

# ANNUAL REPORT 2016



DOST



**ITDI**

**"OUR BUSINESS IS INDUSTRY..."**

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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



## MESSAGE OF THE SECRETARY



Congratulations to the Industrial Technology Development Institute (ITDI) for its significant accomplishments in 2016 and for continuing to aggressively pursue the DOST vision of providing Science for the People.

Let me cite some of the notable achievements of ITDI in 2016. Foremost is the recognition of the Pack of Hope and the Mosquito OL Trap System by the 2016 R&D 100 Awards, a prestigious international recognition for exemplary contribution to science, technology, and innovations, dubbed as the global "Oscars of Invention". The ITDI was again awarded by the National Academy of Science and Technology the "Best Institute" for Utility Model (UM) Registrations. The Institute was also able to file 15 additional applications for intellectual property protection of its technologies. Let me also mention the launching of the innovative *Tryk ni Juan* that has used abaca fiber-reinforced composites as material in tricycle roofs and body, a product of green technology.

The Institute also implemented relevant interventions to help drive the growth of food manufacturing industry via Food Innovation Centers (FICs) established nationwide. To encourage researchers to actively engage in R&D and innovation, innovative food products developed in the various FICs were given due recognition. The FICs became more prominent in DOST Technology Transfer Day celebrations held across the Philippines for a more aggressive promotional stance. In the area of disaster preparedness, the ITDI contributed its technologies inclusive of the ceramic water filter, ready-to-eat relief food for deployment in the first stages of disaster response, and the low-cost modular type rainwater collection system.

It is also fitting to celebrate the effort of ITDI in improving its testing and analytical services. In 2016, it expanded the range of testing services for rubber-based products. The OneLab, an IT-based public service innovation to enable easy access to the different laboratories and services in the country, continues to link with even more laboratories nationwide.

Congratulations ITDI for a fruitful 2016. I am banking on your relentless effort to be among DOST's prime movers in advancing S&T for national development.

**FORTUNATO T. DE LA PEÑA**  
Secretary



## MESSAGE OF THE DIRECTOR

The Industrial Technology Development Institute (ITDI) takes pride in presenting the 2016 Annual Report highlighting significant accomplishments of its major programs and projects including its active participation in the various initiatives of the Department of Science and Technology (DOST).

The ITDI designed and implemented for the Regional Food Innovation Centers (FICs) four operational systems to effectively reach out to communities and lay the seeds for industry growth throughout the country. The systems of food product conceptualization and prototype development were introduced per FIC for them to utilize local food resources and talents. Concepts of technical and sales pitch for developed prototypes were introduced and utilized during the several DOST technology transfer activities in Davao, Ormoc, Bulacan, and National Capital Region.

Spearheaded by its Food Processing Division (FPD), with it as the Main FIC, set the bar high at the onset of 2016 when it initially launched a spread of 200 new food product prototypes developed from 2000 concepts. These prototypes developed using the High Impact Technology Solutions (HITS) equipment (water retort, vacuum

fryer, spray dryer, and freeze dryer) were launched on a national scale during the First DOST Technology Transfer Day held at the Philippine Plaza Manila on April 27, 2016. The Regional FICs presented their own prototypes during this occasion and in succeeding technology transfer activities. Competence in technical and sales pitch were utilized by all FIC personnel during presentation of prototypes to the public in all occasions.

In the last quarter of the year, the ITDI through a grant from PCIEERD and the participation of distinguished people from industry, academe, and other concerned food regulatory agencies, recognized the Regional FICs with the most innovative products developed from the major DOST-developed equipment. This recognition was considered an avenue for encouraging creativity and innovation among the FICs. Likewise, this final FIC activity provided the groundwork for preparing the eventual market entry of these innovative products from the Regional FICs, which will take off in 2017 with an initial test marketing of the FIC products in selected stores in Metro Manila.

At the forefront of green technology R&D, ITDI through its Materials Science Division (MSD) together with the Korea Institute of

Materials Science (KIMS) embarked on the utilization of abaca fiber, one of the abundant and strongest natural fibers in the country, as green composite reinforcement for the fabrication of an environment-friendly tricycle drivers' roof named as *Tryk ni Juan*. In the third quarter of the year, ITDI deployed 15 units for field testing and awarded certificates of beneficiaries to officers and members of the tricycle and operators' drivers association and private tricycle school services in Bicutan, Taguig City. To date, the *Tryk ni Juan* units continue to traverse the busy streets of Taguig City showing no signs of delamination. The developed green composite material from abaca fiber is also envisioned for wider application in other modes of local transportation like buses, jeepneys and pump boats. It is a dream that green technology be used in the manufacture of Philippine mass transport vehicles.

The ITDI also deployed and installed, 30 units of low cost modular-type rainwater collection system in 12 barangays from Districts V and VI of Quezon City and several other barangays and municipalities in Nueva Ecija, Pampanga, Mindoro, Laguna, Mountain Province, Manila, and Taguig in preparation for the adverse effects of the El Niño phenomenon in 2016. These foldable units of rainwater collection system with conical cover, which were developed using local materials, can collect and store rainwater up to 1 cubic meter for non-potable domestic use such as for washing clothes, flushing toilets, and for watering lawns and gardens. The rainwater collection system also addresses contaminations with the incorporation of the ITDI-developed micro-filtration technology with anti-microbial coating produced from local indigenous materials. This project, which was funded by DOST-PCIEERD, aims to promote the practical but nonetheless hygienic practice of rainwater collection and storage. Thirty more units will be deployed in other areas in Metro Manila by January 2017. The social relevance of any basic research gives impetus to the rigors of the work.

Through its Packaging Technology Division (PTD), the ITDI produced and is now active in the dissemination of a first-stage disaster relief food for calamity victims in the country. In October 2016, the ITDI distributed 30 boxes or 720 packs of ready-to-eat (RTE) chicken *arroz caldo* to calamity victims in Cagayan that was hit by super typhoon *Lawin* (Haima). Branded as "Pack of Hope", the RTE chicken *arroz caldo* does not need any preparation, can be consumed without drinks, and is stable for one year. The technology was designed for land, sea, and aerial drop of about 30 ft. and by water submersion. A total of 2000 retort pouches of RTE chicken *arroz caldo* and 2000 RTE smoked fish rice meal were produced as stockpile using PTD's facility, which can be rolled out anytime in the event of natural calamities and disaster in the country. The Kai Anya Foods, a local company that adopted the ITDI technology, also produced 82,000 RTE chicken *arroz caldo* for the Department of Social Welfare and Development (DSWD) during the last quarter of 2016. Considering the Philippines as a disaster-prone country, the ITDI continues to pursue the development of other RTE disaster relief foods to contribute to the country's efforts on disaster relief preparedness.

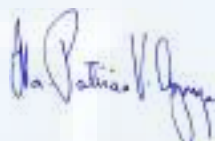
The ITDI, in joint efforts with DOST-Region IX, established the OneLab as an IT-based public service innovation to enable easy access to the different laboratories and services in the country. The OneLab integrated 21 DOST and 7 non-DOST laboratories all over the country in a single website platform which efficiently permits continuous and unified control, from receiving of the customer sample, referral, transfer, and analysis execution to the delivery of results. It is equipped with a customer portal where agency services, quotation request, and result tracker can be accessed through its website, [onelab.ph](http://onelab.ph). On December 20, 2016, a OneLab Networking Forum was conducted at the Acacia Hotel, which was participated in by DOST regional laboratories/offices and non-DOST members. Five more non-DOST

laboratories signified their intention to join the network early 2017.

To cap the last quarter of 2016, ITDI received local and international awards from prestigious award-giving bodies for its significant contribution to science, technology, and innovation. The Mosquito Ovicidal/Larvicidal (OL) Trap System: DOST Anti-Dengue Device and the Shelf Stable Ready to Eat (RTE) Chicken *Arroz Caldo* (chicken congee) as First Stage Disaster/Relief Food were named Finalists in the 2016 R&D 100 Awards held in Washington, D.C., USA. This high achievement has rendered the ITDI-DOST an honored place in the international R&D community. For the second consecutive year, the ITDI was recognized the "Best Institute" for Utility Model (UM) Registrations by the DOST and the National Academy of Science and Technology (NAST) during the awarding ceremony held at Hotel Jen, Pasay City on December 1, 2016. Utility Model Registrations were granted to the following ITDI technologies: Biodegradable Composition Comprising Thermoplastic Nanocomposite and Polylactic Acid and Process for Producing thereof and Process for Producing Biodegradable Composition Comprising Thermoplastic Nanocomposite and Polylactic Acid.

With the new government marking its first year of stewardship, ITDI refocused activities to aggressively contribute to the DOST platform anchored on the four items of the 11-point Agenda of the Duterte Administration. These were translated to projects and programs for technology development and innovation addressing regional concerns; sustainable process for industries and support value chain components; STI-based risk reduction initiatives on climate change, natural disaster, and environmental degradation; knowledge enhancement; and knowledge transfer/technical services.

To my dear ITDI, the realization of our essence within the DOST community would allow us to pursue the needed science, technology, and innovation for our country. The immense support of the DOST Management for us to chase our dictum almost makes it inevitable for us to do our work. The pool of talents exists within our Institute and we should harness this wealth to help drive our industry as a platform to support our country.



**MARIA PATRICIA V. AZANZA, PhD**  
Director

# ITDI Portfolio 2010-2016

In the last six years, ITDI has achieved remarkable progress in performing its mandate. This was realized with the significant improvement in its resources and facilities, and technical services delivery that have made the Institute relevant and responsive to its stakeholders.



# R&D COMPLETED PROJECTS

From 2010 up to 2016, ITDI has completed a total of 295 R&D projects on various areas delving on biotechnology, chemical synthesis, packaging, health and wellness, and energy; with most researches focusing on food, environment, and materials science.

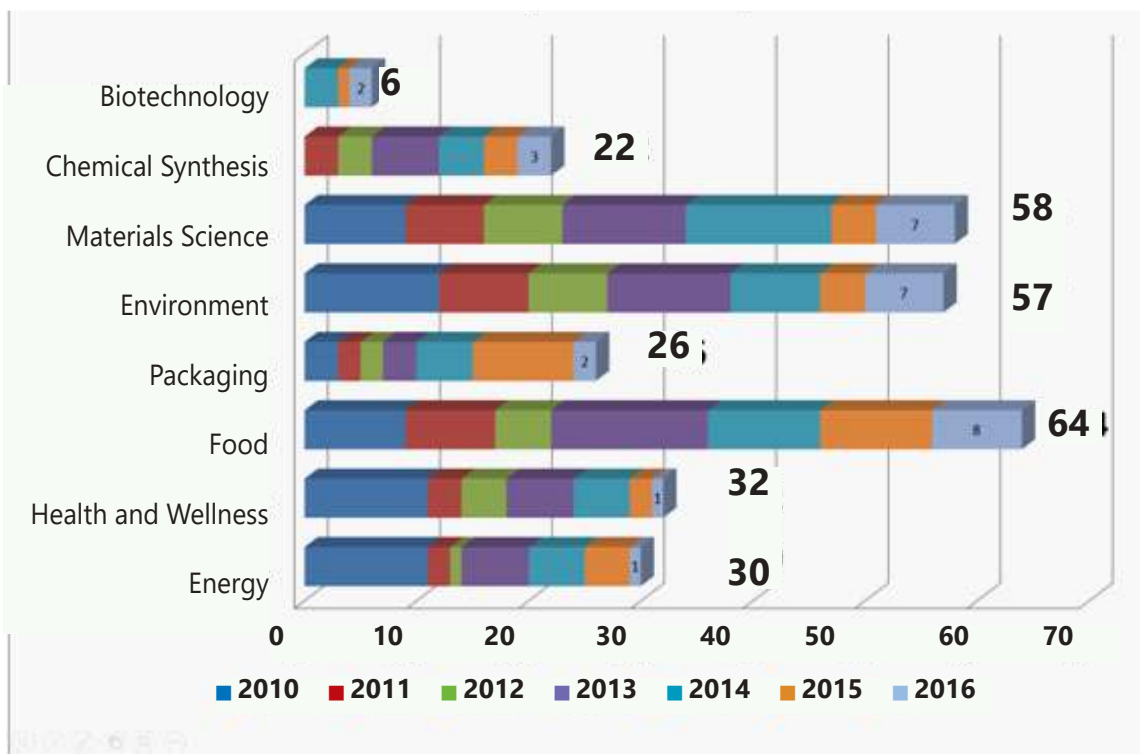


Figure 1. R&D completed projects



# COMMERCIALIZED TECHNOLOGIES

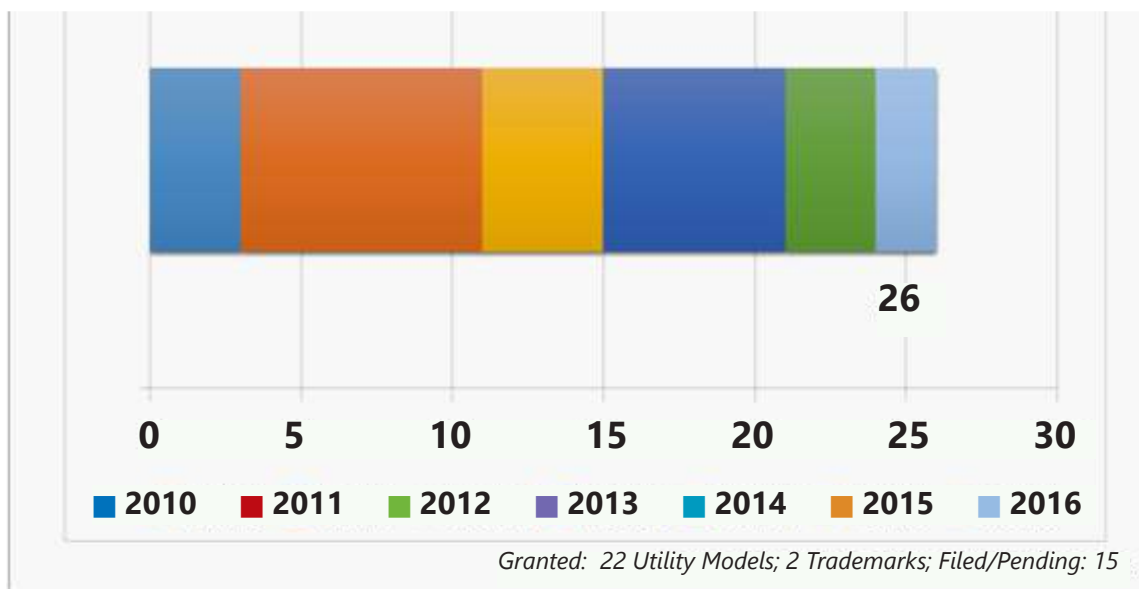
Twenty-nine (29) technologies from these R&D activities have spun-off to commercialization with some even being recognized/awarded both locally and internationally. These included the DOST-ITDI Mosquito OL Trap for the 2014 Lingkod Bayan Award (Group Category) and the Pack of Hope for the Katha Awards in the International Food Exhibition (IFEX). These two were also selected as finalists in the 2016 R&D 100 Awards in the US. Also a recipient of the 2010 Lingkod Bayan Award (Group Category) was ITDI's bioreactor technology.

## Technologies Commercialized in 2010 - 2016

<b>DOST Mosquito OL Trap System</b> *2014 Lingkod Bayan Award (Group) *2016 R&D 100 Awards Finalist, USA	Commercial production of pectin from <i>Calamansi</i> Waste
<b>Pack of Hope</b> *Katha Awards, 2015 IFEX *2016 R&D 100 Awards Finalist, USA	Multi-layer high barrier packaging technology for frozen durian
<b>Emergency Food Reserve (EFR)</b>	Transport packaging technology for fresh durian
<b>Ceramic Water Filter</b>	Gasifier Combustor
<b>Salt Iodizing Machine</b>	Ebulliometer
<b>Essential Oil Extractor</b>	Wine Kit
<b>Bioreactor</b> * 2010 Lingkod Bayan Award (Group)	<i>Muscovado</i>
<b>Acetator</b>	Essential Oil Technology

# INTELLECTUAL PROPERTIES & SCIENTIFIC PUBLICATIONS

As part of knowledge management initiatives, ITDI has also maintained 26 intellectual property grants, 24 of which as utility models and two as trademarks. Another batch of 15 technologies have been filed, adding more to the Institute's growing number of IPRs.



**Figure 2. Intellectual Properties**

## Intellectual Properties 2010 - 2016

### 2010

- ♦ Anaerobic filter bed baffled reactor
- ♦ Caffeine: A novel slimming agent
- ♦ Natural-based analgesic balm

### 2011

- ♦ Method of producing pectin from *calamansi* wastes
- ♦ Pectin from *calamansi* wastes
- ♦ Composition of ovicide/larvicide for *Aedes* mosquito and process of production thereof
- ♦ Water retort machine for processing food packed in flexible retort pouches
- ♦ Development of sugar alternative: Pineapple sugars
- ♦ Waste plastic bags in asphalt mix for road pavement
- ♦ Production of high dietary fiber from *calamansi* wastes
- ♦ Dietary supplement from *Moringa oleifera*, *Syzygium cumini* and *Musa sapientum*

### 2013

- ♦ An improved portable biogas digester
- ♦ An improved coffee roasting system
- ♦ Process of producing floor tiles from rubber crumbs
- ♦ *Rapya*

### 2014

- ♦ Dreamweave logo (The traditional *T'nalak* of the *T'boli*)
- ♦ Oil expeller
- ♦ Process of preparation of natural health supplement from *Annona muricata* fruit in capsule
- ♦ Process preparation of tea from *Annona muricata* fruit
- ♦ Process of preparation of natural health supplement from *Annona muricata* leaves in capsule
- ♦ Process preparation of tea from *Annona muricata* leaves

### 2015

- ♦ Montmorillonite functionalized nanofibers for adsorption of organic molecules through electrospinning
- ♦ Process for producing nanoclays for polymer nanocomposites
- ♦ Process of producing montmorillonite functionalized nanofibers for adsorption of organic molecules

### 2016

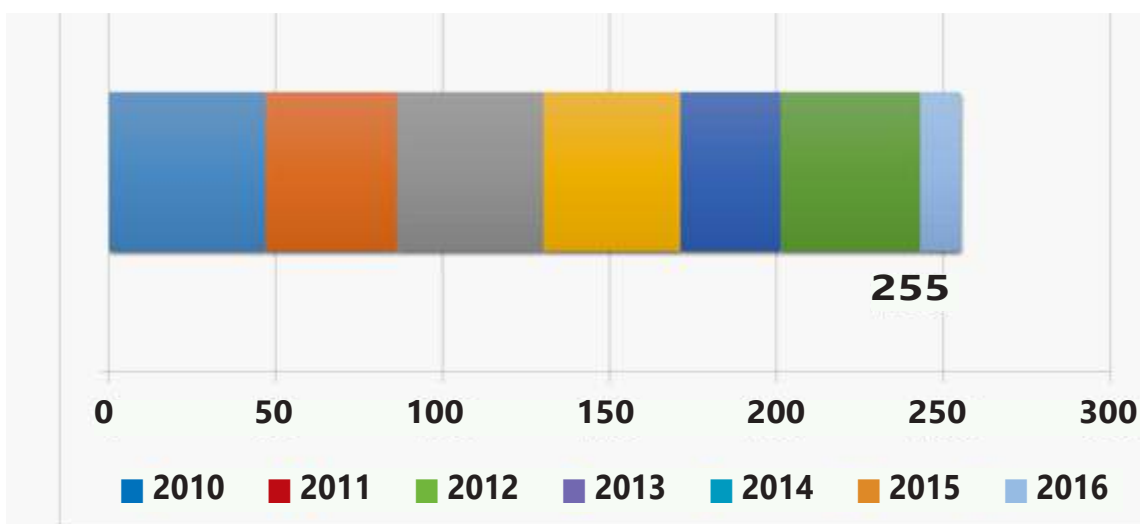
- ♦ Process for producing biodegradable composition comprising thermoplastic nanocomposite and polylactic acid
- ♦ Biodegradable composition comprising thermoplastic nanocomposite and polylactic acid and process for producing thereof

## Intellectual Properties 2010 - 2016

### FILED/PENDING

- ◆ Anaerobic filter bed reactor
- ◆ Process for producing biodegradable composition comprising thermoplastic nanocomposite and polylactic acid (Process)
- ◆ Biodegradable composition comprising thermoplastic nanocomposite and polylactic acid and process for producing thereof (Product)
- ◆ Rice wine (*tapuy*) prepared from a novel *bubod* starter (Process 1)
- ◆ Rice wine (*tapuy*) prepared from a novel *bubod* starter (Process 2)
- ◆ Granulated *bubod* starter for rice wine (Process)
- ◆ Granulated *bubod* starter for rice wine
- ◆ Process of preparing *bubod* starter for rice wine (*tapuy*) Process 1
- ◆ Process of preparing *bubod* starter for rice wine (*tapuy*) Process 2
- ◆ Process of preparing *bubod* starter for rice wine (*tapuy*) Process 3
- ◆ Cookies using squash puree as an ingredient
- ◆ Process of preparing squash puree
- ◆ Process of preparing squash puree using lactic acid as acidulant
- ◆ Process of preparing squash puree using glucono delta lactone as acidulant
- ◆ Process of preparing squash soup using squash puree as ingredient
- ◆ Process of producing montmorillonite functionalized nanofibers of adsorption of organic molecules

In its continuous effort to disseminate technical information and contribute to exchanges in the scientific community, publication of ITDI R&D works was mandated. To date, a total of 255 scientific papers have been published in peer-reviewed journals both locally and abroad.



**Figure 3. Scientific papers published in ISI/ISBN journals**

Total Services Rendered:  
**30,240**

Total Clients Served:  
**7,264**

Total Income:  
**51,133.75**

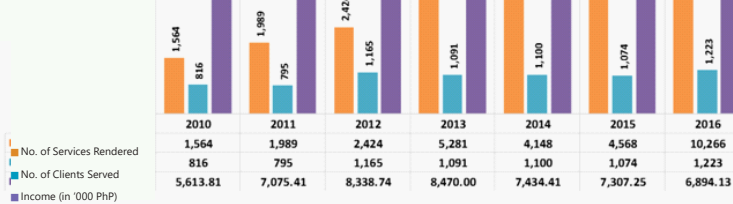


Figure 4. Testing and analyses

Total Services Rendered:  
**68,342**

Total Clients Served:  
**9,648**

Total Income:  
**63,806.50**



Figure 5. Calibration

Total Services Rendered:  
**4,547**

Total Clients Served:  
**4,048**

Total Income:  
**28,202.48**

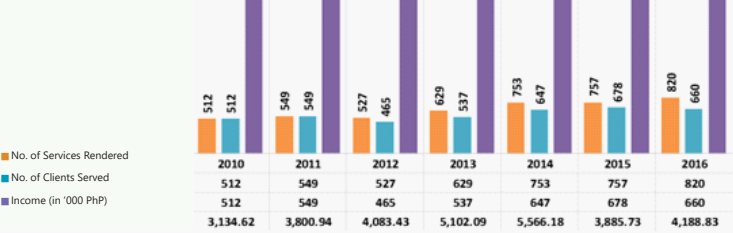


Figure 6. Other specialized technical services

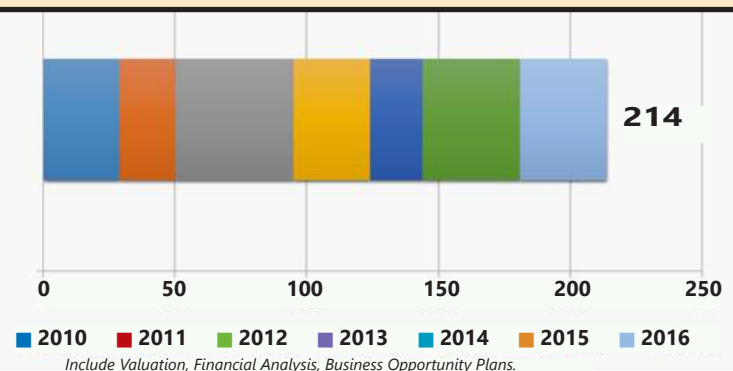


Figure 7. Pre-commercialization services 2010-2016

# TECHNICAL SERVICES

ITDI has provided technical interventions to its wide array of industry, government and academe clientele through the conduct of testing and analyses, calibration and other specialized technical services (i.e. packaging, environmental technology verification or ETV, energy audit, etc.).

For the past 6 years, total income from technical services amounted to ₱ 143,142,730.00, serving 20,960 clients, for a total of 103,129 various services; broken down as follows:

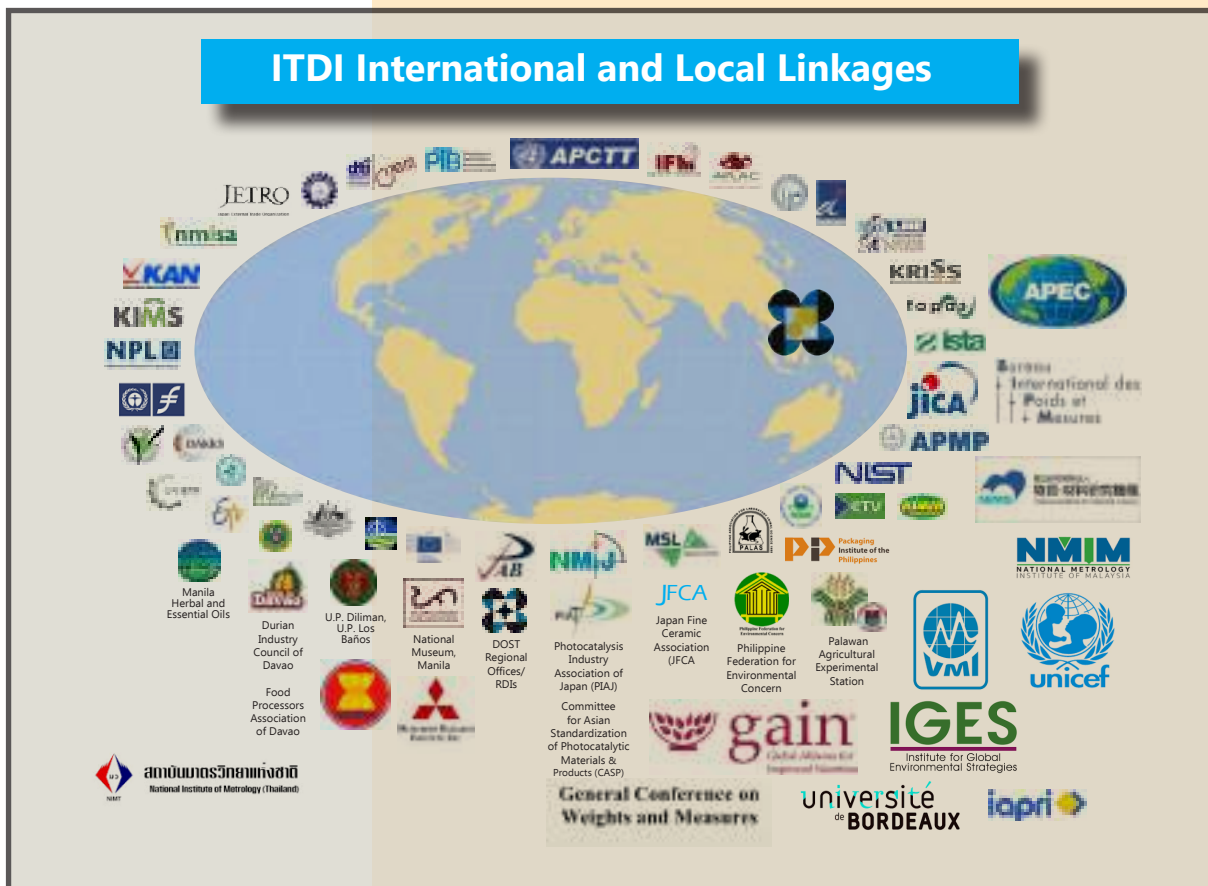
Testing & analyses – ₱ 51,133,750.00; 7,264 clients; 30,240 services  
 Calibration services – ₱ 63,806,500.00; 9,648 clients; 68,342 services  
 Other specialized services – ₱ 28,202,480.00; 3,728 clients; 4,121 services

Pre-commercialization services were also offered to possible technology adopters, 214 of which involved technology valuation, financial analysis and business opportunity plans (BOPs).

Technical Services 2010-2016	
Services rendered	103,129
Clients served	20,960
Income	₱ 143,142,730.00

# LINKAGES & NETWORKS

To keep abreast with the most innovative scientific advances and further strengthen its technical capabilities, ITDI has established linkages/networks with local and international organizations to work on various collaborative endeavors that has also mutually enhanced the capacities of all parties.



# INDUSTRY CONSULTATIONS/ TECHNOLOGY FORUM

From 2015 to 2016, ITDI has conducted multi-sectoral consultations as platforms to interact with stakeholders and together, identify the technology gaps as well as the possible areas for intervention. Among these were the ASEAN Economic Community (AEC) Forum, Kapihan ni Juan, Tech Transfer Day and FIC Technical Fora.

These have been well attended by individuals representing various sectors namely materials engineering, food and beverage, energy, mining, packaging, industry associations/cooperatives, testing/calibration, government, pharmaceutical, shipping and forwarding, materials sourcing and academe.

The technology gaps identified by the sectors include process technology, support facilities (i.e. testing and calibration), compliance to regulations and quality standards, non-DOST public support, availability of local raw materials, utility/operation cost, availability of equipment, financial/technical support, market competitiveness and information dissemination.

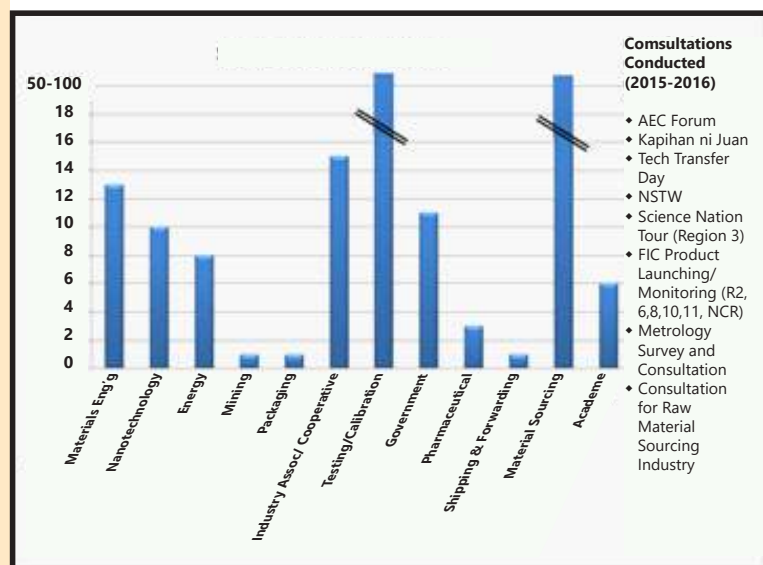


Figure 8. Stakeholders profile

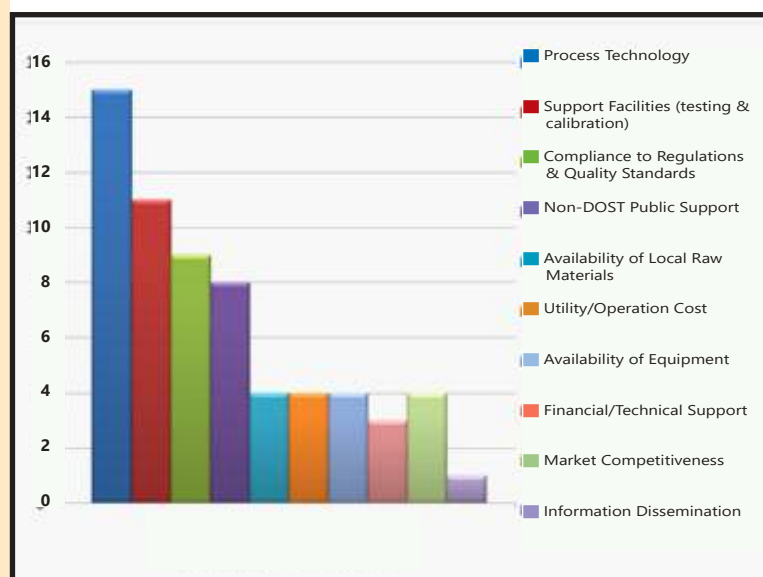
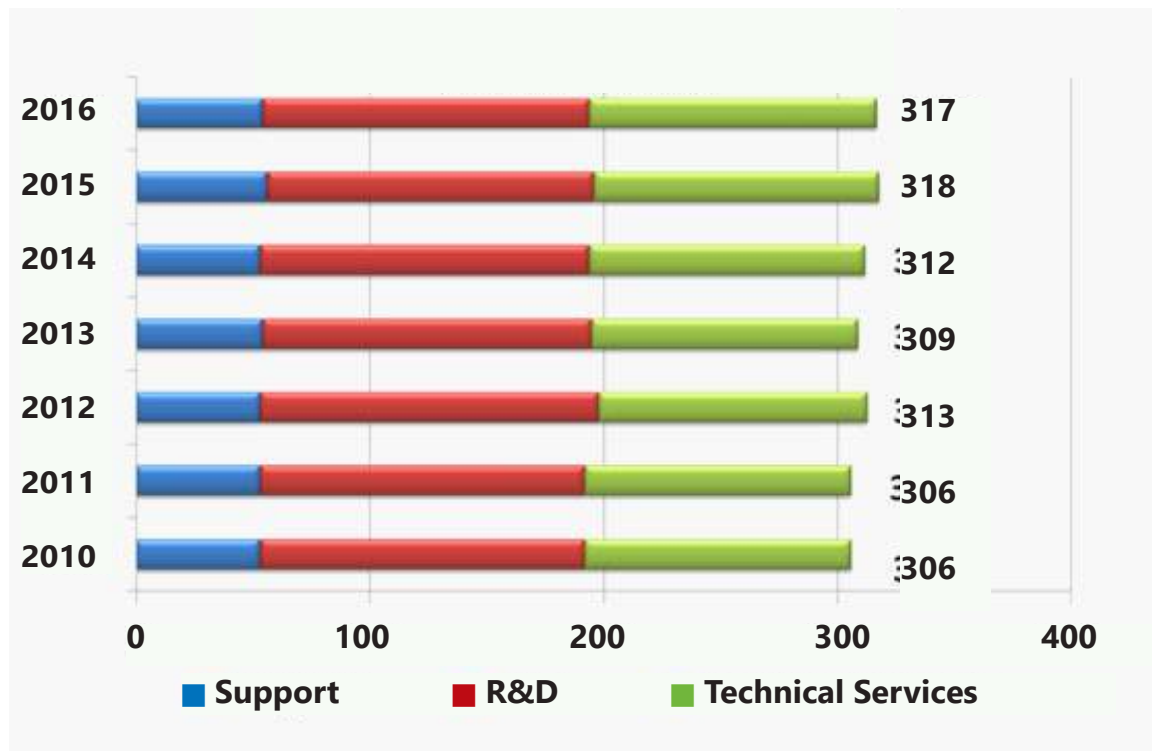


Figure 9. Technology gaps 2015-2016 industry forum

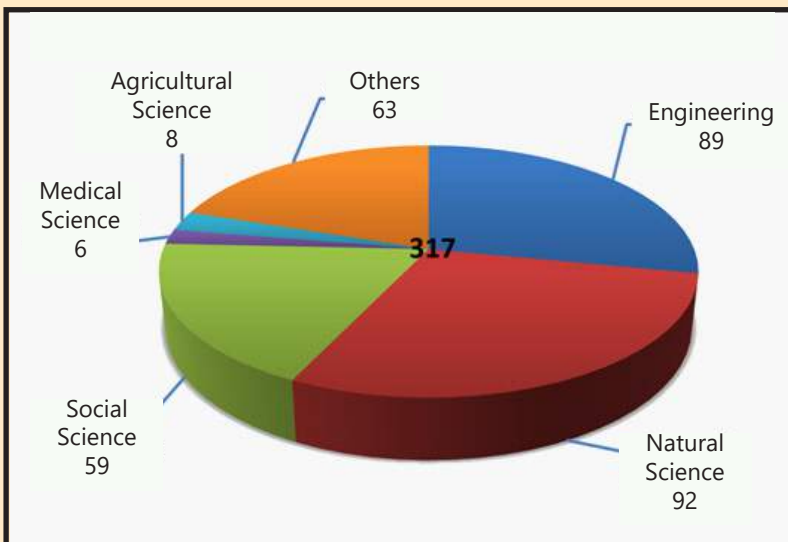
# HUMAN RESOURCE DEVELOPMENT & CONSOLIDATED BUDGET

ITDI's operational workforce has gradually increased from 306 to 317 consisting of personnel from various disciplines including engineering, natural, social, medical, and agricultural sciences. Forty-five staffs obtained advanced degrees, 31 with Master's degree, and 14 with Doctorate degree.

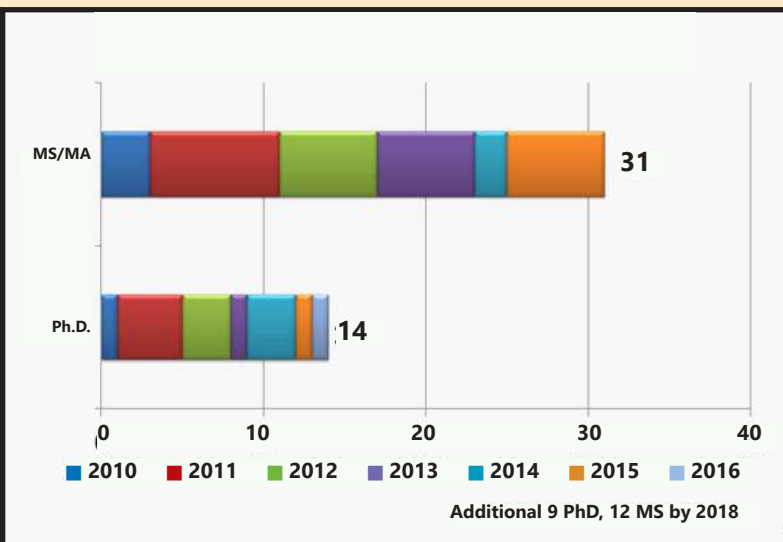


*Figure 12. Personnel complement 2010-2016*



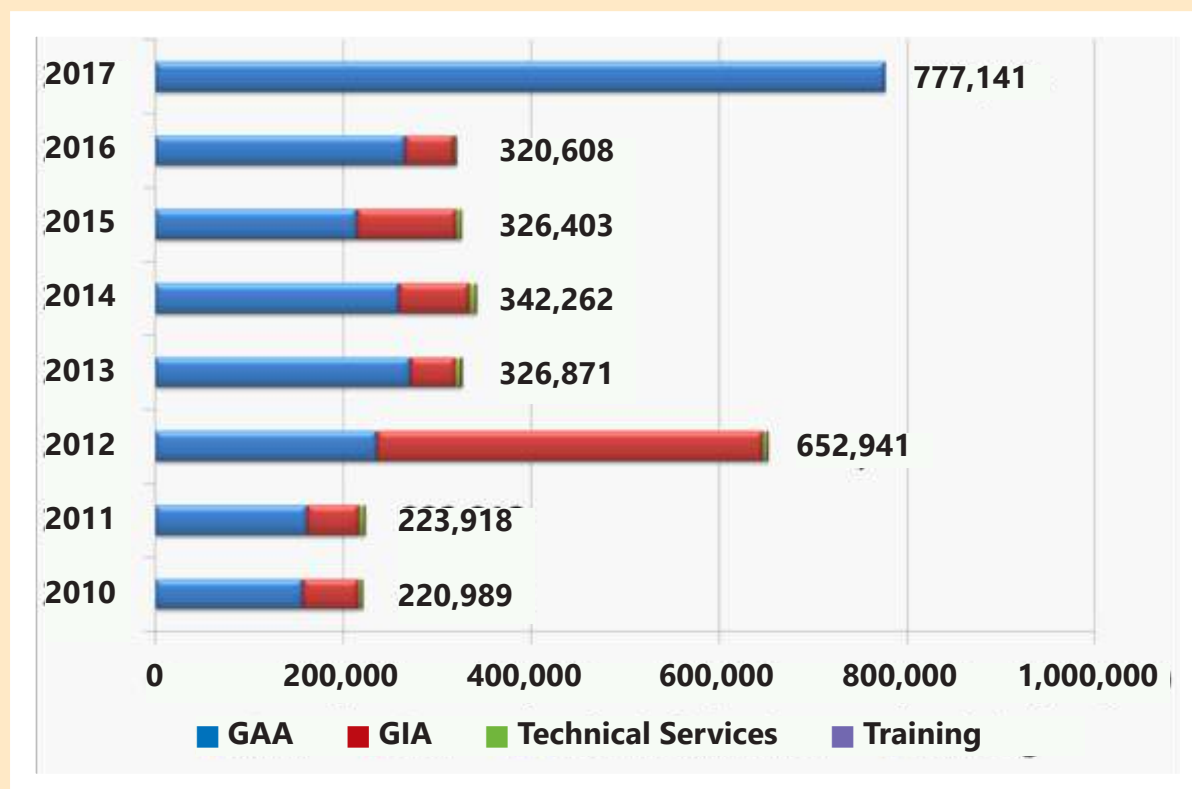


**Figure 10. Human resource by field of study**



**Figure 11. Human resource development 2010-2016**

Total budget of ITDI has been sourced mainly from General Appropriations (GAA) augmented by Grants-in-Aid (GIA) and income from technical services and trainings ranging from ₱ 220 million to ₱ 350 million. This is with exception to 2012 budget that amounted to ₱ 652 million largely contributed by GIA. For the following year 2017, GAA budget amounts to ₱ 777 million.



**Figure 13. Consolidated budget from all sources ('000)**



# 2016 FIVE MAJOR ACHIEVEMENTS



## 1. R&D 100 Awards for DOST-ITDI Technologies

The DOST-ITDI has been named to the list of 2016 R&D 100 Awards, joining the ranks of 100 finalists comprising of world-renowned R&D agencies, companies, and universities from around the globe. Now on its 54th year, the R&D 100 Awards, also often referred to as the "Oscars of Invention" honors the 100 most innovative technologies and services e.g., promising new products, processes, materials, or software developed throughout the world and introduced to the market previous year. Awards are based on each project's technical significance, uniqueness, and usefulness compared to competing technologies or services.



The DOST-ITDI was awarded for its innovative projects under the Process/Prototyping category, namely:

1. Pack of Hope RTE Chicken *Arroz Caldo* as First Stage Disaster/Relief Food, and
2. Philippine Mosquito Ovicidal/Larvicidal (OL) Trap System: DOST Anti-Dengue Device.



## 2. Best Institute Award for Utility Model (UM) Registration

The DOST-ITDI again won the 2016 “Best Institute” award for Utility Model (UM) Registrations given by the DOST and the National Academy of Science and Technology (NAST). Utility Model Registrations were granted to the following technologies:

1. “Biodegradable Composition Comprising Thermoplastic Nanocomposite and Polylactic Acid and Process for Producing thereof”, and
  2. “Process for Producing Biodegradable Composition Comprising Thermoplastic Nanocomposite and Polylactic Acid.”
- The ITDI won the same award last 2015.

## 3. Development of Competence of the DOST Food Innovation Center (FIC) and Recognition of Most Innovative Products

The DOST-ITDI implemented the project entitled “Development of Competence of the DOST Food Innovation Center (FIC) and Recognition of Most Innovative Products” to further support the operation of established FICs in the regions by strengthening their capabilities through detailed trainings on: product conceptualization and prototyping, compliance to food safety regulations, appropriate use of food packaging, technical sales and pitching, product costing, and marketing strategies. The project encouraged the regional FICs to excel in their innovation activities by recognizing and awarding their most innovative products. This recognition of the most innovative FIC products provided the groundwork for their eventual market entry.

## 4. ONELab Project

The DOST-ITDI established OneLab as a public service innovation. It is an IT-based system to enable public access to different laboratories and services. OneLab integrates 21 DOST and 7 non-DOST laboratories all over the country on a single website platform which efficiently permits continuous and unified control, from receiving of the customer sample, referral, transfer, analysis execution to the delivery of results. It is equipped with a customer portal where agency services, quotation request and result tracker can be accessed through its website [onelab.ph](http://onelab.ph). Five more non-DOST laboratories will be added to the network. On December 20, 2016, a OneLab Networking Forum was conducted at the Acacia Hotel where DOST regional laboratories/offices and non-DOST members participated.

## 5. Abaca Fiber-Reinforced Composite Roof (*Tryk ni Juan*)

The abaca fiber-reinforced composite for industrial application is a project of the DOST-ITDI and the Korea Institute of Materials Science (KIMS), South Korea. The project takes advantage of the abundance of abaca fibers in the Philippines. It addresses the need for new reinforcing materials that are both cheap and environment-friendly. The abaca fiber-reinforced composite is lightweight and has low heat conductivity. These properties improve fuel efficiency and protect the passengers and driver from the sun’s heat.

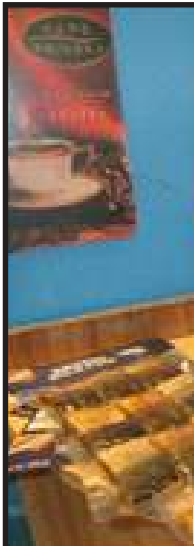
## OUTCOME 1

*Science-based know-how and tools that enable the agriculture sector to raise productivity to world-class standards*

ITDI interventions for agriculture focuses on developing and introducing packaging technologies to reduce post harvest losses, and expand market reach; and optimizing traditional processes to produce variants for new applications.

# Enhancing the competitiveness of fresh and semi-processed agricultural products through the application of appropriate and sustainable packaging technology

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*'Tsukudani' style smoked fish*



*Sorting of mangosteen at farm level*

Implemented by the Packaging Technology Division (PTD) in cooperation with JICA (Japan International Cooperation Agency), the project aims to reduce post-harvest losses in eight (8) target commodities through the introduction of appropriate packaging technology. Packaging technology and interventions for frozen and fresh durian, sweet potato, cut-flowers (rose and chrysanthemum) and smoked fish were already developed while packaging studies for broccoli, cauliflower, mangosteen and mango are on-going.

In addition, packaging design and branding for smoked fish and sweet potato were completed as well as the initial shipments of frozen durian to Japan and fresh durian to Singapore using the developed packaging technology. Feedback from participations in international and national food expositions also indicated that the products sporting their new packaging exhibited high market potential.

In-house training conducted by Japanese Experts and counterpart training in Japan has also enhanced the capability of PTD in the areas of distribution packaging for fresh and semi-processed agricultural products, packaging design and branding, postharvest, and modified atmosphere packaging (MAP).



*Transport packaging for 1 piece fresh durian*



*Transport packaging for frozen durian*

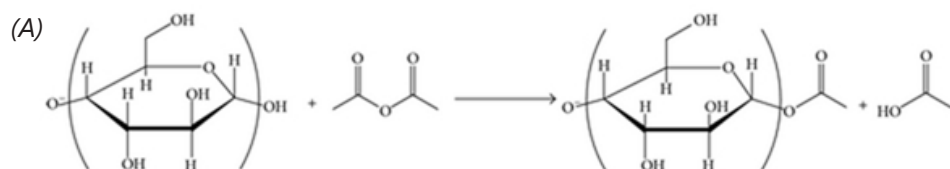


# Modified starches

Three variants of modified starches for food applications were developed through an optimized scale-up process. These are starch acetate, cross-linked modified starch and heat-moisture treated starch. Functional properties are comparable with the commercial modified starches.

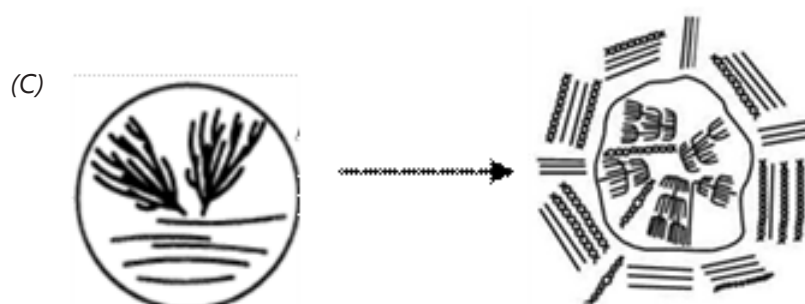
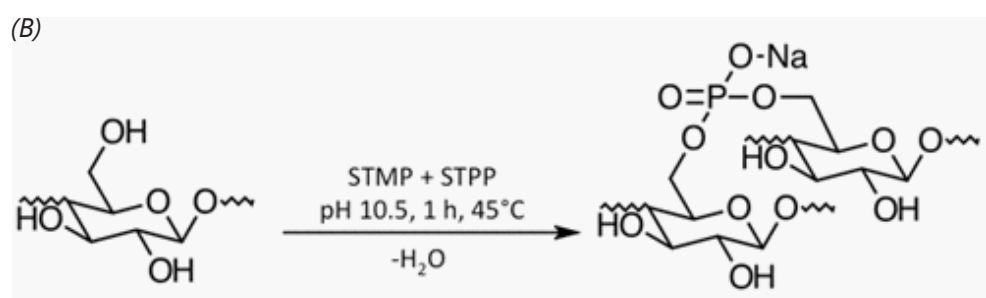


Starch acetate



Modification process of native cassava starch:

- (A) acetylation of an anhydroglucose unit of starch polymer with acetic anhydride,
- (B) cross-linking of starch molecule with phosphate,
- (C) reorganization of starch molecule in heat-moisture treatment.



## OUTCOME 2

*Innovative, cost-effective, and appropriate technologies that enable MSMEs to develop and produce competitive products that meet world-class standards*

ITDI continues to implement initiatives to help enhance the competitiveness of MSMEs.

The potential of locally abundant materials is continually explored while harnessing the fast growing applications of nanotechnology and green technology, among others.

# Bioplastics from blends of renewable polymers and local nanomaterials



*Oxidized cassava starch nanocomposite disposable cutleries*

The use of renewable resources and locally-produced nanomaterials in the production of bioplastics can provide realistic solutions to 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 processability and 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 were also derived from materials that occur naturally and had proven to give adequate results in improving biopolymer properties even at low filler concentration.

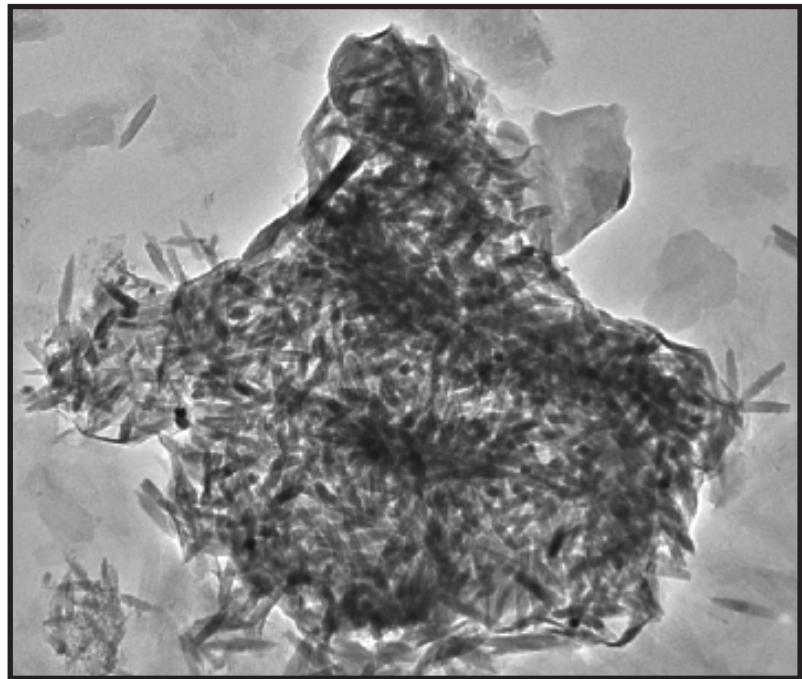


*Oxidized cassava starch nanocomposite*



# Surface modification of locally produced nanozeolite for water purification system

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*Transmission Electron Microscope (TEM) micrograph of metal oxide modified nanozeolite*

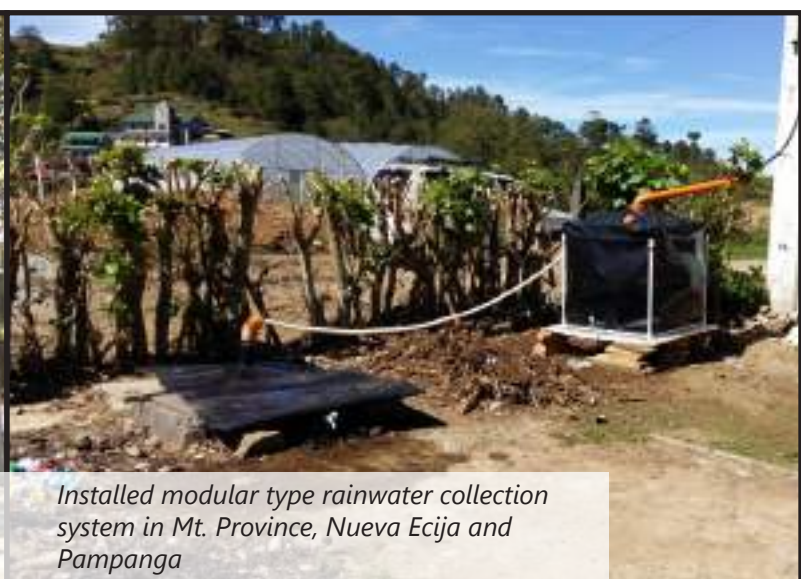
In the Philippines, accessibility to safe, potable drinking water has been a problem not only in the rural areas but also in urban areas like the National Capital Region due to shortage and water contamination. If unchecked, these contaminated water sources can be carriers of microbial contaminants and pollutants such as heavy metals that can cause water-borne diseases.

To address this problem, nano materials from local natural resources like zeolite are being developed (nanozeolite) for water purification. The produced nanozeolites were modified using metal oxides for removing contaminants (heavy metals, anions, organic matter, and microorganisms) in water. Results of anti-microbial test by disc diffusion method and heavy metal analysis by AAS were promising, indicating the potential of these modified local nanozeolite materials for water purification.

# Deployment of low cost modular type rainwater collection system using locally available materials



*MOA signing and turn-over ceremony of modular type rainwater collection system in Taguig City.*



*Installed modular type rainwater collection system in Mt. Province, Nueva Ecija and Pampanga*

In preparation for the El Niño/La Niña Phenomenon, water conservation and the practice of storing rain water should be promoted. In support of this objective, ITDI in partnership with Manly Plastics Inc., and PCIEERD (Philippine Council for Industry, Energy and Emerging Research and Development) developed a rainwater collection and storage system. The developed system is modular and pillow type, and made from local raw materials. It is also cheap and easy to install.

The rainwater storage system will be deployed in households, barangays and municipalities around the country. So far, fifty beneficiaries have already been identified that include Laguna, Misamis Oriental, Mt. Province, Nueva Ecija, Pampanga, Taguig City, Quezon City, and Manila. Evaluation of the microbial, physical, and chemical attributes of the rainwater collected and stored in the installed systems is on-going.



*Test Panels for Year 3 and Year 5 retrieval mounted on exposure racks*



*ACM sensor after 1 month exposure*

## South East Asian atmospheric corrosion exposure study of electronic equipment and components under a marine environment in the Philippines – Year 2

The Southeast Asian Atmospheric Corrosion Exposure Study (SEA-ACES) is a project implemented by ITDI in collaboration with Japan's National Institute of Materials Science (NIMS). The main objective of the study is to obtain and establish scientific data on the corrosivity and corrosion performance properties of test panels consisting of electronics/telecommunication components, auxiliaries, coated steel panels/casings, etc. subjected under aggressive atmospheric marine environment in the Philippines. Corrosion products that developed on the retrieved metal based samples with exposure time will be characterized as well.

Now on its second year, one set of test panels were retrieved last June 23, 2016 after one-year exposure at the site. The

panels were weighed and characterized (e.g. color and gloss determination) at the laboratory of the Materials Science Division (MSD). Minor changes in terms of appearance, weight, color and gloss were observed on the surface of the test panels. The retrieved test panels were then sent to NIMS of Japan for further characterization and evaluation.

No significant effect were observed on the test panels exposed for one year. Thus, NIMS decided to extend the project to five years to determine the effect of long term exposure on the test panels. The retrieval will now be on the third and fifth year no longer on the second and third year as originally proposed.



## *Tryk ni Juan*

Focusing on the green attributes of abaca fiber, MSD (Materials Science Division) researchers have developed an abaca fiber-reinforced composite for the fabrication of an environment-friendly tricycle driver's roof. The locally abundant abaca fiber is one of the strongest natural fibers and is lightweight, and heat and corrosion resistant. These characteristics make automotive roofing materials from abaca fiber-reinforced composite improve fuel efficiency and passenger's comfort.

The eco-friendly abaca fiber-reinforced composite tricycle driver's roofs were distributed to the members of the General Santos Street Lower/Upper Bicutan Taguig Tricycle Operators-Drivers Association, Inc. (GSS-LUBTTODAI) last July 1, 2016 which was also the launching of the field testing activity for the tricycle units with the abaca composite roofs aptly named *Tryk ni Juan*.

The abaca fiber composites for industrial applications is a project of ITDI and the Korea Institute of Materials Science (KIMS). The collaboration explored the use of different abaca treatments, surface modification techniques, and composite production technologies for natural fiber-reinforced composite production.



## Plans for biotech researches

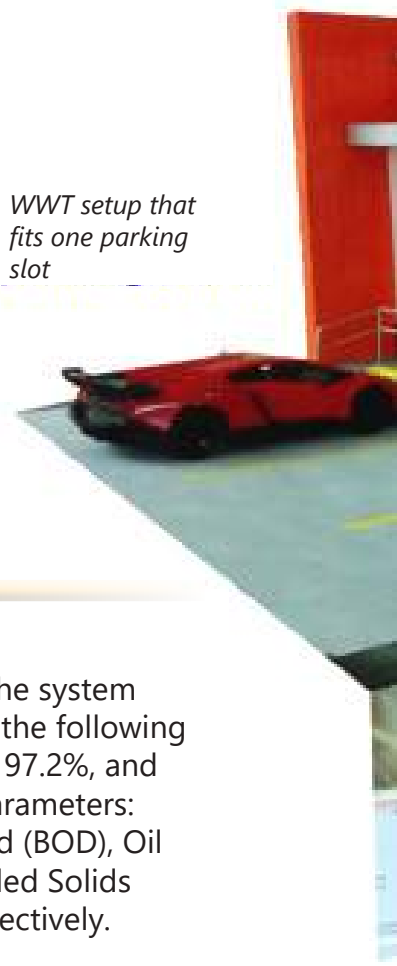
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Prior to the 2009 rationalization, biotechnology programs and projects of ITDI were spearheaded by the Microbiology and Genetics Division (MGD). Among the technologies developed included those for application in pharmaceutical, food, energy and environment industries. With the merging of MGD and the Environmental and Biotechnology Division to form EBD, and retirement of most of its scientists, biotechnology research took a backseat. But with this year's successful transfer of the technology on food color from *Monascus purpureus*, biotech R&D resurgence at ITDI is expected in 2017.

Over the next five years, EBD will expand its focus in the fields of food and pharmaceutical biotechnology. With the completion of advance studies of its staff, biosensors and nanobiotechnology will be among those to be prioritized. EBD shall also start the groundwork for the establishment of a National Reference Laboratory for Pathogens and Non-Genetically Modified Organisms by next year.

# Compact wastewater treatment system for Quick Service Restaurants (QSRs)

WWT setup that fits one parking slot



The Environment and Biotechnology Division (EBD) has developed a compact wastewater treatment system for quick service restaurants (QSRs) which will require less space and capital investment. This compact system is flexible enough, that it can be retrofitted with existing oil and grease traps and/or other existing primary treatment units.

Furthermore, the treatment efficiency of the compact wastewater treatment system will be enhanced by bio-augmentation through the use of immobilized microbial cells. The immobilization of bacteria allows for a higher concentration of microorganisms inside the reactor. Based from the

bench-scale experiment, the system was able to come up with the following efficiencies: 97.5%, 99.9%, 97.2%, and 98.0% for the following parameters: Biological Oxygen Demand (BOD), Oil and Grease, Total Suspended Solids (TSS), and Surfactant, respectively.

This project can be considered as an initiative of the government to help fast food industries meet the effluent (wastewater discharged after treatment has been applied) standard set by the Philippine Clean Water Act at a lower cost, which is beneficial to both the people and the industry as this affects environmental and health concerns.

**Table 1. Results of analysis before and after treatment**

Parameters	Effluent (Raw WW)	Effluent (Treated WW)	Standard Unit for Class C
BOD,mg/L	554	14	50
Oil & Grease, mg/L	1354	0.9	5
TSS, mg/L	464	13	100
Surfactant, mg/L	1.96	<0.04	15
pH	5.5	7.65	6.0 - 9.5

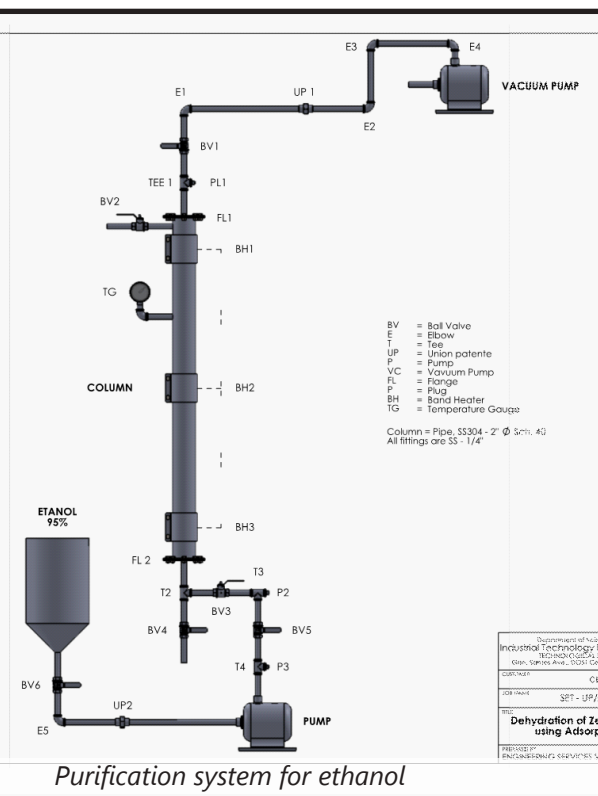


# Nanozeolite-based molecular sieve membrane

The developed nanozeolite-based molecular sieve membrane can be used for purifying fuel grade ethanol up to 99.8%. It can also be used for capturing CO<sub>2</sub> from post-combustion system adsorbing 13% CO<sub>2</sub> emissions in diesel-fired boiler system.



CO<sub>2</sub> capture in boiler system



Purification system for ethanol

## OUTCOME 3

*State-of-the-art facilities and capabilities that enable local industries to move up the value chain and attain global competitiveness*



# ADMATEL milestones

In support of local industries, ITDI continues to develop its capability and establishes facilities as well, to enable provision of various technical services and generate quality products and processes that meet global requirements.

The year 2016 marked another milestone for ADMATEL contributing up to ₱ 9.977 million in revenue, which has increased by 99% from 2015, as well as providing solutions to a plethora of customer needs. This remarkable increase was spurred by a two-fold approach; 1) reduction of turnaround time to 24 hours, and 2) capture of a broader market reach covering not only the electronics companies but also automotive, construction, foods, plastics, paints and coating, metal fabrication, petrochemical, batteries, industrial gasses, and telecommunications.

### **24-hours turnaround time**

Reducing the turnaround time to 24 hours was a struggle, because it entailed a deeper cognizance of its importance and a paradigm shift for the whole team. A "sense of urgency" mindset has to be imbibed to ensure immediate response to urgent customer requirements. This has been realized through the following initiatives:





- ◆ Positioning of full time employees,
- ◆ Equipping the technical staff with basic and advanced trainings on both the principles and hands-on operation of key instruments such as Focused Ion Beam-Field Emission Scanning Electron Microscope (FIB-FESEM), Auger Electron Spectroscopy (AES), Time-of-Flight Secondary Ion Mass Spectrometer (ToF-SIMS), and Thermo-Mechanical Analyzer (TMA); and,
- ◆ Streamlining of processes and procedures.

### **Capturing a broader market reach**

In relation to market share, ADMATEL is expanding its clientele portfolio to other industries by assembling a highly driven multidisciplinary team to better understand and provide solutions to a wider variety of failure analysis problems, new product development, and validation of designs and technologies. This is done in conjunction with the following approaches:

- ◆ Actively participating in various electronics convention and academic conferences,
- ◆ Plant visits and face to face interaction with key personnel from semiconductor and electronics companies,
- ◆ Ensuring customer satisfaction by adhering to the principles and practices of ISO 17025; and,
- ◆ Close coordination with clients.

### **Future Plans**

2017 will be a challenging year for ADMATEL and will focus primarily on its sustainability. The sustainability program will be anchored on three key elements which we call 3P's; People competency, Process improvements, and business Performance. With these innovations, ADMATEL expects to be more relevant and responsive to industry.

# Enhancement program of the NML

The DOST's National Metrology Laboratory Enhancement Program establishes state-of-the-art equipment and facilities, and technical expertise to deliver credible measurement services for every user in the country to meet the current and future requirements of the global economy.

The program was benchmarked with the capabilities of the National Institute of Metrology of Thailand (NIMT) through a proxy survey wherein the economic profiles of Thailand and the Philippines were compared which showed that the top grossing industry divisions of both countries are in agreement. This was validated by the 2012 data of NSO Thailand and Philippine Statistics Authority as in Table 2.

**Table 2: Top grossers in value of output fo all manufacturing establishments by division of industry 2012**

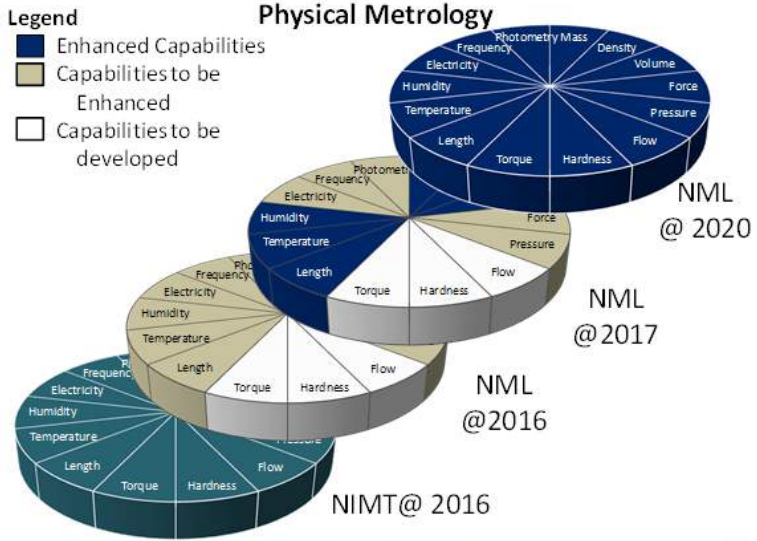
Thailand		Philippines	
Industry Division	Billion Pesos	Industry Division	Billion Pesos
Manufacture of food	1,876.64	Manufacture of computers, electronic and optical products	997.20
Manufacture of motor vehicles, trailers and semi-trailers	1,643.03	Manufacture of coke and refined petroleum products	477.60
Manufacture of computers, electronic and optical products	1,471.53	Manufacture of food	416.40
Manufacture of coke and refined petroleum products	275.24	Manufacture of beverages	195.10
Manufacture of beverages	178.86	Manufacture of motor vehicles, trailers and semi-trailers	157.60

\*NSO Thailand 2012

\*PSA 2012

The five-year enhancement program has a total budget of ₱ 998M. This would enhance 13 existing measurement areas and establish 9 new areas in the Physical, Chemical and Biological Metrology. As of October 2016, DBM has already approved ₱ 395M budget to start up the program.

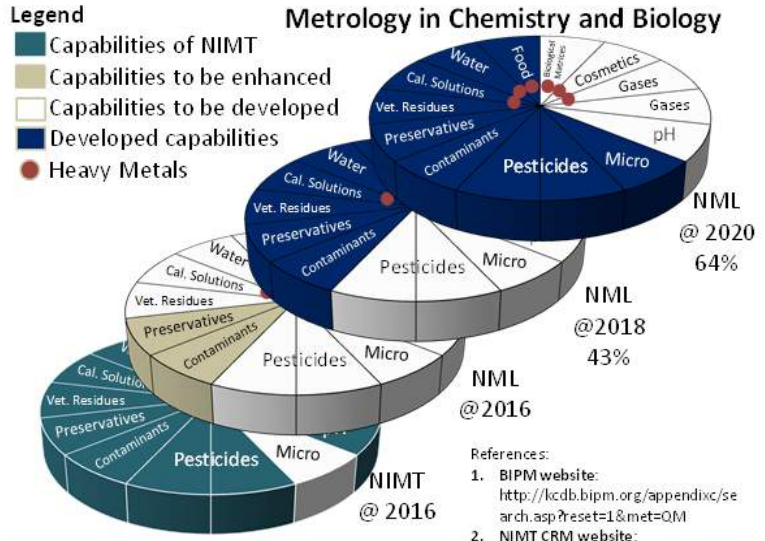
**Legend**  
 ■ Enhanced Capabilities  
 ■ Capabilities to be Enhanced  
 □ Capabilities to be developed



National Metrology Laboratory of the Philippines

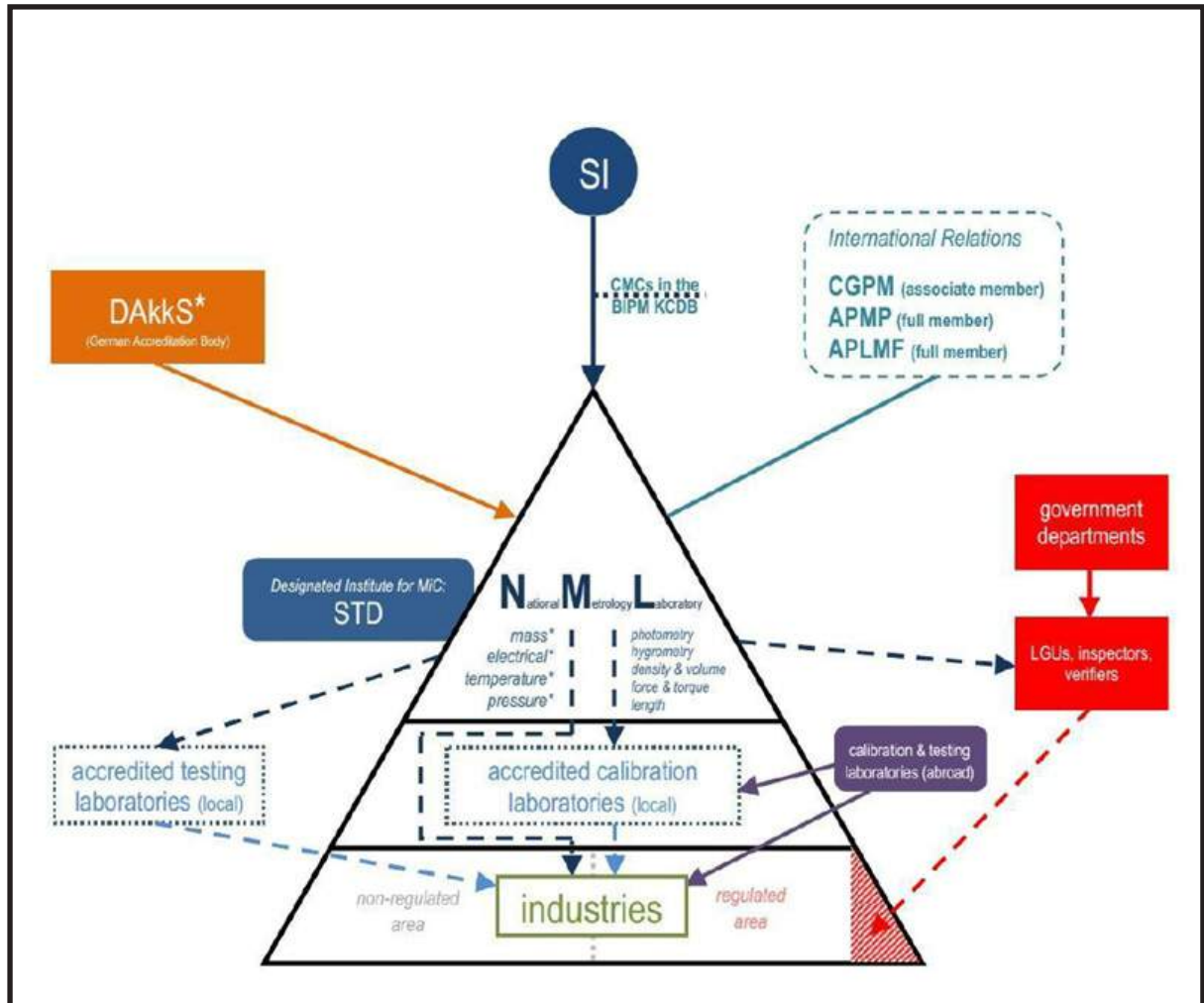
**Figure 14. Five-year expected output in the Physical Metrology**

**Legend**  
 ■ Capabilities of NIMT  
 ■ Capabilities to be enhanced  
 □ Capabilities to be developed  
 ■ Developed capabilities  
 ● Heavy Metals



National Metrology Laboratory of the Philippines

**Figure 15. Five-year expected output in the Chemistry and Biology Metrology**



**Figure 16. Current status of the Philippine Metrology Infrastructure**



# Rubber testing laboratory



*Volume Resistivity Tester*

The Physical Performance Testing Laboratory under the Standards and Testing Division recently acquired new rubber testing equipment namely Ozone Testing Chamber, Volume Resistivity Tester, Rebound Resilience Tester, Brittleness Temperature Tester, High Column Universal Testing Machine for flexible/elastic materials and Buffing Machine for sampling. These were acquired as part of the implementation of the project entitled "Integration of Testing Services for Rubber and Rubber-based Products" which aims to enhance the capacity of ITDI to offer complete testing services for manufactured or processed rubber. With these acquisitions, new test services are now offered and this will be applied for ISO/IEC 17025:2005 accreditation.

Two more testing equipment, the Bursting Machine and Flammability Apparatus, arrived at year end and will be offered to clients starting first semester of 2017. With the completion of the facility, the Philippines through ITDI can now align with the ASEAN harmonization of standards.

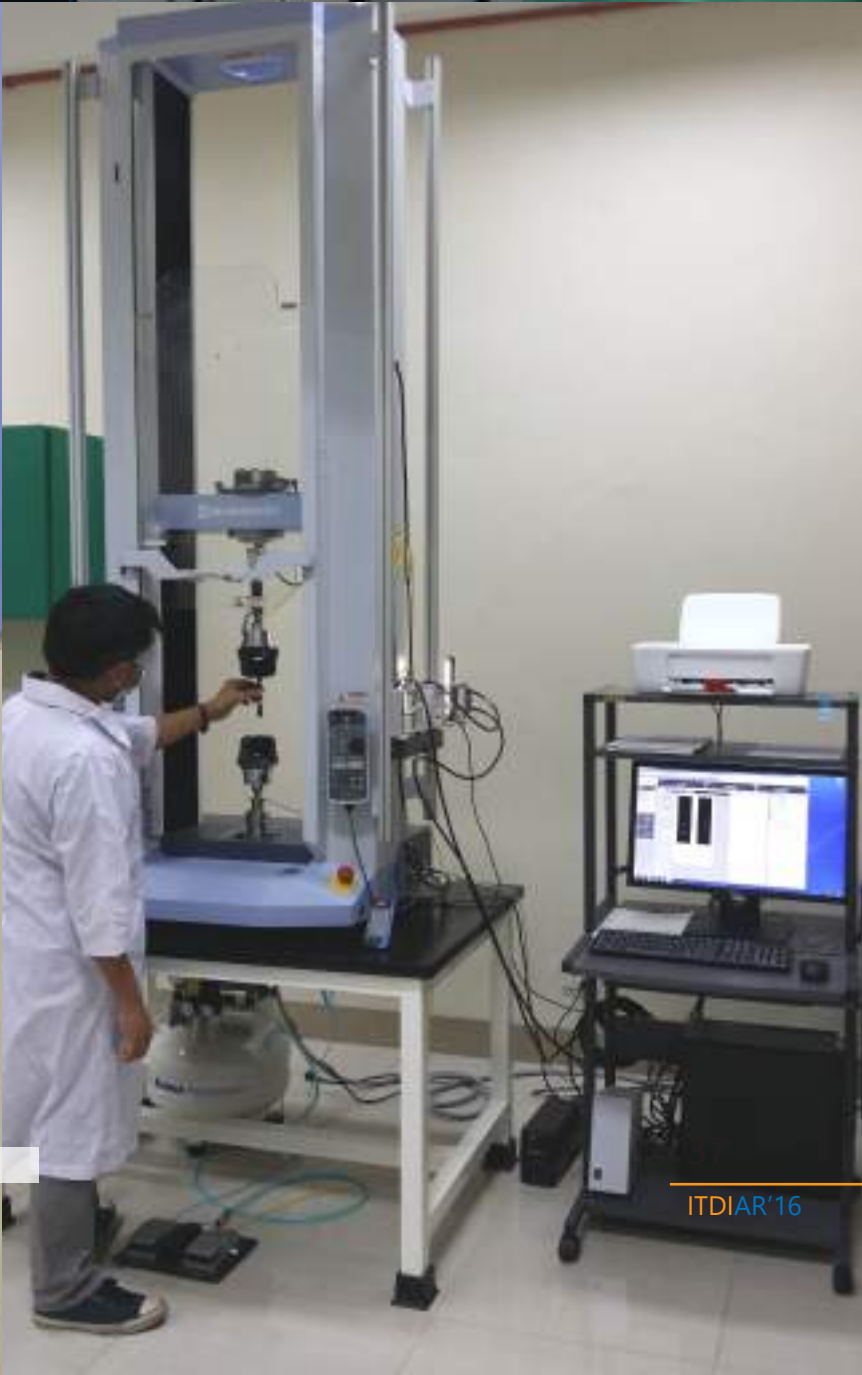




Ozone Testing Chamber

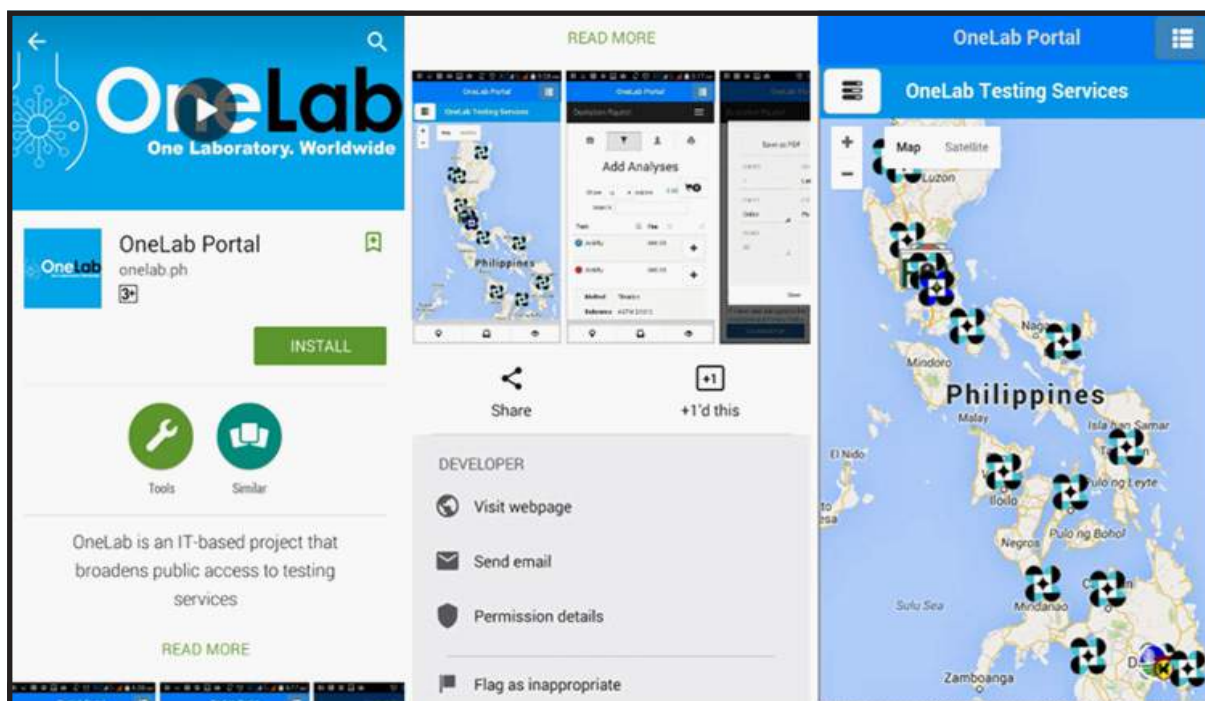


Brittleness Temperature Tester





The OneLab project on its Phase 2-Y2 implementation have formally launched the OneLab Customer Portal on April 27, 2016 at Sofitel Philippine Plaza. The portal serves as an online information center that provides detailed instructions to customers for their test and calibration requirements as well as quotation requests and online access to track the status of their test requests. It is available on three platforms (web, android, and IOS) and can be accessed through the domain: [onelab.ph](http://onelab.ph).



Trainings on IT (Information Technology) were also conducted which were attended by RSTLs (Regional Science and Technology Laboratories) and RDIs (Research and Development Institutes) staffs. These include: Intel XDK Training (July 5-9, 2016), Mean Stack-Intermediate Level (Nov. 14-18, 2016), Mean Stack-Advanced Level (Dec. 5-9, 2016), and Customer Relations Officer (CRO) Training (Nov. 22-25, 2016).



The OneLab network is likewise continuously being expanded with seven new added members from the private laboratories, namely: INTERTEK Phils., SENTROTEK, QUALIBET, GCH Center, Optimal Lab. Inc., and Jefcor Lab.

Also, a year-end activity, the OneLab networking forum, was conducted on December 20, 2016 at Acacia Hotel, Alabang, Muntinlupa City. It was attended by all members of the OneLab network where they shared and learned from the best practices of efficient and sustainable laboratories and received updates from accreditation bodies like the Philippine Accreditation Bureau (PAB) and Food and Drug Administration (FDA).





# Thermal process validation services

The Food Processing Division (FPD) continues to support the food industry by providing thermal validation services for thermally processed products. These services include the conduct of heat distribution tests (HDT) for retorts, pasteurizers, and heat penetration tests (HPT) for thermally processed food products in cans, bottles, and pouches to develop adequate and safe thermal processes. These services were further enhanced with the acquisition of a new thermal validation system from Ellab A/S, Denmark through a PCIEERD fund.

The Institute has provided thermal process validation services for 12 companies comprising of 32 heat penetration tests for products and three heat distribution tests for retorts.

In addition, the Institute, in support of the DOST project on “The Establishment of Regional Food Innovation Centers (FICs)” conducted a training for technical personnel from four regional FICs on the establishment of thermal process for canned foods last June 2016 in order to build their capability on establishing safe thermal processes.

More recently, the Institute in partnership with Ellab Philippines, began to develop its capability to validate aseptic processing systems used for Ultra-High Temperature (UHT) Processing. The Institute successfully provided this service to Eau de Coco, Inc. enabling the company to export aseptically processed coconut water to the U.S.





Operator: Rommel Mercado Belandres  
 Process: Heat Penetration Test  
 Session Start: 28/09/2016 10:17:48 AM  
 Session Stop: 28/09/2016 12:03:48 PM  
 Session Name: HPT  
 Session Test: HPT

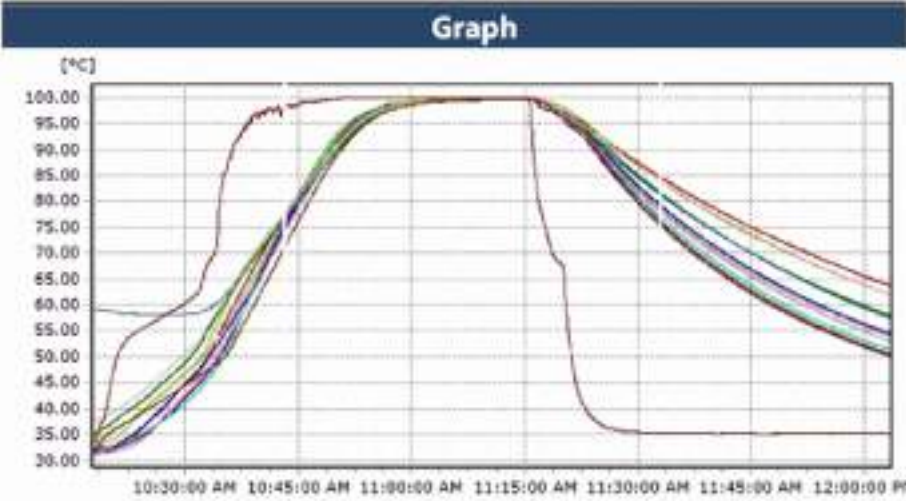


Figure 17. Thermal validation software graph output

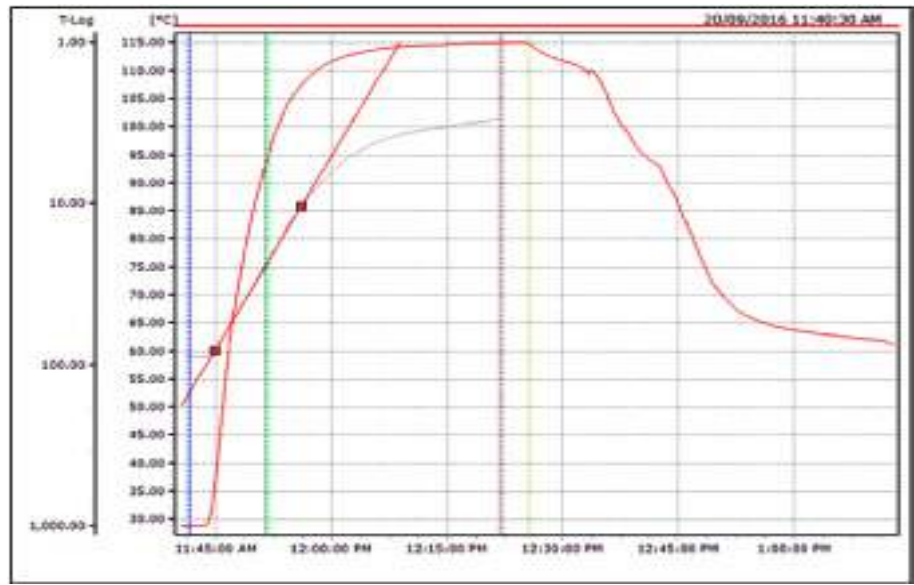


Figure 18. Thermal validation software process simulation graph output

Table 3. Thermal validation software heat penetration report

Operator: Rommel Mercado Belandres  
 Process: Heat Penetration Test  
 Session Start: 30/09/2016 2:30:31 PM  
 Session Stop: 30/09/2016 4:08:16 PM  
 Session Name: Reysons T1 Halo-Halo & White Beans  
 Session Test: Reysons T1 Halo-Halo & White Beans 9/2016



**Heat Penetration**

Name: Heat Penetration

**Input parameters**

Broken Heating: No  
 Mode: Desired Lethality Value: 5  
 Retort Temperature: 115.00°C  
 Tc: 20.00°C  
 C.U.T: 0.58  
 Correction: 1  
 Ball setup: Manual

**Data Series Analysis**

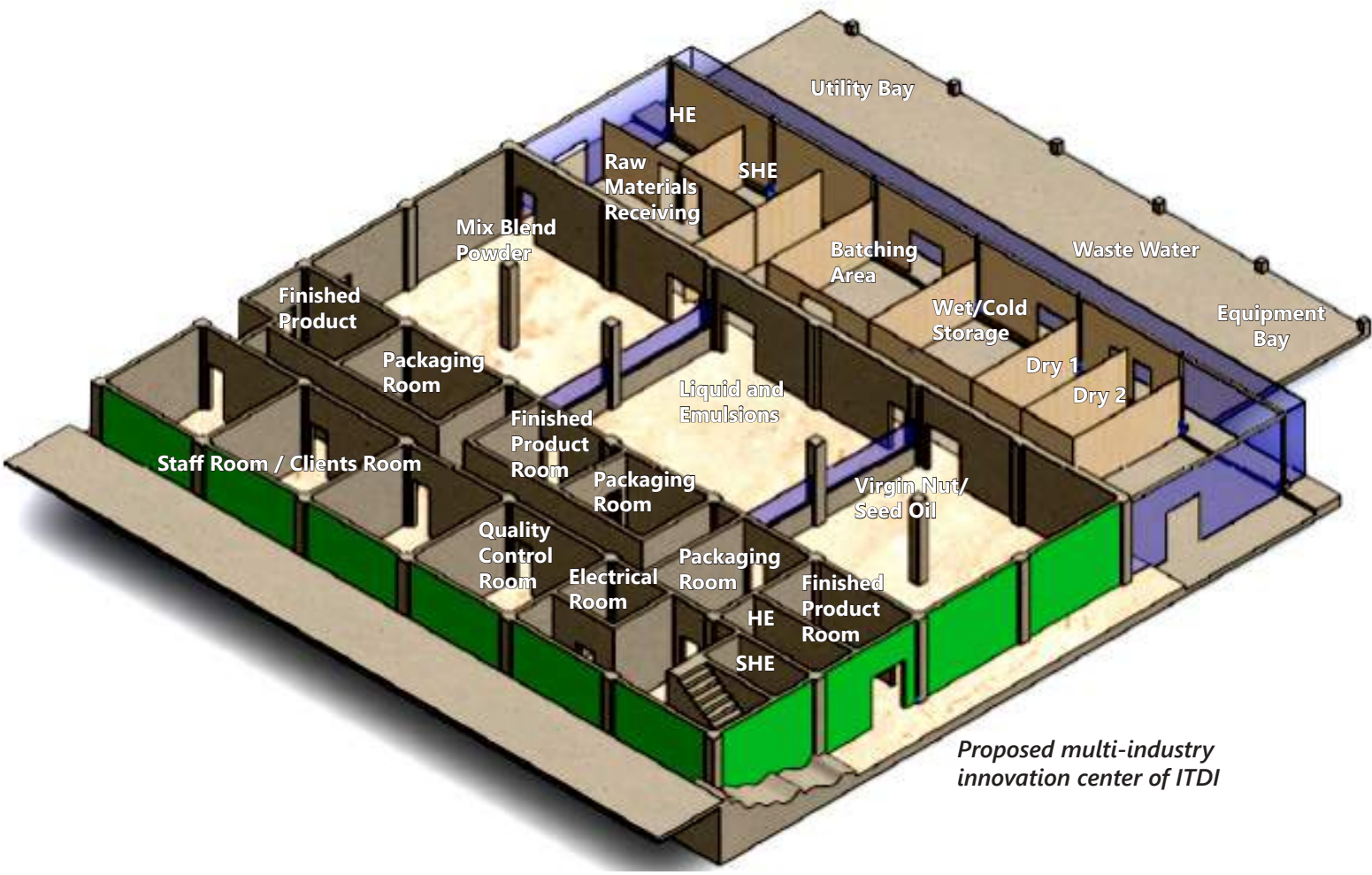
ID	Name	RT	ih	fh	Result
1	TC272262 - Ch 1	118.00°C	1.23	49.47	88.66
2	TC272265 - Ch 2	118.00°C	1.27	49.56	88.94
3	TC272266 - Ch 3	118.00°C	1.24	46.97	85.66
4	TC272267 - Ch 4	118.00°C	1.25	48.18	87.64
5	TC272264 - Ch 5	118.00°C	1.13	46.17	82.66

# Modular multi-industry innovation center

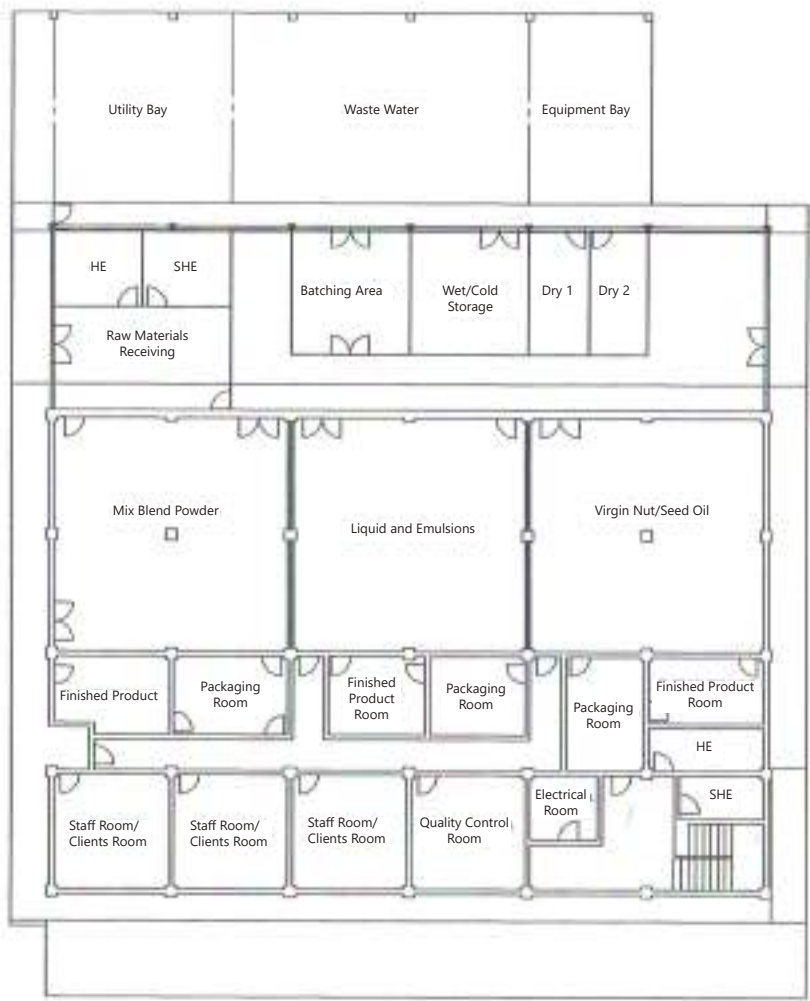
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Establishment of a ₱ 52 million multi-industry innovation center is now being undertaken by ITDI. The 'inno hub' will be equipped with modular, common and generic equipment having multi-function/ application such that these can be retrofitted to different manufacturing lines such as: virgin oils, powder blends and emulsions. Modular design of single-unit equipment with 'plug-and-play' features is the new and innovative approach to achieving flexibility and resource efficiency in different stages of production. Its main advantage, in contrast to a conventional manufacturing facility, is that it can be used for different processes that suit specific process requirements and final products. Other features of the center include process automation system and upscaling to pilot capacity production with materials handling support equipment.

The modular multi-industry innovation center offers flexibility, cost effectiveness, and fast results. Initially, it envisions to cater to the food, pharmaceutical, and cosmetics sectors as part of its primary lines. Industries from the fuels, feeds, fertilizer, and energy will be considered as secondary line to handle by-products. Once the facility has been established, tested, and certified, industries may use the hub for development of new products, product variances, and product reintroduction. These industries already have ideas or initial concepts that need further research and development.



*Proposed multi-industry innovation center of ITDI*



**Figure 19. Proposed layout of inno hub**

# The DOST Food Innovation Centers program

In 2013, the DOST kick-started a national movement to establish a Food Innovation Center (FIC) in each region. Envisioned to become full-service research and development facilities for food manufacturing using indigenous raw materials, each FIC shall assist countryside MSMEs in the food processing sector in an assortment of enterprise establishment issues; on top of the list is the creation of novel products using uncommon technologies. Positive feedback to the initial FIC-gearred projects led to the appointment of ITDI as the oversight body for R&D activities in the FICs.

Of the planned projects under the FIC program umbrella, ITDI contributes to the following: 1) Roll-Out of DOST-Developed Food Processing Equipment to the Regions, with ITDI as lead, and the Metals Industry Research and Development Center (MIRDC) and the Project Management and Engineering Design Services Office (PMEDSO) providing technical assistance; and 2) Development of Competence of the DOST FICs and Recognition of the Most Innovative Products. These are being implemented alongside an aggressive promotional campaign for the Centers' services and products.





Cagayan State University

Bulacan State University

Bicol University

Eastern Visayas State University

Mindanao University  
of Science & Technology

CARAGA State University

Philippine Women's College

Halal R&D Center



## HITS roll-out of DOST-developed food processing equipment to the regions

The goal of this project is to support the DOST Regional Offices in setting up their Regional FICs by equipping them with their first set of DOST-developed R&D equipment: water retort, freeze dryer, vacuum fryer, and spray dryer.

Since the project started in 2013, the project has assisted 13 participating FICs, each with food processing equipment and staff capable of independent or contract research and development. And after having received a flood of positive feedback, in 2015, ITDI's Food Processing Division (FPD) was appointed by DOST as FIC-Main, the oversight body for R&D activities in the Regional FICs.

Aside from the DOST-developed equipment, ITDI is also equipping all FICs with automated can seamers to enable their water retort units to process foods in tin cans; and cabinet dryers, one of the most basic drying equipment. Strategically selected FICs have been provided with state-of-the-art thermal validation systems for use in establishing food process schedules for pasteurized and sterilized FIC products.

### DOST-developed food processing equipment



Vacuum fryer

Spray dryer

Freeze dryer

Water retort

Cabinet Dryer

Can Seamer

Thermal Validation System

Auxiliary equipment to be supplied to the FICs

## Development of competence of the DOST FICs and recognition of the most innovative FIC products

As the newly identified FIC-Main, ITDI-FPD implemented a project designed to encourage research and development among the Regional FICs. Its methodology is two-fold, trainings and friendly competition. First, a common training program levelled off all participating FICs in terms of product research and development using the rolled out DOST-developed processing equipment. After having been given a common launching point, the FICs were then given a few months to submit product prototypes for the most innovative FIC products competition.

Eight Regional FICs participated, resulting in 86 submissions across the four equipment-based categories.

These were initially presented to judges from the Philippine Council for Industry, Energy and Emerging Technology Research and Development (PCIEERD) and ITDI-FPD on September 22 and 23, 2016. Twenty finalists, five per category, were selected from out of the 86 submissions.

Finalists were given seven weeks to improve their products and presentations before they were invited back to Bicutan for the Finals. Judgment at the Finals involved a more diverse panel composed of academics and industry experts in both food processing/manufacturing and food and beverage service.

**Table 4. Most innovative products per equipment category**

AWARD	ENTRY	WINNER	
		DOST Region	Host Institution
With the Most Number of Qualifying Products	<for 7 entries>	2	Cagayan State University (CSU)
Most Innovative Product: Water Retort	Tea-Tums	NCR	University of the Philippines Diliman
Runner Up	<i>Uved</i>	2	CSU
Most Innovative Product: Freeze Dryer	Gracilaria	2	CSU
Runner Up	<i>Arius</i>	2	CSU
Most Innovative Product: Spray Dryer	Sea Grapes Powder	9	Zamboanga State College of Marine Science and Technology (ZSCMST)
Runner Up	<i>Bukolyte</i>	11	Philippine Women's College of Davao
Most Innovative Product: Vacuum Fryer	Crispy Sprouted <i>Monggo</i>	2	CSU
Runner Up	<i>Crunchy Mayahini</i>	8	Eastern Visayas State University
Industry Choice award	Sea Grapes Powder	9	ZSCMST
	Crispy Sprouted <i>Monggo</i>	2	CSU



**Tea-Tums**

A flavorful ready-to-drink blend of lemongrass and *calamansi* extracts infused with turmeric and ginger.



**Uved**

An Ivatan dish made of banana roots, fish, and seasoning. *Uved* is popular among tourists served in broth or deep-fried. Using the water retort, *uved* is turned into a storage-and transport-friendly commodity.



**Gracilaria**

Freeze-dried gracilaria, a type of edible algae, can be used to impart flavor to recipes. Gracilaria from Cagayan is valued for its low heavy-metals content (ex. lead and mercury).



**Arius**

The *arius* tree can be found all over Batanes; the tree yields fruit rich in antioxidants and iron twice a year. The berries are preserved using the freeze dryer for later use in pastries, jams, and as a colorant.



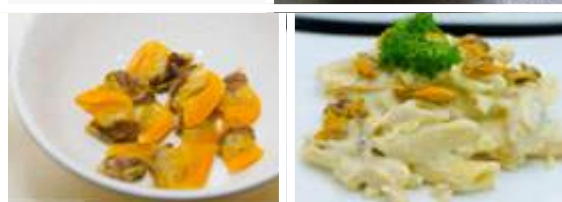
**Sea Grapes Powder**

Powdered extract from sea grapes or lato for use as a condiment or fortificant in food products. Can be used in combination with other flavors, such as *dalandan*, *calamansi* or lemon for variety.



**Crispy Sprouted Monggo**

Healthy snack food from *togue* or *monggo* sprouts seasoned with garlic and salt. *Togue* has been shown to have higher nutritive value than *monggo*.



**Crunchy Mayahini**

Vacuum-fried *Paphia undulata*, known in parts of Leyte as *barinday*, is a crunchy seafood snack that can also be used to garnish food and flavor soups.



**Bukolyte**

*Bukolyte* is powdered coconut for use primarily as an instant *buko* juice mix; it can also be used to flavor other food products, like jams, jellies and ice creams.

## Promotional activities for FIC services and products

The aforementioned projects are all being implemented alongside an aggressive promotional campaign for FIC product prototypes as well as services by participating in various government- and industry-led activities nationwide.



To drum up interest for the nascent FIC in Benguet, ITDI presented in the *"Kordilyera Para sa Agham at Teknolohiya: A DOST-CAR S&T Roadshow"* (April 22, 2016).



The first FIC product presentation for then-Secretary Mario G. Montejo was a DOST-only activity; ITDI was then green-lit for public presentations (February 15, 2016).



FIC products have also become a regular feature in the DOST Technology Transfer Days; the first was held on April 27, 2016 at Sofitel in Manila.



The first public presentation of the FIC products, featuring a total of 200 products from all four DOST-developed food processing equipment, was for the Central Luzon Science Nation Tour and SET-UP Congress (April 12, 2016).







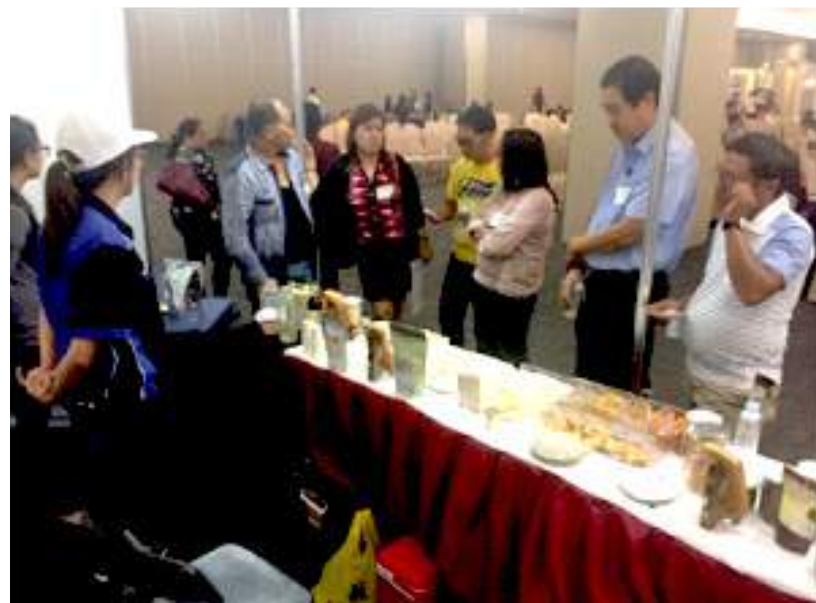
Franchise Asia Philippines  
(July 22-24, 2016)

DOST Science and Technology Week (July 25-29, 2016)



Visayas Technology Transfer  
Day, Ormoc City Superdome  
(September 14, 2016)

Mindanao Technology  
Transfer Day, SMX  
Convention Center,  
Davao City  
(December 13, 2016)



## *Recognition of Most Innovative Products*



*ITDI and PCIEERD officers (front row), and representatives from the participating FICs*

**Table 5. List of FIC promotional activities**

Activity	Date/Venue
Product Presentation for Water Retort	Feb. 15- FPD Training Room, ITDI-DOST
Central Luzon Science Nation Tour, SET UP Congress	April 12- Casa Buena De Pulilan, Pulilan, Bulacan
Technology Caravan, "Kordilyera Para sa Agham at Teknolohiya: A DOST-CAR S&T Roadshow"	April 22- Inglay Restaurant, IC-15 Betag, Km. 6, La Trinidad, Benguet
1st DOST Technology Transfer Day	April 27- Sofitel, Philippine Plaza, Manila
Training on the Establishment of Thermal Process for Canned Foods	May 30- FPD Training Room, ITDI
Advances in Philippine Science and Technology in Support of the Self-Reliant Defense Posture (SRDP) Program	June 3- DOST, Bicutan, Taguig City
	June 6- Camp Aguinaldo, Quezon City
Trade and Industry Development Updates (DOST Innovation Hubs)	June 17- DOST Complex, Bicutan, Taguig City
PCIEERD 6th Anniversary	June 29- Widus Hotel, Clarkfield, Pampanga
Franchise Asia Philippines	July 22-24- SMX Convention Center
2016 National and Science Technology Week	July 25-29- DOST Complex, Bicutan, Taguig City
Leaders in Innovation Fellowship Program Demo Day	Aug. 5- Asia Institute of Management
SCSC Supporting MSME's Trade Facilitation thru Standardization Activities	Aug. 9-15- Lima, Peru
Regional Technology Transfer Day (Visayas Cluster)	Sep. 14- Ormoc City Superdome, Ormoc City, Leyte
Preliminary Screening of FIC Products	Sep. 22-23- FPD Training Room, ITDI-DOST
Davao Technology Transfer Day	Dec. 13- SMX Convention Center, Davao City



# Techno-transfer and pre-commercialization initiatives

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The TSD (Technological Services Division) is the Institute's arm for technology transfer and commercialization. Pursuant to its mandate, the TSD facilitates and implements projects that would lead to or promote the eventual adoption or transfer of technologies and technical services towards commercialization of products and services in the market. This is carried out through various knowledge translation channels such as training, technical assistance and consultancy; development of marketing and business portfolios; technology roll out; and communication collaterals, media, and campaigns.



### Training, technical assistance and consultancy

To accelerate the possibility of getting ITDI technologies and services in the market, the TSD continues to develop and produce various types of business portfolios such as business opportunity plans (BOP) and financial analysis/parameters. This year, four BOPs on *muscovado*, nipa sap sugar, *nutria polvoron*, and *nutria choco bar* were developed while 12 technologies were further subjected to financial analysis namely: alternative sugar for nipa sap, mango flakes, emergency food reserve, vacuum fried carrots, spray dried egg white, freeze dried avocado, water retort chili (pouch and bottle), spray dried *camote* tops (pink lady) and HITS equipment. Alongside, technology/development fees for 18 marketable technologies were computed. To strengthen the above parameters on the business and marketing aspects, three marketing plans were finalized during the period: alternative sugar from nipa sap; encapsulation of *malunggay*, *duhat*, and *saba*; and emergency food reserve (EFR).

In addition, four memoranda of agreement (MOA) were prepared and completed: raw brown sugar with Rhum mfg., water filter with Vigan LGU, prototype spray dryer with K&E Industrial Lime, and technical services with University of Northern Philippines. The renewed accreditation for equipment fabrication with Pimentel Creative Builders was also facilitated.

In 2016, a total income of ₱ 1,017,571.82 was generated from 123 technical services covering a range of disciplines, rendered to 1,602 beneficiaries all over the country (Table 6). This was accomplished in coordination with the technical experts in the various divisions of ITDI.

The 85 trainings conducted in all the regions covered various areas notably calibration (e.g., thermometry, mass metrology, volumetric wares, uncertainty measurement in chemical analysis (Metrology in Chemistry); and livelihood technologies (e.g., fruit and vegetable based food processing, emergency food reserve (EFR), nipa sap sugar, detergents and personal

**Table 6. Technical services 2016**

Type of Service	Income (₱)	Frequency	Clients/beneficiaries
Trainings	1,117,527.25	120	2,048
Technical assistance/consultancy	-	21	21
Technology transfer	31,990.97	27	27
<b>TOTAL</b>	<b>1,149,518.22</b>	<b>143</b>	<b>2,071</b>

care products, styro densifier and bioreactor). Training on the production of candle-type ceramic water filter was also provided in Region IV-B (Gabisan Pottery Plant, Torrijos, Marinduque) and CAR (LGU-Bauko, Mt. Province) as part of the DOST priority program of ensuring access to safe/potable drinking water in far flung communities, and for livelihood purposes.

An innovation in training delivery was also introduced during the year through the production of livelihood technology videos that aims to capitalize on the use of cyber media by posting the techno-videos in Youtube and Facebook as non-streamed e-learning packets readily available to every Juan.

To date, six techno-videos namely:

- 1) *calamansi* concentrate processing,
- 2) bottled *bangus* in oil processing,
- 3) dried mango processing,
- 4) *taho* processing,
- 5) charcoal briquetting, and
- 6)

herbal processing were completed and already available online through Youtube and the DOST-ITDI Updates, the official ITDI facebook page. These contain the step-by-step process and estimated cost of production to provide viewers financial requirements especially those who would like to venture in putting up a business. This was made possible through the project titled, "Boosting Delivery of ITDI-DOST Training Services through E-learning Packets" funded by PCIEERD. In addition, through this project, the ITDI corporate video is also being developed.

On the other hand, consultancy services to improve processes and facilities that were facilitated mostly focused on cleaner production, process and product improvement, and shelf life determination. Among the technologies/areas covered include: soya milk processing, chicken farm and feed livestock, ice cream, packaging, gasifier, Pampanga food delicacies, bioreactor, and ceramic water filter.

During the year, four technologies were also successfully negotiated and transferred to 21 clients (Table 7).

**Table 7. Technologies transferred by region**

TECHNOLOGY	REGION	NOS. OF CLIENT/S
Vinegar acetator kit	IV-A	5
	VIII	2
	XII	3
	CAR	1
Wine fermentation kit	IV-A	3
	NCR	3
Bioreactor (500 kg capacity)	II	1
	III	1
	IX	1
	X	1
Ceramic water filter	CAR	1
Styro plastic densifier	III	2
	IV-B	1
	IX	1
	X	1
<b>TOTAL</b>		<b>27</b>





## Exhibits

ITDI technologies and services were featured in about 8 exhibitions, the biggest of which was the NSTW 2016 celebration. This year, the NSTW was celebrated nationwide and simultaneously in all the regions. It was a 'free for all' type of celebration with each DOST agency mounting its own exhibition and activities for the weeklong event.

The ITDI-NSTW 2016 was led by the TSD and was proposal-driven obtaining a total fund of ₱ 791K from TAPI, PCIEERD, and DOST-GIA. It was composed of: modular and interactive exhibits, open house, clients' exhibition, technology fora on various topics, and technology demonstrations on personal care products. ITDI had a total visitors' turnout of 4,584 which was more than double the target of 2,000 visitors/viewers assigned per agency.

Other exhibitions participated in by the Institute include: technology transfer day at Sofitel, Reg 12 Science Nation Tour, school science fairs in universities, and one international exhibition on alternative energy led by CED.





## Communication collaterals/media and campaigns

To perk up and support its technology transfer and commercialization function, the TSD develops and produces communication collaterals and conducts/implements campaigns in various forms and channels.

Networking and engaging with the penta media and other relevant partners is also actively pursued. All these aim to let people know what is in store for them from ITDI, serving as gateway for stakeholder engagement.

Different types of communication collaterals produced and released in 2016 include the following of which approximately 3,600 copies were disseminated to various parties in different events:

- ◆ Annual Report 2015
- ◆ 2 issues Techno Bulletin
- ◆ 11 issues MiscellaNews
- ◆ 13 technology flyers
- ◆ 1 corporate brochure with jacket

Continuous press and media relation engagements gave the Institute a record high of 192 releases in both print and cyber media. Adding to these are 13 radio interviews, 8 DOSTv interviews (3 from TSD), and 2 press conferences. Four product launches were also conducted and led by the TSD. An interview/testimonial video of FIC clients was also produced in cooperation with the STII at the DOST Region 3 Science Nation Tour in Bulacan.

The launching of the DOST-ITDI facebook (FB) page last year likewise helped increase interest on ITDI. Data showed that the ITDI FB page garnered in 2016 a total reach of 65,160. Highest post reach were obtained in the months of February, June, July, and November.



ITDI FB postings in 2016 consisted of live coverages (as the event happens), videos and links, and articles or press releases; while 20 articles were posted in the ITDI official website. A new window, the Technology Transfer Bulletin was also opened during the year as one way of promoting seven ITDI technologies ready for transfer.

During the first half of the year, TSD contributed in drumming up DOST accomplishments through the DOST Special Communication Task Force by contributing press materials and features, and facilitating radio and DOSTv interviews.

A total of 26 study tours to ITDI labs and facilities were accommodated during the year with visitors coming from schools/universities, LGUs, Congress, and other government agencies.

## Fora/Consultative Meetings

In time with the celebration of the NSTW 20126, six fora on various topics were conducted at the ADMATEL conference room. Invited participants from industry, other government agencies, and academe attended the sessions. Technologies and/or services tackled in these fora include:

- ◆ Energy audit success story
- ◆ EBD capabilities in providing wastewater treatment solutions to SMEs
- ◆ Metrology in health
- ◆ Field testing and validation study of retort food (chicken *arroz caldo*) as disaster mitigation/relief food using DSWD's and LGUs distribution protocols
- ◆ Thermal process validation in canned foods
- ◆ Technological support for the upgrading of the local cacao and cocoa industry



## Knowledge Bank

Building up of the ITDI Knowledge Bank is still pursued amidst various constraints. In-house collection of completed R&D projects and related reports along with other Filipiniana materials are continuously catalogued and encoded to the Science Integrated Library Management System (SILMS). About 362 have been added to the collection during the year while 30 terminal reports already have ISBN. The ITDI online resource also increased with 83 new additions while 403 in-house publications have been scanned, a step towards digitization.

# Pharmaceutical-grade calcium carbonate

## OUTCOME 6

*Improved quality healthcare and quality of life through science, technology, and innovation*

Through an improved chelation method, highly purified pharmaceutical-grade calcium carbonate from nano-precipitated calcium carbonate was produced by CED researchers. The product exhibited over 100% purity while obtaining 99.14% yield.



*Purity determination of pharmaceutical grade calcium carbonate*



In support of the healthcare sector, the Chemicals and Energy Division (CED) develops new high-value-added products and technologies for diverse applications.

# FINANCIAL MANAGEMENT

For 2016, the Institute has an allotment amounting to ₱ 278,813,285.00 broken down into (1) Personal Services (PS) inclusive of RLIP of ₱ 215,429,285.00; (2) Maintenance and Other Operating Expenses (MOOE) of ₱ 47,509,000.00; and (3) Capital Outlay of ₱ 15,875,000.00. As shown in figure 20, the largest allocation was for PS (76%) followed by MOOE (19%) and Capital Outlay (5%).

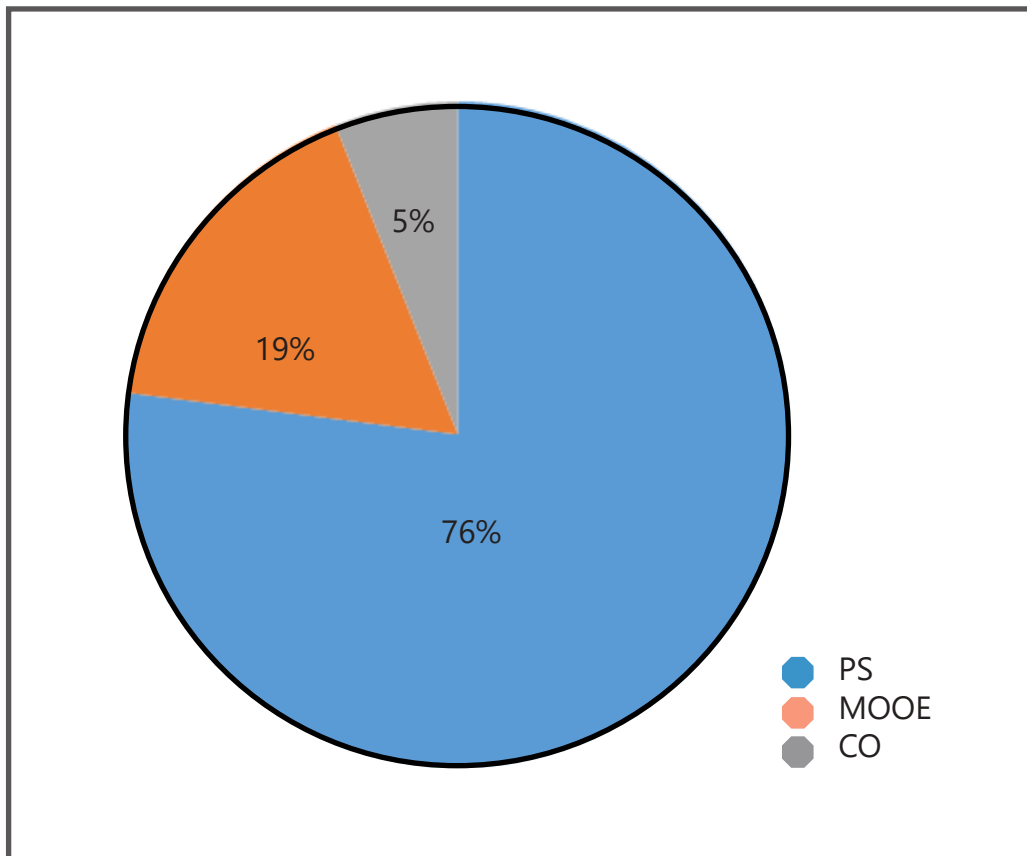
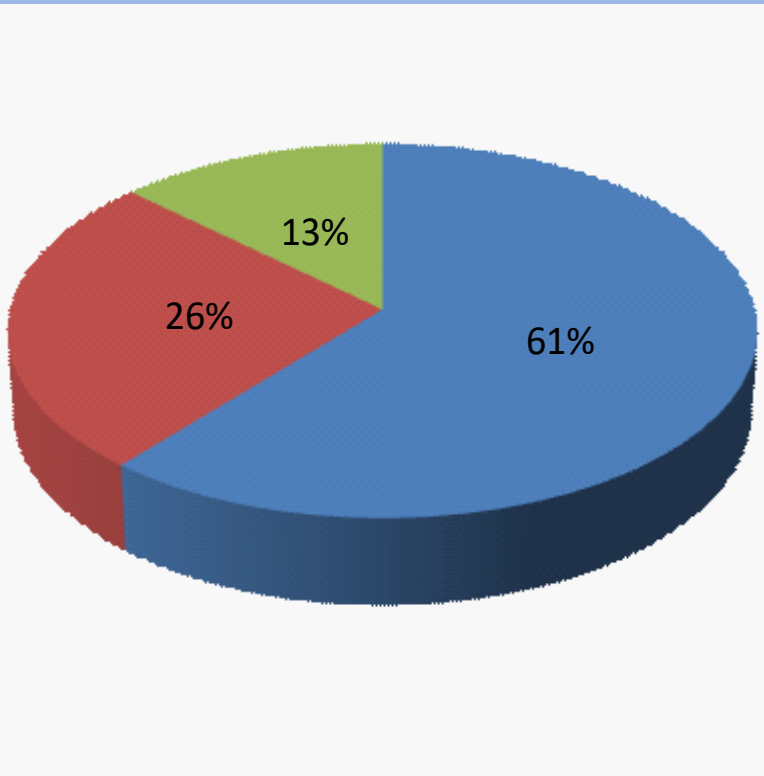


Figure 20. ITDI allotment

In terms of programs/projects/activities, 61% or ₱ 88,568,000.00 was allocated for MFO 1 or Research and Development; and for MFO 2 or Technical Advisory Services, 26% or ₱ 37,690,000.00 and 13% or ₱ 18,834,000.00 were apportioned for Testing and Analysis and Promotion and Marketing of Technologies respectively.



■ **Research and Development - P88.6 M**

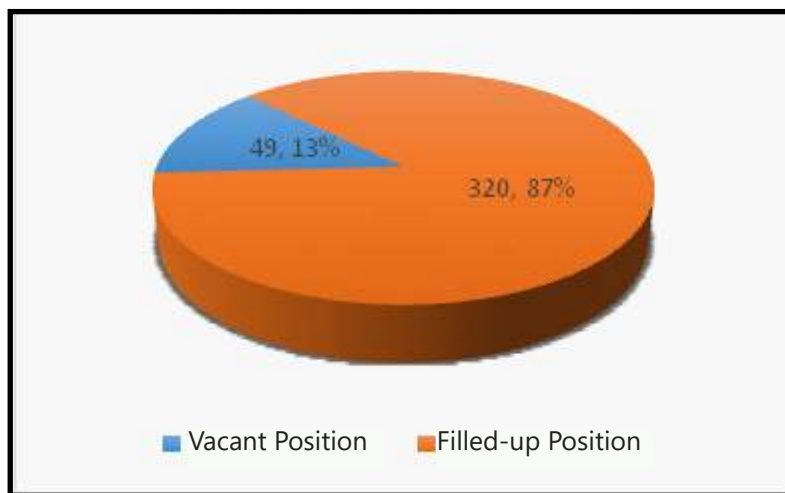
■ **Technical Advisory Services - P 37.7 M**

■ **Testing and Analysis and Promotion and Marketing of technologies - P18.8 M**

**Figure 21. Budget distribution by major final output**

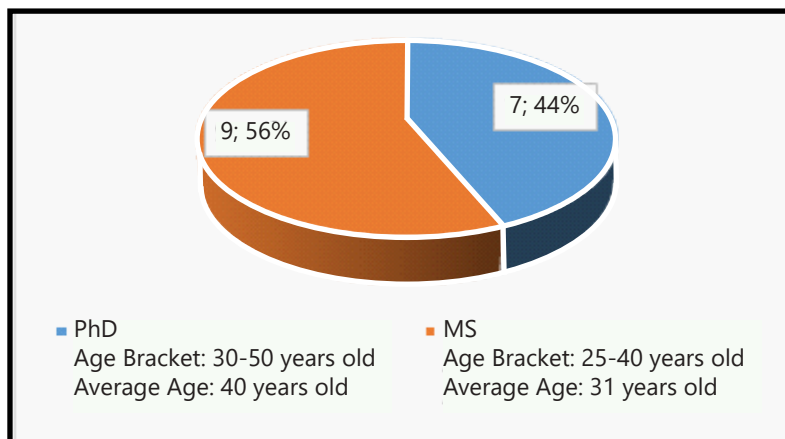
# HUMAN RESOURCES DEVELOPMENT

In 2016, the Institute recorded the highest number of filled-up positions for its manpower with a total of 320 employees. This included originally appointed, promoted, and transferred employees. Through the revised criteria for selection and promotion, the remaining vacant positions will be filled up with new breed of competitive individuals.

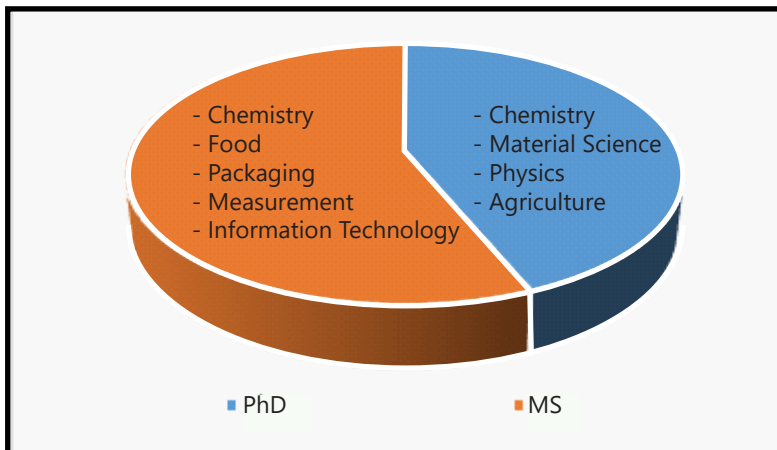


**Figure 23. Manpower profile**

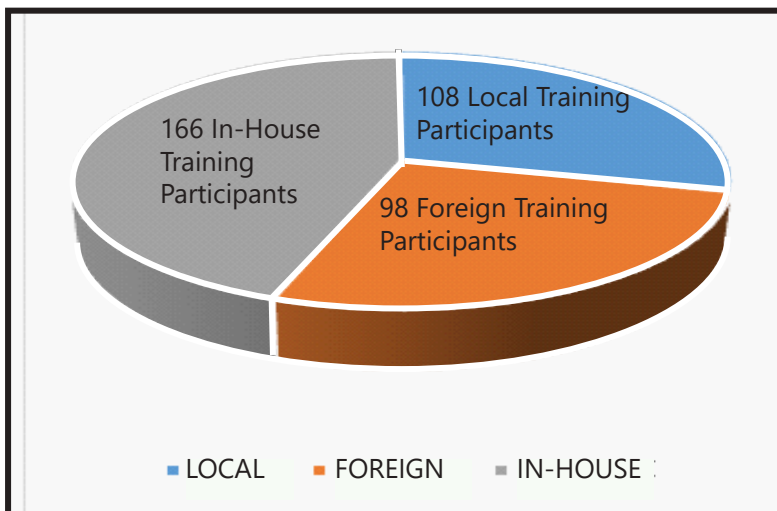
This year, in terms of staff development, employees were enabled to pursue their academic advancement in MS and PhD as DOST-ITDI Scholars, four of whom are enrolled abroad and the rest are at top universities in the Philippines.



**Figure 24. Age bracket of DOST-ITDI scholars**



**Figure 25. Scholars' field of study**



**Figure 26. Number of ITDI participants per training category**

Another remarkable intervention to develop staffs' competence were the numerous seminars, trainings, and conferences attended by the employees in 2016 both in international and local settings including in-house seminars organized by the Staff Development Committee (SDC) in coordination with the different divisions.

Through the core competency profile, the Management will continue to enhance employees' capabilities in carrying out its mandate, mission, and vision.

**Table 8. Field of Training**

FOREIGN	LOCAL	IN-HOUSE
<ul style="list-style-type: none"> <li>♦ Metrology</li> <li>♦ Material Science</li> <li>♦ ASEAN Committee on S&amp;T Conference</li> <li>♦ Biological Safety</li> <li>♦ Packaging</li> <li>♦ Food Safety</li> <li>♦ Innovation in Governance</li> <li>♦ Technology Transfer</li> <li>♦ Chemical Weapon/ Safety</li> <li>♦ Equipment Training</li> <li>♦ Environment</li> </ul>	<ul style="list-style-type: none"> <li>♦ ISO 9001:2015 Transition</li> <li>♦ Management</li> <li>♦ GAD</li> <li>♦ PWD Sensitivity</li> <li>♦ Publishing Journal</li> <li>♦ Graphic Design</li> <li>♦ Environment</li> <li>♦ Climate</li> <li>♦ Energy</li> <li>♦ Semi Conductor and Electronics</li> <li>♦ Chemistry</li> <li>♦ Laboratory Standard</li> <li>♦ Food Safety</li> <li>♦ Animals</li> </ul>	<ul style="list-style-type: none"> <li>♦ ISO 9001:2015 Transition</li> <li>♦ Hazardous Waste Management</li> <li>♦ Selection Criteria</li> </ul>

# ITDI Graduates 2010-2016

YEAR	NAME	DEGREE
2010		
	Bienvenido Almonte	MS in Chemical Engineering
	Severino Bernardo	MS in Management Engineering
	Elizabeth Santos	MS in Chemical Engineering
2011		
	Carmel Gacho	PhD in Chemistry
	Marissa Paglicawan	PhD in Engineering (Major in Polymer Science and Engineering)
	Janet Quizon	Doctor of Public Administration
	Rosalinda Torres	PhD in Chemistry
	Cleotilde Bulan	MS in Technology Management
	Sharlene Cabanilla	MS in Chemistry
	Milagros Magnaye	Master in Public Management
	Natividad Mamplata	MS in Chemistry
	Sol Reyes	Master in Public Management
	Carlos De Vera	MS in Technology Management
	Marina Yao	MS in Chemistry
2012		
	Glory Rose Echavia	PhD in Environmental Science
	Emelda Ongo	PhD in Chemistry
	Elizabeth Panerio	PhD in Microbiology
	Annabelle Flores	MS in Chemical Engineering
	Lolit Garcia	Master in Public Management
	Rosela Gomez	MS in Food Science
	Teresa Herrera	Master in Public Management
	Grace Noceja	MS in Food Science
	Candy Valdecañas	MS in Environmental Science



YEAR	NAME	DEGREE
<b>2013</b>		
	Edita Lagasca	Doctor of Public Administration
	Rommel Belandres	MS in Food Science
	Josefina Diaz	MS in Technology Management
	Oliver Evangelista	MS in Food Science
	Rosario Fuertes	MS in Chemistry
	Joannalene Tuazon	MS in Technology Management
	Francis Villamor	MS in Technology Management
<b>2014</b>		
	Annabelle Briones	PhD in Chemistry
	Aldrin Calderon	PhD in Material Science
	Violeta B. Conoza	PhD in Development Communication
	Vivian Lagura	MS in Material Science
	Jo Ann Sy	MS in Material Science
<b>2015</b>		
	Zorayda Ang	Doctor of Business Administration
	Clare Anne Capito	MS in Information Technology
	Kristine Ann Dela Cruz	MS in Food Science
	Rocheel Lee Deluta	Master in Business Administration
	Michelle Evaristo	MS in Food Science
	Federico Del Pozo Jr.	MS in Industrial Engineering & Management
	Maryness Salazar	MS in Science of Measurement
<b>2016</b>		
	Persia De Yro	PhD in Material Science



**R&D 100 Awards dubbed worldwide as the "Oscars of Invention"**

The DOST-ITDI was awarded for its innovative projects under the Process/Prototyping category, namely:

1. Pack of Hope RTE Chicken *Arroz Caldo* as First Stage Disaster/Relief Food, and
2. Philippine Mosquito Ovicidal/Larvicidal (OL) Trap System: DOST Anti-Dengue Device.

Thus, DOST-ITDI now joins the ranks of 100 finalists comprising of world-renowned R&D agencies, companies, and universities from around the globe. Started in 1963, the R&D 100 Awards honors the 100 most innovative technologies and services developed throughout the world and introduced to the market the previous year. Awards are based on each project's technical significance, uniqueness, and usefulness compared to competing technologies or services. The awardees were presented with their honors at the annual black-tie awards dinner last November 3, 2016 at the Gaylord National Resort and Convention Center in Oxon Hill, Maryland (Washington, D.C.).





### Best Institute Award for Utility Model (UM) Registration for 2016

ITDI clinched the "Best Institute" award for Utility Model (UM) Registrations for the second year in a row for the following technologies: (1) Biodegradable Composition Comprising Thermoplastic Nanocomposite and Polylactic Acid and Process for Producing thereof; and (2) Process for Producing Biodegradable Composition Comprising Thermoplastic Nanocomposite and Polylactic Acid. Given by the DOST and the National Academy of Science and Technology (NAST) during the awarding ceremony held at Hotel Jen, Pasay City on December 1, 2016.

### ISI Publication Award

Facile synthesis of nitrogen-doped carbon quantum dots for bio-imaging (MATEC WEB OF CONFERENCES, doi:10.1051/mateconf/20164304002)

### Poster Presentation Awards

**First Prize**, Philippine Institute of Chemical Engineers National Convention, Feb 17-20, 2016), Development of chitosan-calcium carbonate composites from kitchen waste for oil spill remediation.

**Second Prize**, Philippine Institute of Chemical Engineers National Convention, Feb 17-20, 2016, Surface modified local zeolite for the treatment of oil sheen contaminated wastewater.

**Third Prize**, NRCP Annual Scientific Conference, March 16, 2016, PICC, Development of a small-scale motorized composter for management of biodegradable waste.

**Best Presentation Award**, Third International Conference on Agriculture and Forestry (ICOAF), June 1-3, 2016, Sofitel, Manila Utilization of agricultural wastes for oil-spill remediation.



### PSM Outstanding Service Award

In due recognition of its research and development efforts in the area of biotechnology, the ITDI was accorded the "Outstanding Service Award" (Institutional Category) by the Philippine Society for Microbiology (PSM), Inc. on the occasion of the 7th Asia Pacific Biotechnology Congress 45th Annual Convention and Scientific Meeting held in Vigan, Ilocos Sur on July 20-24, 2016.



### 2016 PhilAAST Poster Competition

Dr. Rosalinda Torres of the Chemicals and Energy Division (CED won **second place** in the 2016 PhilAAST (Philippine Association for the Advancement of Science and Technology) Poster Competition during its 65th Annual Convention held in conjunction with the 8th Asian Heads of Research Councils (ASIAHORCs) Joint Symposium on September 22-23, 2016 at Sequoia Ballroom, Acacia Hotel Manila in Alabang, Muntinlupa City.





## **OUTCOME**

### ***Enhanced delivery of public good and services thru STI***

#### **Organizational Change**

**Technology-based industries for countryside development:**

**a. Techno-transfer**

- ◆ Community HRD
- ◆ Increased PPP
- ◆ Increased techno-transfer for commercialization

**b. Technical services**

- ◆ Provision of state-of-the-art R&D, testing and metrology facilities
- ◆ Safety regulations and quality standards compliance

#### **R&D**

- ◆ Development of process for sustainable industries and its support chain components
- ◆ Risk reduction initiatives

#### **Knowledge Enhancement:**

- ◆ Systems/acquisition and development
- ◆ Tech expertise development

**ITDI ROAD MAP**

**2017**

**2022**

1. Transition
  - a. NML to NMI (2017-2019)
  - b. Packaging Division to Center (2017-2019)
2. Institutionalization of ADMATEL (2013-2018), Onelab (2014-2017), and Rubber Lab (2017-2019)

#### R&D (2017 onwards)

1. New researches
  - a. Sea salt (2017-2019)
  - b. Modified starches (2017-2019)
  - c. FIC continuing researches
  - d. Technological support for cacao products (2017-2019)
  - e. RFID and intelligent packaging (2017-2022)
  - f. Industrial oleochemicals (2017-2019)
  - g. Natural dyes and colorants (2017-2019)
  - h. Energy efficient systems for industrial manufacturing (2017-2019)
  - i. Risk reduction initiatives
    - ♦ Development of relief and military foods FIC-based production system (2017-2019)
    - ♦ Potable water analyses (metal, physical and other biological indicators) (2017-2019)
    - ♦ Resource efficient and cleaner production for industries (waste management: minimization, recycling, utilization and treatment) (2017-2022)
2. Establishment of new and enhanced laboratories and development centers
  - a. Green composite materials lab (2017-2022)
  - b. Green packaging lab (2017-2019)
  - c. Packaging simulation research and testing lab (2017-2018)
  - d. Food allergen lab (2018-2020)
  - e. Non-GMO lab (2017-2022)
  - f. Food pathogen references/Thermobacteriology lab (2018-2022)
  - g. Industrial corrosion R&D lab (2017-2022)
  - h. Industrial membrane (2017-2022)
    - i. Modular multi-industry innovation center) (2017-2022)
    - j. Rubber testing lab (2017-2019)
3. Data mining on R&D archives on material science and biotechnology for food and other industrial applications (2017-2022)
4. Quality and safety guidelines in aid to standards development (2017-2022)
5. New test services and training modules for industries (2017-2022)

#### A. Appropriate management systems improvement: (on-going)

1. Components of project management system incorporated/enhanced in all R&D projects to be implemented:
  - a. Sustainability
  - b. Business plan (Investment portfolio and strategic plan)
2. ISO quality, safety, environment, and energy management systems

#### B. Human Resource Development

# 2017 Major Projects

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## 1. Enhancement of the competence and capabilities of the National Metrology Laboratory (NML) of the Philippines

The DOST-ITDI's program "Enhancement of the competence and capabilities of the National Metrology Laboratory (NML) of the Philippines" with a total budget of approximately ₱ 998 M, will be implemented for 5 years starting January 2017. The program is composed of four projects:

- Project 1: Chemical metrology for organic contaminants in food and water
- Project 2: Chemical metrology for inorganic toxic elements in food and water
- Project 3: Biological metrology for microorganisms in food
- Project 4: Strengthening the physical metrology capabilities of the National Metrology Laboratory

The program aims to develop DOST-ITDI's capabilities for metrology in chemistry and biology, and strengthen as well, its physical metrology that will enable the Institute to provide accurate and internationally traceable measurements in the country. For 2017, ₱ 395 M will be used for the acquisition of reference standards and measuring equipment, augmentation of manpower, and renovation and extension of facilities. A total of 10 measurement areas will be enhanced and established, translating into new measurement services for the industry.

## **2. Upgrading and enhancing the capacity of the Packaging Technology Division in packaging research and innovation**

Development of active, smart, and innovative packaging technologies and designs for Philippine products will be accelerated. Specific agenda of the project will include: (1) addressing the high losses of fresh produce and non-food products during handling and distribution, (2) enhancing the competitiveness of Philippine products through innovative packaging, (3) addressing the poor packaging design of local products, and (4) widening the radius of distribution of Philippine products through increased shelf-life with improved packaging.

## **3. Natural colorants for food and cosmetic applications**

A two-year, ₱ 31.7 M project for the development of colorants from natural plant sources for food and cosmetic applications will be undertaken. These projects are under the Natural Dyes and Colorants Program funded by PCIEERD (Philippine Council for Industry, Energy and Emerging Research and Development) in collaboration with DOST-PTRI (Philippine Textile Research Institute) and DOST-FNRI (Food and Nutrition Research Institute) that envisions to discover environment-friendly alternatives to the commercially available synthetic colorants, benefitting our local farmers/producers and the food and cosmetic industries.

## **4. Integration of testing services for rubber and rubber-based products**

The Institute has upgraded its rubber testing facility with the acquisition of new equipment namely ozone testing chamber, volume resistivity tester, brittleness temperature tester, rebound resilience, high-column universal testing machine, and bursting pressure machine. The Project aims to enhance the capability of DOST-ITDI to offer complete testing services for manufactured rubber by 2017. It is expected that all new tests with other existing parameters will be ISO/IEC 17025: 2015 accredited in preparation for the ASEAN harmonization of standards.

## **5. Modular multi-industry innovation center**

Another priority project in 2017 is the establishment of a multi-industry innovation center with a budget of ₱ 52 M. The center will be equipped with assemblies of independent equipment that can be used to construct complex processing lines working as integrated modules. The equipment can variably be retrofitted to different manufacturing lines including: Philippine virgin oils, powder blends using local plant resources, and emulsion-type products using local plant and animal materials.

Its main advantage, in contrast to conventional manufacturing facility, is that it can be used for different processes that would suit specific operation requirements. Other features of the Center will include: process automation systems and upscaling to pilot capacity production with materials handling support equipment.

# R&D Projects (GAA-funded)

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Study 2: Field testing of nanozeolite membrane for CO<sub>2</sub> capture in boiler system

A. Bawagan

Sub-project 3: Production of cross-linked starch

C. Bulan

Sub-project 4: Production of heat-treated starch

M. Carandang

Sub-project 2: Production of starch acetate

L. Hermosura

Sub-project 1: Rehabilitation of processing equipment

C. De Vera

Setting-up of packaging system for carrageenan solution

N. Ambagan

Functional characterization of ITDI-developed modified starches for food application: oxidized, acetate, cross-linked, heat-treated

M. Evaristo

Study 1: Application of modified cassava starch as building agent/carrier in drum drying and spray drying

M. Falco

Study 2: Use of modified cassava starch as binder for gluten-free rice noodles

M. Falco

Calcium carbonate in the neutralization and clarification of ready-to-drink sugar cane juice (pure and with fruit flavors)

D. Villasenor

Study 5: Effect of nano calcium carbonate modified pH and temperature on the inversion of sucrose in sugarcane juice

D. Villasenor

Study 2: Determination of aerobic-biodegradation of polymeric materials

U. Bigol

Study 1: Aerobic treatment of wastewater

F. Coronado

Study 2: Information, Education and Communication campaign (IEC) and development of electric plastic densifier

L. Egay

Study 3: Isolation, characterization and validation of microorganisms for bioremediation of wastewater from modified starch production and biodegradation of plastic additives

L. Egay

Study 1: Field-testing of modified zeolite for oil-spill remediation

C. Gacho

Study 2: Field-testing of chitosan-CaCO<sub>2</sub> composite for oil spill remediation

E. Ongo

Study 1: Waste analysis and characterization study and industrial design improvement of bioreactor

M. Tangsengco



# R&D Projects (Assisted)

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Bench scale production of locally produced nanozeolite pellets and powder

J. Celorico

Study 1: Scale-up production of NPCC for industrial application

J. Celorico

Study 1: Surface modification of locally produced nanozeolite for water purification

J. Celorico

Biodegradable nanocomposites from cassava starch

M. Paglicawan

Study 1: Production of nanozeolite films for advanced industrial applications

M. Paglicawan

Nano-precipitated calcium carbonate for flexible and rigid plastics production

M. Paglicawan

Study 2: Comparative optimization study on the use of modified cassava starch and rice starch as *Monascus spp* Response Surface Methodology (RSM)

Development of transport packaging technology for fresh fruits and vegetables

D. Tañafranca / E. Nolasco

Development of competence of the DOST Food Innovation Center and recognition of most innovative products  
M. D. Villaseñor

Establishment of an Advanced Device Materials Testing Laboratory for the semiconductor and electronics manufacturing industries (ADMATEL) Phase-5 Operation of ADMATEL

A. Monsada

Establishment of Emergency Food Reserve (EFR) production capabilities of the Technoville site in Barangay Tanza, Navotas City

L. S. Montevirgen

Interlaboratory comparison of additives and contaminants in foods - Project 2

B. Ebarvia

Plasma-treated abaca fiber composites for industrial application (ITDI-KIMS research collaboration project) - Phase 2

M. Paglicawan

Setting-up of One Stop laboratory for global competitiveness - Phase 1

MPV Azanza / AV Briones

Southeast Asian Atmospheric Corrosion Exposure Study (SEA ACES) of steels, electronics equipment and components in Philippine marine environment - Year 2

A. Monsada

# Publications (ISI)

**Nanoparticles formation of Philippine carrageenan with pDNA/polyethylenimine and pDNA/chitosan as monitored by atomic force microscopy (AFM) for potential use in gene delivery.**

Dr. Anabelle Briones, Asian Journal of Biological and Life Sciences, January-April 2016, India

**Ovicidal, larvicidal and adulticidal activity of *Citrus grandis* L. (Osbeck) against dengue vector-*Aedes aegypti*.**

Dr. Rosalinda Torres, et. al, Indian Journal of Natural Products and Resources, India

**Removal of heavy metal compounds from industrial wastes using novel locally-isolated *Vanrija* sp. HMA2.**

Coronado, F., et. al., Phil. Journal of Science Vol 145 (4), 327-338, 2016, Philippines

**Development of a small-scale composter and its application in composting of solid waste generated from a government institution: Department of Science and Technology.**

Tansengco, et. al., Asian Journal of Biological and Life Sciences (Accepted for publication), India

**The significance of heating profiles and its effect on sintered silver die attach agglomeration, aggregation and adhesion on a copper lead frame surface.**

Richard Q. Clemente, Blessie A. Basilia, Erik Nino Tolentino, International Refereed Journal of Engineering and Science, ISSN 2319-183X, 2319-1821 Volume 5, Issue 1 (January 2016), pp. 01-08.

**Determining the compatibility of sintered silver die attach in terms of delamination performance as compared to existing high lead solder types in a semiconductor power package.**

Richard Q. Clemente, Blessie A. Basilia, Erik Nino Tolentino, e-ISSN:2278-800X, www.ijerd.com, Volume 11, Issue 12 (December 2015), pp. 68-75, Philippines

**Facile synthesis of nitrogen-doped carbon quantum dots for bio-imaging.**

Persia Ada N. de Yro, Beejay T. Salon, Blessie A. Basilia, Mark Daniel de Luna and Peerasak Paoprasert, MATEC Web of Conferences 43, 04002 (2016), DOI:10.10051/mateconf/20164304002 © Owed by the authors, published by EDP Sciences, 2016

**Larvicidal activity of Philippine medicinal plants against dengue vector, *Aedes aegypti*.**

Dr. Rosalinda Torres, et al, "NRCP Research Journal, ISSN: 0117-3294, Vol. XV, No. 1, 2016", Philippines

**Safety assessment, process standardization and antimicrobial activity evaluation of *Zingiber officinale* Roscoe (Ginger).**

Dr. Rosalinda Torres, et al, Proceedings / Book of Almanacs of the 65th PHILAST Convention and 8th Asian Heads of Research Councils Joint Symposium, Philippines

**Bioactivity of the aqueous and ethanolic extracts/pellet form of Philippine *Piper nigrum* L. on the duration of egg, larval and pupal development stages of *Aedes aegypti* mosquitoes.**

Briones, A.V. et al, Journal of Entomology and Zoology Studies Vol 4, Issue 6 Part C, p196-202, India

# Publications (ISBN)

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Southeast Asian Atmospheric Corrosion Exposure Study (SEA ACES) of steels, electronics equipment and components in Philippine marine environment (2015-2018) Year 1  
ISBN 978-971-9646-72-3 (March 14, 2016)

Nano zeolite: Production, application and performance testing  
ISBN 978-971-9646-70-9 (March 14, 2016)

Production of nano precipitated calcium carbonate (industrial grade)  
Nano precipitated calcium carbonate: production, application and performance testing.  
ISBN 978-971-9646-71-6 (March 14, 2016)

Nano copper impregnated ceramic water filters: production, application and performance testing  
ISBN 978-971-9646-73-0 (March 14, 2016)

Validation on the implementation of the Environmental Performance Report and Management Plan (EPRMP) of ITDI  
ISBN 978-971-9646-84-6 (June 30, 2016)

Design of purification system for fuel-grade ethanol using zeolite-based molecular sieve  
ISBN 978-971-9646-85-3 (June 30, 2016)

Production of secondary certified reference materials and provision of proficiency testing for metals (elemental standard solutions) in water (Proj. 1)  
ISBN 978-971-9646-95-2 (August 26, 2016)

Field testing and validation study of retort food (*arroz caldo*) as disaster mitigation/relief food using DSWD's and LGU's distribution protocols  
ISBN 978-971-9646-93-8 (August 26, 2016)

Biodegradable nanocomposites from cassava starch  
ISBN 978-971-9646-97-6 (Sept 26, 2016)

Interlaboratory comparison of additives and contaminants in foods  
ISBN 978-971-9646-96-9 (Sept. 26, 2016)

# Papers Presented

## Development of chitosan-calcium carbonate composites from kitchen wastes for oil spill remediation

Dr. Emelda Ongco et al, 77th PIChE National Convention, February 2016, Phil.

## Production of nano precipitated calcium carbonate from local materials

Dr. Blessie Basilia et al, 77th PIChE National convention, February 2016, Philippines

## Surface modified local zeolite for the treatment of oil sheen contaminated wastewater

Dr. Carmel Gacho et al, 77th PIChE National Convention, February 2016, Phil.

## Southeast Asian Atmospheric Corrosion Exposure Study (SEA ACES) of steels, electronics equipment and components in Philippine marine environment

Dr. Araceli Monsada, Philippine Institute of Chemical Engineers (PIChE) 77th National Convention, February 21-25, 2016, Phil.

## Complexation of carrageenan with pDNA/PEI & pDNA/chitosan nanoparticles as monitored by Atomic Force Microscopy (AFM) for potential use in gene delivery

Dr. Annabelle Briones, NRCP 83rd General Membership Assembly and Scientific Conference, March 16, 2016, Philippines

## Utilization of nanozeolite during anaerobic digestion of swine waste

Dr. Carmel Gacho et al, BIOTA Annual Conference, UPLB, April 7-9, 2016, Phil.

## Application of locally produced nanosilica in construction

Josefina Celorico, 33rd Philippine Chemistry Congress April 13, 2016, Phil.

## Biodegradable thermoplastic oxidized cassava starch (*Manihot esculenta*) reinforced with locally produced nanoprecipitated calcium carbonate

Dr. Marissa Paglicawan et al, 31st Philippine Chemistry Congress, April 13, 2016, Phil.

## Characterization and determination of antioxidant activity of some Philippine medicinal plants

Dr. Rosalinda Torres, 31st Philippine Chemistry Congress April 13, 2016, Phil.

## Effect of nanozeolite and polyethylene wax on the properties of HDPE film

Dr. Marissa Paglicawan et al, 31st Philippine Chemistry Congress, April 13, 2016, Philippines

## Utilization of agricultural waste for oil-spill remediation

Dr. Emelda Ongco, 3rd International Conference on Agriculture and Forestry (ICOAF), June 1-3, 2016, Sofitel, Manila, Philippines

## Biological treatment of wastewater from semiconductor industry

Fe Coronado, 45th Annual Convention and Scientific Meeting and the 7th Asia Pacific Biotechnology Congress of Philippine Society for Microbiology, July 2016, Philippines

## Development of a compact wastewater treatment system enhanced with bio augmentation technology for Quick Service Restaurants (QSRs)

Gelito Sikat, 45th Annual Convention and Scientific Meeting and the 7th Asia Pacific Biotechnology Congress of Philippine Society for Microbiology July 2016, Phil.

## Nanotechnology and its application in food packaging

Dr. Blessie Basilia, 2016 Philippine Association of Food Technologists Conference, July 2016, Philippines

## Wastewater treatment of molasses-based distillery effluent using anaerobic sequence batch reactor

Dr. Myra Tansengco, 38th NAST Annual Scientific Conference, July 2016, Philippines

## Biochemical profile of cacao beans from selected fermentaries in Davao

PhilAAST, Philippines

## Preparation and characterization of laminates of woven abaca fiber/HDPE composite with nanoprecipitated calcium carbonate

Marissa Paglicawan, 10th Asian-Australasian Conference on Composite Material, October 16-19, 2016, South Korea

## Abaca fiber-reinforced composite for tricycle roof application

Marissa Paglicawan, 6th KIMS-ASEAN Conference on Materials Science, October 20-21, 2016, South Korea

## Mechanical behavior of abaca woven glass fiber hybrid epoxy composite fabricated by vacuum-assisted resin transfer molding

Marissa Paglicawan, Blessie A. Basilia, Byung Sung Kim, et. al., KIMS-ASEAN International Symposium 2016 on Materials Science and Technology, Thailand

## Morphological mutants from gamma irradiated *Monascus purpureus* with improved color production

Ms. Ursela Bigol et al, Convention on Rapid Detection of Clinically Important Microbes Using Molecular Technique, Philippine Network Microbial Culture Collection, November 19, 2016, Philippines

# Collaborations

## International

- ♦ ITDI-KIMS (Korea Institute of Materials Science)
  - 3 year collaboration (Part 2)
  - Plasma-treated abaca fiber reinforced plastics for industrial application (Funding - ₱ 0.8 M)
- ♦ ITDI-NIMS (National Institute of Materials Science) - Japan
  - 3-year project
  - Simultaneous exposure sites in Vietnam and Thailand

## Local (in process)

- ♦ MOA with SMYPC
  - Production of flexible and rigid plastics with nano-additives
- ♦ MOA with D & L, Inc.
  - Production of biodegradable plastics with nanoclay
- ♦ MOA with K & E Industries
  - Production of nano-precipitated calcium carbonate (Rehabilitation and deployment of spray dryer)

# ITDI Executive Committee

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Director

*(First to fifth row, L-R)*

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**Engr. Reynaldo L. Esguerra**  
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# Research & Development



Chemicals and Energy Division (CED)





Environment and Biotechnology Division (EBD)  
Food Processing Division (FPD)



Materials Science Division (MSD)  
Packaging Technology Division (PTD)



# Technical Services



Advanced Device and Materials Testing Laboratory (ADMATEL)  
National Metrology Division (NMD)



Standards and Testing Division (STD)



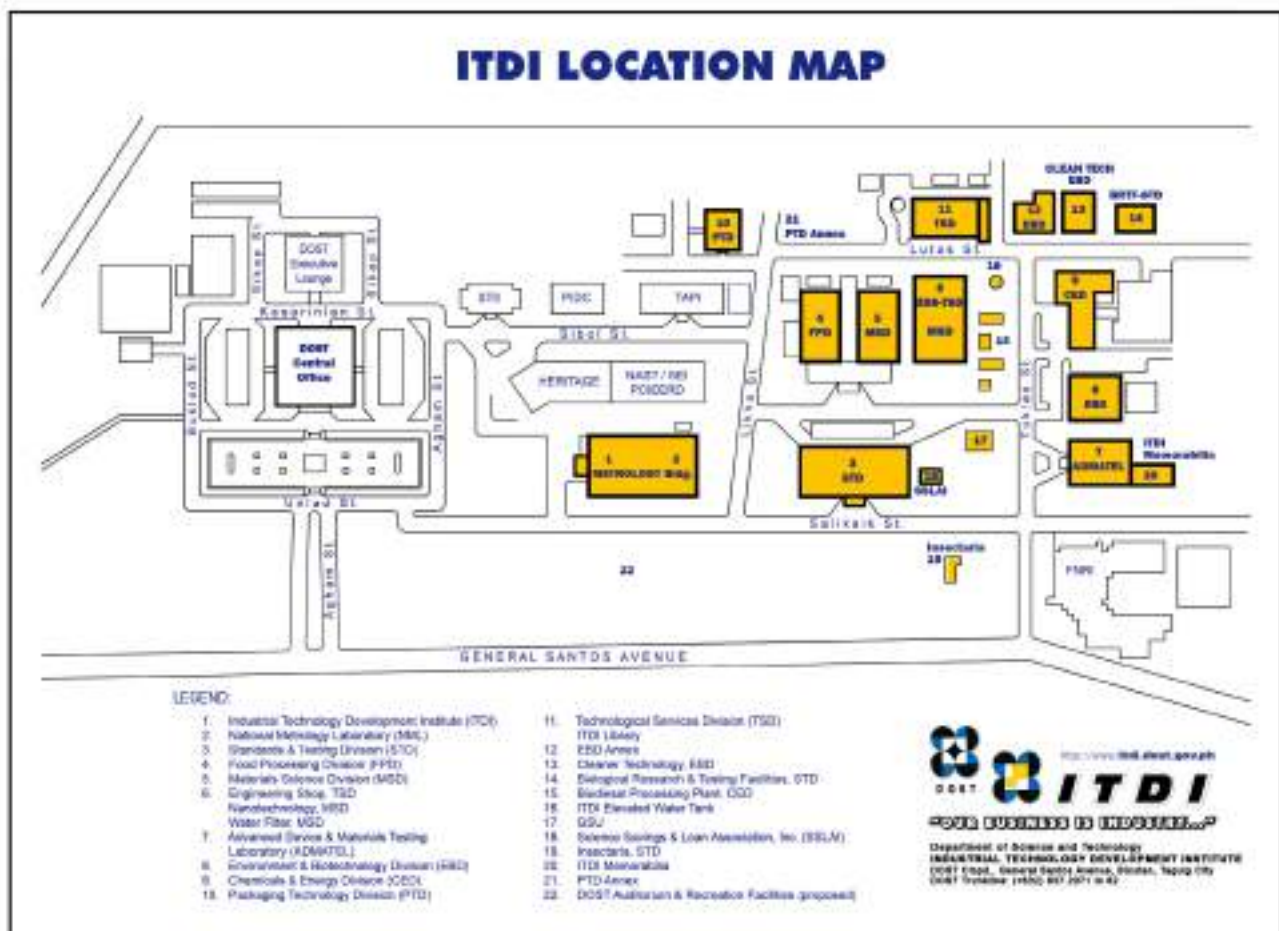
# Support Services



Administrative Division (AdmD)  
Financial Management Division (FMD)



## Planning and Management Information Systems Division (PMISD)



# Organizational Chart

## DIRECTOR

### Deputy Director R&D

### Deputy Director ATS

#### 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**

#### 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**

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