managing Director of TUV Rhineland.**

# HUMAN RESOURCE DEVELOPMENT

The ITDI manpower increased to 334 with the addition of 14 new staff from various fields of study filling 90.5% of the total available plantilla positions. The ITDI workforce is comprised of 149 male employees (44.61%) and 185 female employees (55.39%).

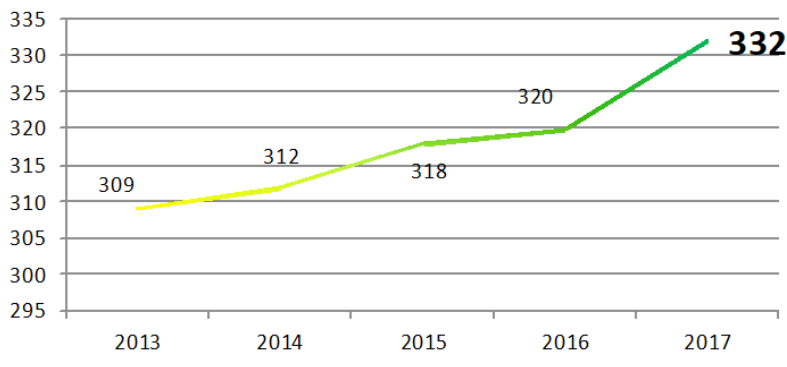


Figure 8. ITDI Personnel Count



Figure 9. By Gender

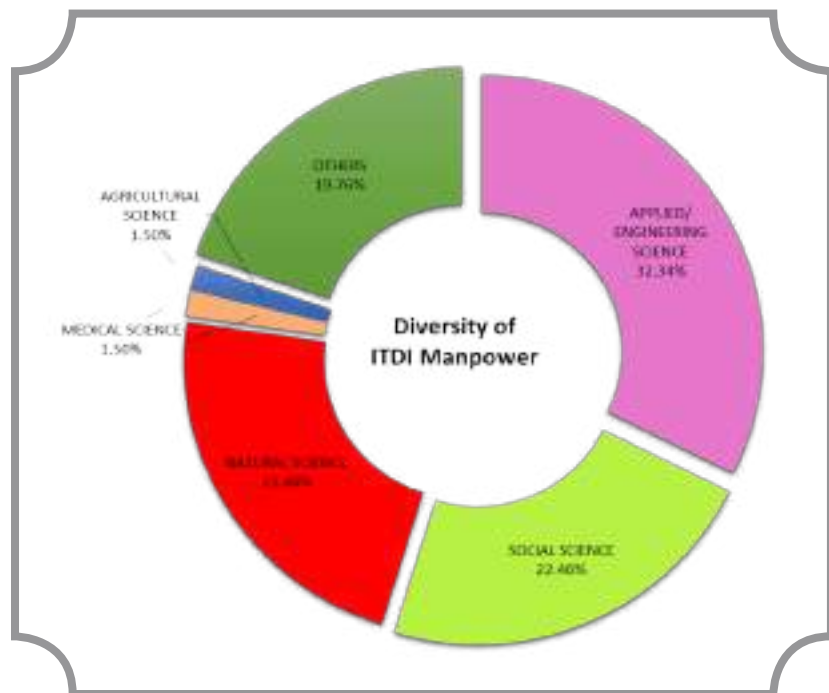
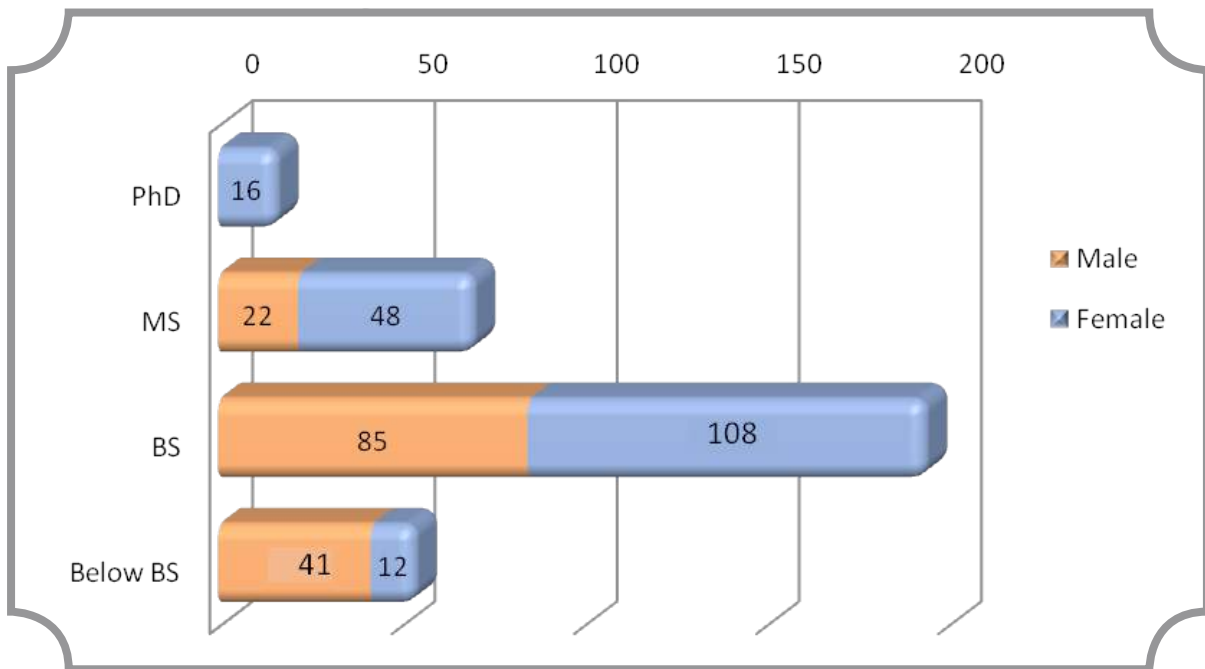


Figure 10. By Field/Area



The diversity of ITDI manpower includes expertise from various fields such as applied/engineering science, natural science, social science, medical science, agricultural science, measurement science, and other fields.

Pursuit of academic advancement by the ITDI staff continues to contribute to the performance of the Institute’s mandate and the achievement of its short-term and long-term goals. As of 2017, 16 ITDI personnel have obtained their Doctorate degrees and a total of 70 employees have their Master’s degree.



**Figure 11. By Educational Attainment**

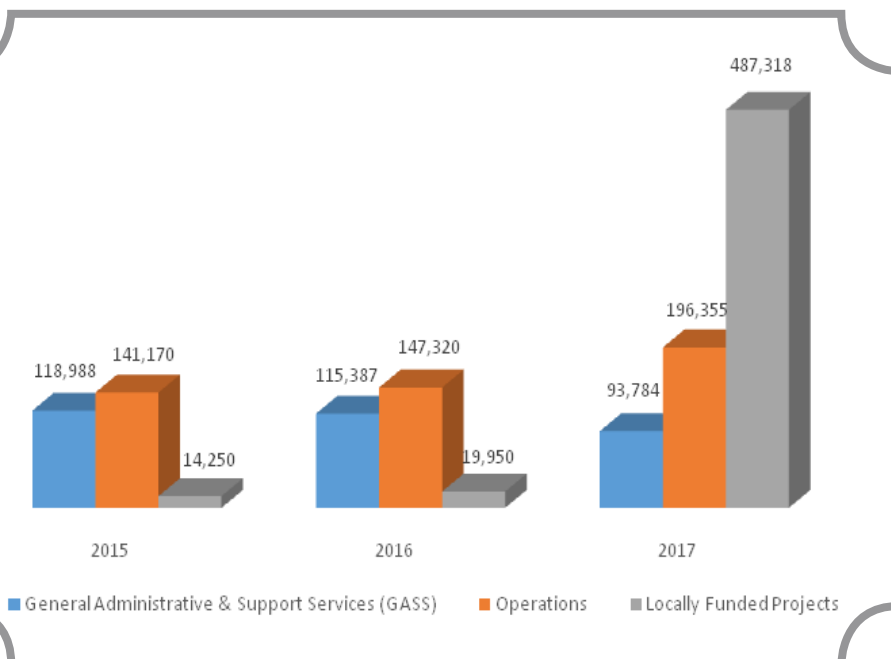
This year, three ITDI staff graduated with the following degrees:

| Name              | Master’s Degree          |
|-------------------|--------------------------|
| Angel T. Basbasan | Agricultural Engineering |
| Alleni B. Tongson | Chemistry                |
| Monalisa R. Enot  | Measurement Science      |

# FINANCIAL MANAGEMENT

2017 marked an unprecedented increase in the amount of financial resources made available for the operational requirements of ITDI. The institute received a legislative appropriation of PhP 777,457 Million through the General Appropriations Act (GAA) - a huge increase of 68% compounded annual growth rate based on its budget allotment for the past three years.

By Programs/Activities/Projects (PAPs), the allotment earmarked 63% to Locally Funded Projects (LFPs), 25% to Operations, and 12% to General Administrative and Support Services (GASS). The five-year program on *“Enhancement of the Competence and Capabilities of the National Metrology Laboratory (NML) of the Philippines”* earned the largest share of the 2017 total allotment for LFPs at 81% or PhP 395.4 Million. Operations, which cover Research and Development (R&D), Technology Transfer, and Technical Services - the core mandates of ITDI, were allocated PhP 196.4 Million.



By Allotment Class, the expenditures are classified under the categories of Personal Services (PS), Maintenance and Other Operating Expenses (MOOE), and Capital Outlay (CO). Unparalleled increase in the allotment for 2017 was recorded for CO at 239% and MOOE at 163% when compared to the distribution in the past two years.

**Figure 12. ITDI Budget Allocation ('000), 2015-2017 by Programs/Activities/Projects (PAPs)**

In particular, the 2017 budget reflected an almost equal percentage distribution for all expense items by allotment class at more than 30% each, with MOOE getting the largest share at 36%.

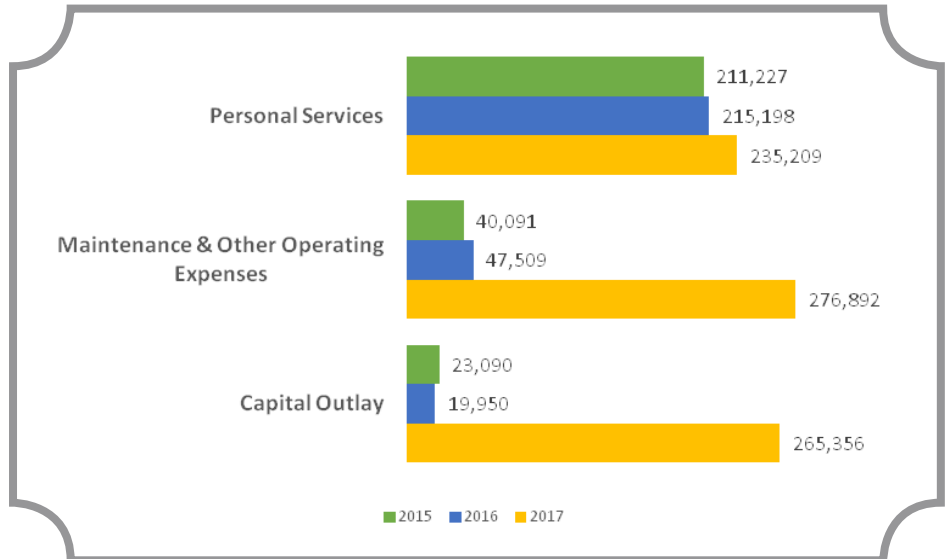


Figure 13. ITDI Budget 2015-2017 by Allotment Class ('000)

In addition to the GAA funds, the ITDI Financial Management Division (FMD) also managed other sources of funds, which amounted to an aggregate total of PhP 242.2 Million. The DOST, through its Grants-In-Aid (GIA) Program and the Philippine Council for Industry, Energy, and Emerging Technology Research and Development (PCIEERD) were the largest sources of funding assistance for ITDI projects at 96%. There were 42 projects implemented in 2017 that were funded largely by DOST and PCIEERD.

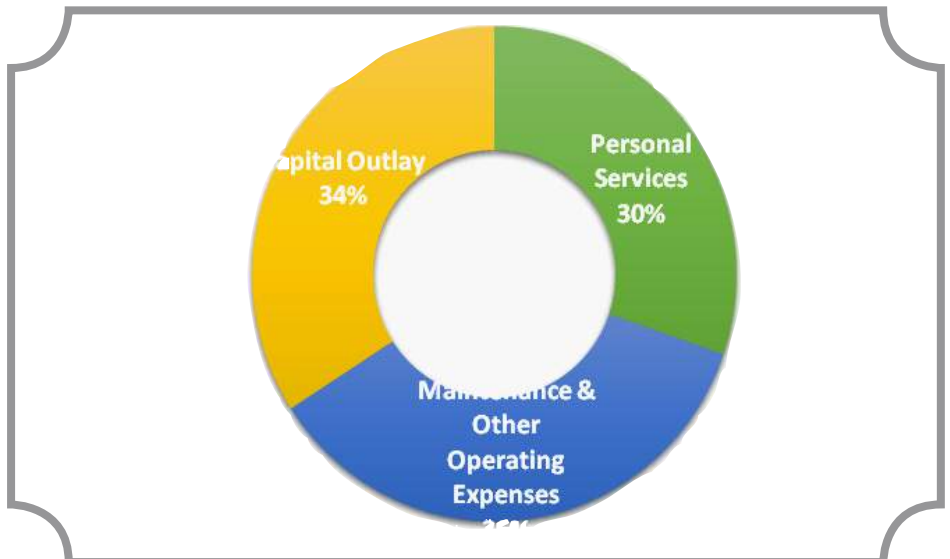


Figure 14. 2017 ITDI Budget by Allotment Class (%)

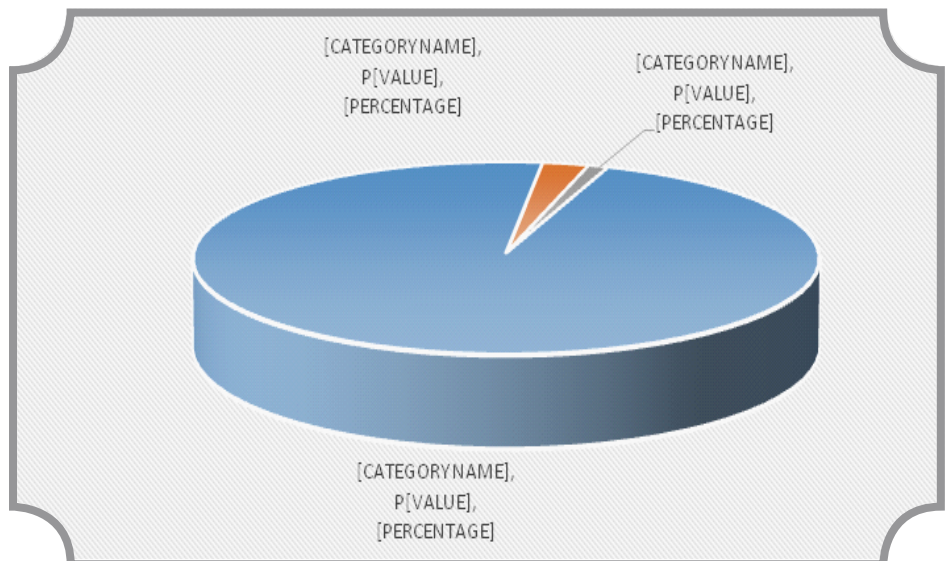
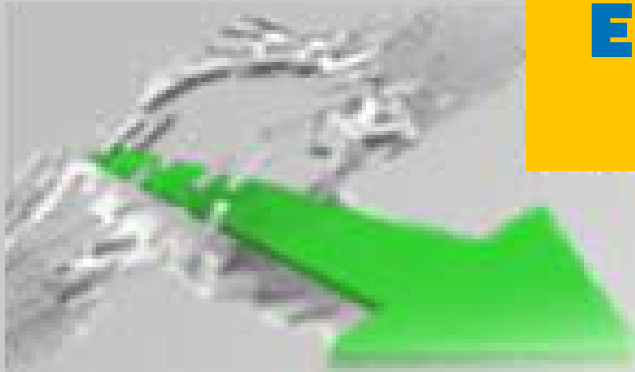


Figure 15. Other Sources of Funds, 2017

# ENVISIONED BANNER F



**Nanotechnology:**  
Military Bullet-  
Proof Vest



**ASSISTANCE**  
Innovation Cen



**Technology Transfer:**  
ASEAN FIC



**Technical Services:**  
ADMATEL Level 1 Failur

FOR 2018

Artificial  
Intelligence  
Illegal Drug  
Trafficking  
Investigation

TO MSMEs.  
Center for Halal



Disaster Preparedness:  
Collapsible Emergency Toilet  
Baby Floating Capsule/Shelter

e Analysis

# ITDI Executive Committee



*L-R*

Engr. Norberto G. Ambagan, Chief, FPD  
Dr. Rosalinda C. Torres, Chief, STD  
Dr. Janet F. Quizon, Chief, FMD  
Lydia M. Ablaña, Chief, PMISD  
Dr. Annabelle V. Briones, Deputy Director for R&D & OIC, CED  
Dr. Maria Patricia V. Azanza, Director  
Dr. Diana L. Ignacio, Chief, AdmD  
Aurora V. Kimura, Chief, NMD  
Nelia Elisa C. Florendo, Chief, TSD  
Daisy E. Tañafranca, Chief, PTD  
Dr. Blessie A. Basilia, Chief, MSD  
Engr. Reynaldo L. Esguerra, Chief, EBD



**OD**

Office of the Director

**ODD**

Office of the Deputy Director





**R&D**

**CED**

Chemicals and Energy Division

**EBD**

Environment and Biotechnology Division







**FPD**

Food Processing Division

**MSD**

Materials Science Division





**PTD**  
Packaging Technology Division

**ADMATEL**  
Advanced Device and Materials Testing Laboratory

**NMD**  
National Metrology Division



## Technical Services





## STD

Standards and Testing Division

## TSD

Technological Services Division





**AdmD**  
Administrative Division

**FMD**  
Financial Management Division

**Support  
Services**





**PMISD**  
Planning and  
Management  
Information  
Systems Division

# Organizational Chart

## DIRECTOR

### Deputy Director R&D

#### Research & Development Group

**C E D**

Chemicals & Energy Division

**E B D**

Environment & Biotechnology Division

**F P D**

Food Processing Division

**M S D**

Materials Science Division

**P T D**

Packaging Technology Division

### Deputy Director ATS

#### Technical Services Group

**ADMATEL**

Advanced Device & Materials Testing Laboratory

**N M D**

National Metrology Division

**S T D**

Standards & Testing Division

**T S D**

Technological Services Division

#### Support Services Group

**Adm D**

Administrative Division

**F M D**

Financial Management Division

**P M I S D**

Planning & Management Information Systems Division





Management System  
ISO 9001:2015



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