

2021 ANNUAL REPORT



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ABOUT ITDI

The Industrial Technology Development Institute (ITDI) laid the groundwork for S&T in the country.

As one of the DOST's R&D agencies that 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.

Our Vision

By 2030, ITDI is the country's leading industry partner in Science, Technology, and Innovation.

Our Mission

To contribute to making local industries globally competitive through research and development, transfer and commercialization of innovative and sustainable technologies, and provision of appropriate technical services.

Our Mandate

- Undertake applied research and development to generate new knowledge, technologies, and innovations in the field of industrial manufacturing, mineral processing, and energy.
- Conduct knowledge translation or technology transfer and commercialization.
- Provide technical services, tests and analyses, and metrology to ensure international traceability of the national units of measure.

INTRODUCTION

This year's annual report presents several impactful and ground-breaking go-to solutions that will bring significant changes to the conventional model of doing business transactions. Ranging from bioinspired technologies, alternative energy, food processing and packaging, 3D printing and nanotechnologies, ITDI offers several kinds of R&D innovations that will contribute hugely to the nation's economic success.

Over the past 120 years, ITDI explores and expands science, technology, and innovation to improve the quality of lives of Filipinos. The following core values serve as its lifeblood, heart, and soul to drive its mission and vision in serving the Filipino people, achieving a remarkable and inclusive recovery, and creating long-term sustainability.

- **Innovativeness.** Fountain of creativity and new ideas fueling better products, services, and processes.
- **Technical competence.** Diverse pool of experts in different fields.
- **Dependability.** Unwavering support and assistance to the public.
- **Integrity.** Diligence in striving to do what is right and just.

WE ARE ITDI.

Inspired by Technology, Driven by Innovation.

ABOUT THE COVER

The cover depicts DOST-ITDI's utmost commitment to Philippine industries, MSMEs, academe, and other stakeholders and in developing reliable R&D and providing quality technical services.

DOST-ITDI is highlighting its five latest facilities, namely the Modular Multi-Industry Innovation Center (MMIC), Metrology in Chemistry (MiC) Laboratory, Biosafety Level 2+ (BSL-2+), Materials Development (MATDEV) Laboratory, and Simulation Packaging Testing Laboratory / Green Packaging Laboratory (SPTL/GPL).

While the hexagon shapes connote the Department's 6Ps - Papers, Patent, Product/Process, People Services, Places and Partnerships, and Policies - the triangles depict the Institute looking back to its accomplishments and its moving forward in gearing up Philippine businesses towards Industry 4.0.

And as the country continues to heal from the impacts of the pandemic, the Institute has also been committed to the frontline in the establishment of the Virology and Vaccine Institute of the Philippines (VIP), one of DOST's major responses to the COVID-19 pandemic. It shall strive to innovate further and deliver better services to better equip its stakeholders.

After 120 years of science, technology, and innovation, ITDI shall continue to fulfill its mandate of bringing science to the Filipino people.



MESSAGE FROM THE SECRETARY

I am deeply happy with my task at hand - of saying "Well done!" and "Thank you."

As I reflect on quite an unprecedented six years of my term, I am content that we have done what should be and confident that the coming years will prove the quality of our efforts. And upon reaching the turn around the corner, let us do so with an eye toward the future.

ITDI is special. For more than 40 years that I have been with the Department, it has been alongside me.

Through the years, I saw how it faced problems that seemed too great to overcome, but always, it comes out better.

As the man at the helm, it is my pride whenever ITDI takes it upon itself to show me what it has accomplished.

Who wouldn't be when you see nine world-class facilities spring up in three years? The Philippines is now scientifically richer, highly competitive, and firmly set to take on the world.

In 2019, ITDI established a Rubber Testing Laboratory. This was followed in 2020 by the high-precision route of additive manufacturing through the Materials Development Laboratory or MATDEV alongside the Halal Food R&D Facility in support of Philippine Halal as industry champion.

The following year 2021 was equally busy. Once again, the food and nutraceuticals industry stood to gain in the new Modular Multi-Industry Innovation Center or *InnoHub sa Pinas*. To ensure product safety while reducing product rejects in foreign ports, a Metrology in Chemistry Laboratory and Metrology in Biology Laboratory were built.

But, COVID-19 preparedness is not far behind with the WHO-compliant Biosafety Level 2+ Laboratory. With this, the initial projects of the Virology and Vaccine Institute of the Philippines program will be implemented safely and securely.

In 2022, before I finish my term, it will inaugurate and operate the Simulation Packaging Testing Laboratory and Green Packaging Laboratory.

ITDI and I - we are a team. We shared insights and grew our presence to serve our country in challenging times. We are no strangers to fully pivoting over the course of 24 hours to working in a super challenging environment.

Not because of anything else, but just because we care for our people.

Next year at this same time, we know that we would still be at it - right at the forefront, standing side by side as we continue to support our communities.

Thus, I say once again, "Well done!" and "Thank you."

Mabuhay ka ITDI!



PROF. FORTUNATO T. DELA PEÑA
Secretary



MESSAGE FROM THE DIRECTOR

For the past 120 years, the DOST-ITDI has incessantly worked on its vision as a recognized and reliable industry partner for Science, Technology, and Innovation. The institute has been steadfast in developing relevant technologies, providing technical services, and establishing advanced laboratory facilities to improve its capabilities and better serve the interests of its various stakeholders, notably the industries or MSMEs, and continue being a pivotal force in pursuing the nation's development goals.

As you turn the pages of this annual report, you'll get a glimpse of how the institute managed to engage its public and still fulfill its mandate amidst the challenging times with exemplary outputs.

The last three years have been quite challenging for the institute. It needs to double-time on its R&D efforts and help alleviate the impact of the COVID-19 pandemic and other natural disasters/calamities that hit the country. The demand for STI has never been more critical than during this pandemic, with DOST-ITDI promptly responding with the appropriate interventions and innovations at the right time. It has stepped up its engagement with stakeholders and uses the different scientific platforms, translating outputs to tangible outcomes, as aligned with the DOST 6Ps.

In 2021, the institute contributed the following to DOST 6Ps: 21 Patents (3 granted, 18 applied), 46 Policies, 26 Products & 22 Processes (34 completed projects), 63 Papers/Publications (11 published, 52 presented), 71 Places and Partnership (5 new facilities, 66 new partners), and 142 People services/training (12,442 people trained).

For the last two years, the major STI initiative was ITDI's spearheading efforts in establishing the Virology and Vaccine Institute of the Philippines (VIP) in response to the pandemic and the continuing emergence of COVID-19 variants and preparation for the threats of future pandemics as well. The VIP will develop diagnostics, vaccines, and therapeutics and conduct innovative scientific research on viral agents requiring high or maximum containment (biosafety level-2 to biosafety level-4). The Virology and Vaccine Institute of the Philippines Bill has passed 3rd Reading at the House of Representatives and, hopefully, will be passed into law soon.

ITDI's biosafety level 2+ or BSL-2+ laboratory under the DOST "Big 21 in 2021" ticket was inaugurated this year. It is located in the Environment and Biotechnology Division building and will work on microorganisms that pose moderate hazards to laboratory staff and the environment. The biological material used in a BSL-2+ laboratory consists of bacteria, viruses, and organisms associated with human diseases. This new laboratory will be adhering to the appropriate biosafety and biosecurity protocols as mandated by international standards, ensuring that the initial projects of the VIP program will be implemented safely and securely.

On the other hand, unceasing R&D works resulted in completing projects in identified research areas: biotechnology, chemicals, energy, environment, food processing, materials science, nanotechnology, and packaging technology. Among these projects are the development of a fermentation product (Kimchi-Filipino adaptation) from locally-grown vegetables using indigenous lab isolates as starter culture; the processing of an anti-freezing agent for biodiesel; an uninterruptible power backup system using motor control for lighting applications as sample electrical load; dissolved copper removal from semiconductor wastewater effluent by electrowinning process; establishment of food safety system for high-risk bakery products for public consumption; emulsified meat products (sausage, nuggets, and burgers) for Halal market; 3D printed carbon-based flexible piezoresistive wearable sensor for smart device gesture to speech applications; porous nanocarriers for drug delivery applications; and antioxidant film based on chitosan containing the spent ground coffee extract.

To complement the institute's R&D initiatives, DOST-ITDI established five state-of-the-art facilities conforming to international standards and guidelines, namely, the Modular Multi-Industry Innovation Center or MMIC, ADMATEL Research and Development Laboratory, Biosafety level 2+ or BSL-2+ laboratory, Metrology in Chemistry (MiC), and Simulation Packaging Testing Laboratory (SPTL) and Green Packaging Laboratory (GPL). Technical expertise and services offered in these facilities are significant interventions that can help upgrade industry processes and overall productivity and make them competitive.

Moreover, the institute continues to strengthen the delivery of its technology transfer or knowledge translation (TT/KT) program so that valuable knowledge products and services are put to good use or applied in the production sector. Leveraging the usage of digital or online platforms and traditional channels, the institute significantly improved its engagements even amidst the pandemic. KT initiatives were pursued through quad media promotions such as publications/press releases, webinars/pressers, virtual exhibits; forums/consultative meetings, training/technical assistance, and technology pitching/offerings. During the year, ITDI's media mileage increased exponentially to 5,211,111.

These KT initiatives were further complemented with the production and streaming of the *TekNegoShow* or TNS Special Edition, a sequel to TNS Season 1 in 2020. TNS enabled ITDI to keep in touch with its clients and still communicate its various technologies and services during the pandemic, limiting mobility and face-to-face engagements. Through TNS, a total of 32 partnerships were clinched with various clients from industry, academe, DOST regional offices, and other government agencies, which helped implement production of the show; leads on possible technology adoption were generated, while a MOA was forged with PRID (Philippine Registry of Interpreters for the Deaf) that will serve the interest of the deaf community through livelihood generation or training.

TNS was also rated successful in creating interest and awareness of ITDI technologies and services, seen as an excellent platform in showcasing ITDI-MSMEs partnership and a good way to promote businesses and the science behind the products, and has managed to convey that STI can be good sources of business opportunities as shown in the result of post-survey or *Pagtatasa* (evaluation).

In 2021, the institute transferred 68 technologies, eight of which were commercialized. Eight product prototypes were developed from these technology transfer agreements and will soon be commercialized. In addition, 158 technologies were transferred as public good.

Likewise, the institute nurtures and perseveres, building partnerships with various stakeholders locally and abroad, summing up to 66 new partners this year. DOST-ITDI maintains 62 partnerships, including international partners based in Argentina, Canada, Europe, India, Indonesia, Japan, Korea, Malaysia, Singapore, and the USA.

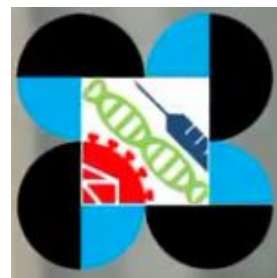
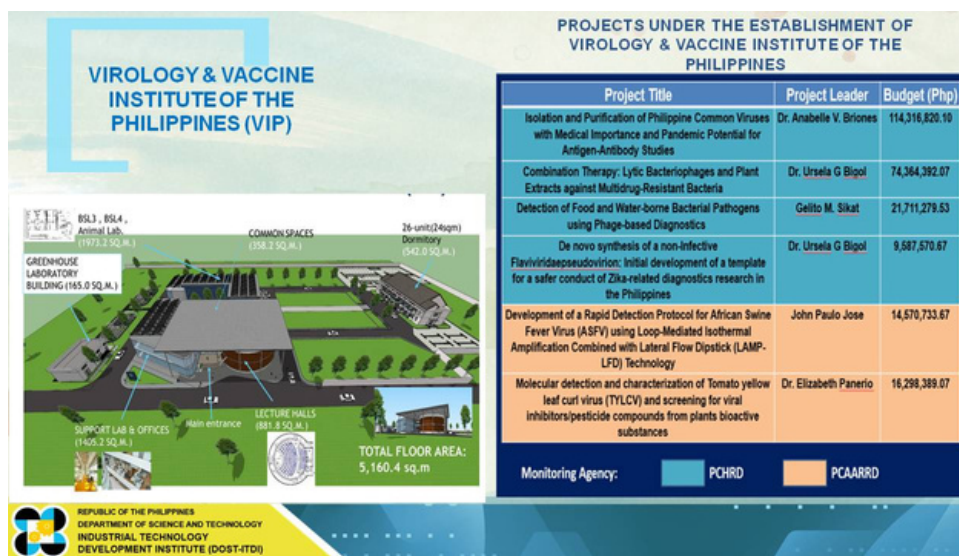
In terms of governance, the institute has also initiated working on its application for the Philippine Quality Award or PQA. The PQA is a global competitiveness template aimed at improving an organization's performance by optimizing the systems and processes it has in place. ITDI has also started preparing the institute to implement GAD mainstreaming initiatives and activities for the coming year. For the first time, strategic planning is now being applied to prepare the ITDI GAD Plan and Budget (GPB) 2022.

DOST-ITDI has accomplished so much, notwithstanding the limited resources, aggravated even by the pandemic. As scientists, researchers, and employees, I encourage you to remain firm in pursuing our goals, ably guided by the roadmap we crafted for the next 10 years while being inspired with the hope of contributing to improving the lives of our people. With unwavering enthusiasm and hard work, and each one rallying behind one another, we can be sure to continue our ascent and steadfastly reach the mountain's summit.

Mabuhay ang DOST-ITDI!



ANNABELLE V. BRIONES, PhD
Director



VIROLOGY AND VACCINE INSTITUTE OF THE PHILIPPINES

To deal with the threat of future pandemics, the DOST through ITDI will establish the Virology and Vaccine Institute of the Philippines (VIP) with the goal of developing diagnostics, vaccines, and therapeutics. It will conduct innovative scientific research on viral agents requiring high or maximum containment (*biosafety level-2 to biosafety level-4*).

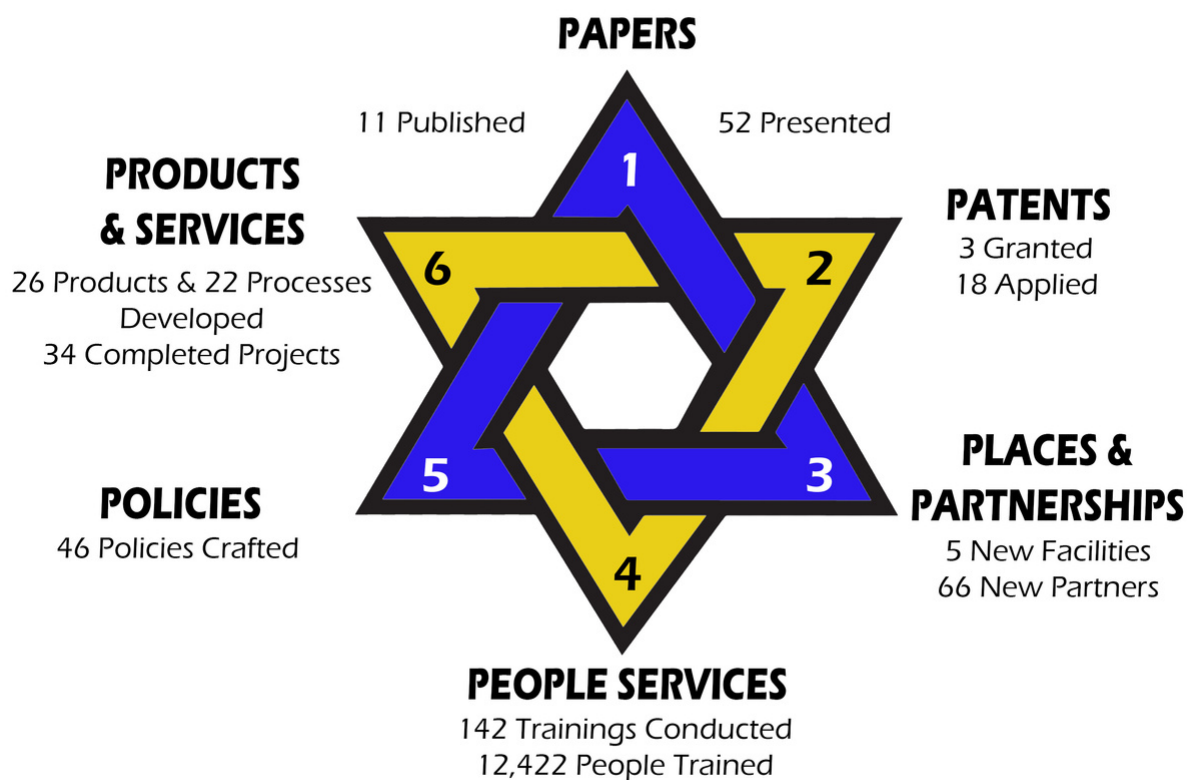
As one of the high-impact S&T programs, the biosafety level 2+ or BSL-2+ laboratory under the "*Big 21 in 2021*" will work on microorganisms that pose moderate hazards to laboratory staff and the environment. The biological material used in a BSL-2+ laboratory consists of bacteria, viruses, and organisms associated with human diseases.

Established in the Environment and Biotechnology Division (EBD), this new laboratory will be adhering to the appropriate biosafety and biosecurity protocols as mandated by international standards. With this new BSL-2+ laboratory, the initial projects of the VIP program will be implemented safely and securely.

Some of the projects under VIP include the following:

- Isolation and purification of Philippine common viruses with medical importance and pandemic potential for antigen-antibody studies;
- Combination therapy: Lytic bacteriophages and plant extracts against multidrug-resistant bacteria;
- Detection of food and water-borne bacterial pathogens using phage-based diagnostics;
- De novo synthesis of non-infective Zika pseudovirus as reference for diagnostics and vaccines development;
- Development of a rapid detection kit for African Swine Fever virus; and
- Tomato yellow leaf curl virus research which infects tomatoes, peppers, beans, and weeds.

VIP will serve as the venue for scientists, both here and abroad, to collaborate in studying viruses and viral diseases in humans, plants, and animals. Through strategic partnerships with some of the world's leading scientists, virology centers, and institutes, it will create ground-breaking and pioneering virology research in the country that will advance the frontiers of virology in the country.



6Ps PROJECT OUTPUTS

One of the metrics that DOST-ITDI uses to gauge its performance is the 6Ps Metrics of the DOST System which include the following:

- **Paper:** published aspect of the research and other research data presented in technical fora;
- **Patent:** proprietary invention or scientific process for potential future profit;
- **Product and Process:** invention with a potential for commercialization;
- **People Services:** people or groups of people, who received technical knowledge and training;
- **Places and Partnerships:** facilities and networks that enable research and development, technical services, and technology transfer to reach as many as possible; and
- **Policies:** science-based policy crafted and adopted by the government or academe as a result of the research output

2021 HIGHLIGHTS OF ACCOMPLISHMENTS

COMPLETED R&D PROJECTS

BIOTECHNOLOGY

Development of a Fermentation Product (Kimchi-Filipino adaptation) from Locally-grown Vegetables Using Indigenous LAB Isolates as Starter Culture

Project Leader: E.G. Panerio

A lactic acid bacteria (LAB) starter-augmentation technology that would aid the fermentation process in locally grown vegetables was developed. The kimchi flavor was adapted to increase product acceptability of the fermented vegetables.

The shelf life of starter cultures using skim milk preservation medium has been tested while the initial colony-forming unit (CFU) counts of starter cultures before storing in either room or refrigerated temperature, as well as the final CFU counts for each setup in both temperatures after 56 days were recorded. Kimchi using



local vegetables with culture augmentation was then prepared along with an acceptability test questionnaire that was used for the taste test.

If commercialized, this would help both vegetable and fermented vegetable producers prolong the shelf life of their products resulting to added value. With the current hype on Hallyu (Korean Wave) that can be capitalized on, a considerable market demand for the developed Filipino adaptation of kimchi is possible.

CHEMICALS

Processing of Anti-freezing Agent for Biodiesel

Project leader: C.A. Bulan

The study aims to address the demand for locally-produced anti-freezing agent so that the existing product, particularly the coconut methyl ester, can compete in the world market.

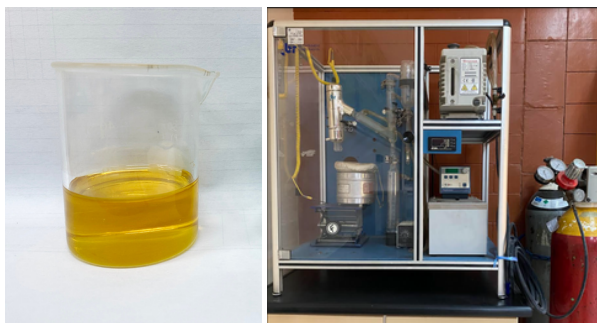
The following were accomplished during the year: optimized the parameters for the synthesis of glycerol acetals with different carbon chain length; completed experimental runs for optimization; conducted analyses of the produced glycerol acetals and biodiesel from coconut and pork oil; prepared biodiesel, glycerol acetal blends at 1% and 3% concentration; performed analyses of the



produced glycerol acetal and biodiesel samples; applied for patent/utility model; trained two staffs; and submitted samples of pure glycerol acetal as well as biodiesel blends to Intertek Testing Laboratory (Singapore) for pour point analysis.

Catalytic Hydrogenation and Transesterification of Highly Unsaturated Fatty Acids from Rubber Seed Oil

Project leader: V.F.R. Ablang



The study aims to enhance the quality of the fatty acids in rubber seed oil and produce a biodiesel that will meet the prescribed local and international standards.

The following activities were conducted: optimization runs of catalytic hydrogenation, analyzed hydrogenated rubber seed oil from trial runs using rancimat, and submitted samples to STD for fatty acid methyl ester (FAME) analysis. A partnership with local rubber seed farmers in Alaminos, Laguna was also established.

Bench-scale Production of Curcumin from Philippine Turmeric Using Different Extraction Methods

Project leader: E.A. Ongo



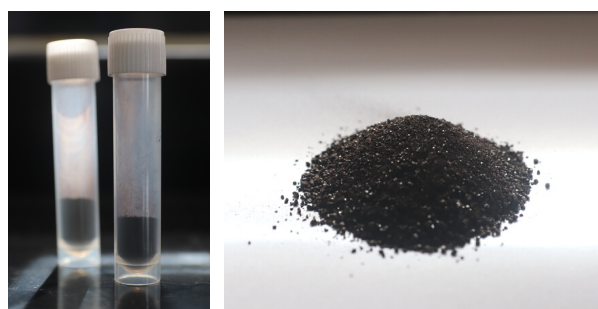
Three different extraction techniques namely; soxhlet, dynamic maceration, and percolation were investigated. Percolation gave the highest yield of crude extract from which curcumin was produced.

A patent for the process of curcumin recrystallization has been applied for, while a technical paper has been published and presented in a conference. A pharmacist was also trained for the project and a partnership with the Chamber of Herbal Industries of the Philippines, Inc. was established.

Curcumin has many uses locally and has export potential. Resulting product from this project could help spark start-up production of curcumin that will benefit the local industry.

Isolation, Characterization and Utilization of Waste Lignin in Bio-based Adhesives

Project leader: C.A.G. Bilbao



The study aims to explore the potential applications of lignin as a natural phenolic polymer. Sample coconut pith were dried and prepared for lignin extraction.

Two trials of lignin extraction using method based on literature were conducted and the brown precipitate (lignin) was collected. The extraction setup was also slightly modified for faster filtration of the lignin extract.

Bench-scale Production, Verification of Optimized Parameters and Sensory Evaluation for the Market Research of Halal Cosmetics and Toiletries

Project leader: R.C. Torres

Bench-scale production, validation of optimized parameters, and safety evaluation of the developed Halal-compliant cosmetics and toiletries were conducted. The developed products were subjected to market research study to be able to identify priority needs of the consumers in terms of raw materials, sensory attributes, and other product specifications.

From lab-scale, production was significantly increased at bench scale: lipstick – 900%, soap – 2,150%, shampoo – 2,900%, lip balm – 900%, and toothpaste – 500%.

Natural Hydrocolloid as Alternative Emulsifier and Stabilizing Agent from Okra (*Hibiscus esculentus*) Pods

Project leader: O.C. Evangelista

The project aims to encourage food manufacturers/processors to use their by-products, and/or oversupply (like okra), excess volume of off-specs and rejects, and generate additional income by creating value-added and innovative products.

From the okra rejects, spray dried okra hydrocolloids and concentrated liquid hydrocolloids were produced and analyzed for their physico-chemical characteristics and functional properties. The effect of varying pH on their viscosity was likewise examined.

Food and non-food products were also prepared using the spray dried okra hydrocolloid such as as *banaba* milk tea and toothpaste with *calamansi* seed oil.

Three personnel were trained while a partnership has been forged with an okra farm grower in Tarlac.



A market research specialist/cooperator was enlisted for the market study. Products were distributed to 34 individuals connected to the cosmetics and personal care industries. Valuable insights were noted for further improvement of the products, including the packaging materials.



ENERGY

Development of Uninterruptible Power Back-Up System Using Motor Control for Lighting Applications as Sample Electrical Load

Project leader: F.E. Del Pozo, Jr.

A power back-up system that is not traditionally made using electronics but instead uses motor control devices that are common in an industrial machine such as contactor, and time-delay relays was developed. It is easy to repair and can adapt to any power source including renewable energy.

It addresses the limitations of a back-up system with a short lifespan, economic value of back-up system compared to the time of consumption of power, difficulty of repair and the negative impact life-cycle assessment of the device.

It has been tested as well for both utility and back-up mode with power analyzer connected, while testing of a commercially available UPS for comparative study was completed.



In addition, a design experiment using factorial design was conducted. Statistical analysis using match paired t-test was also performed.

At least one utility model has been registered with IPO.



Scale Up of Power Back-Up System for Large Equipment

Project leader: F.E. Del Pozo, Jr.

The power back-up system will be upgraded as a reliable source of continuous power for large and critical loads. The adaptability of a power back-up system to any equipment will be determined by (1) system performance, (2) runtime, (3) reliability, (4) maintenance, and (5) total cost of ownership.

A purchase request for solar PV equipment and motor control devices was also prepared while the existing design of the power back up system has been modified. A solar PV system design for large equipment was also prepared.

ENVIRONMENT

Dissolved Copper Removal from Semiconductor Wastewater Effluent by Electrowinning Process

Project leader: J.C. Tezano

Copper's (Cu) high ductility, exceptional electrical and thermal conductivity properties made it a vital component of development of human civilizations. Today however, it is one of undesirable components of wastewater and found toxic to aquatic organisms.

According to WHO (World Health Organization), copper ions content in drinking water should not exceed 2 mg/L. Therefore, there is a need for a technology that will increase usage of recycled copper in various industries, and, at the same time, an innovative solution that can keep copper from contaminating water supplies.

The electrowinning process was continued using copper-graphite electrodes and an upright cell design, and the optimum current and pH for the set-up was determined. Three types of copper wastewater namely; influent, effluent, and concentrated, collected from an industry that responded to an online survey were analyzed for their pH. The electrowinning process was then applied to the wastewater except for the effluent, whose copper concentration is too low to be detected by Atomic Absorption Spectroscopy (AAS).

Another trial run was also conducted using stainless steel as cathode replacing copper plate with graphite as anode to test for improved reduction efficiency.



FOOD PROCESSING

Improving the Quality of Deep-Fat Fried Cassava Chips

Project leader: J.C. Ocasla

The development of appropriate processes for cassava chips would further boost these local snack items particularly the producers of fried cassava chips. This involves transfer of developed techniques on producing cassava chips that conforms to the quality standards.

Using pre-treatment and processing techniques, crispy and less greasy cassava chips were produced that are at par with those found in the market. The parameters used in vacuum frying and deep frying of crispy cassava chips can be adopted by interested would-be partners.

Preliminary tests on pre-treatment and frying of cassava slices were conducted. As well, the experimental design for frying of cassava slices and process flow design for the preparation of crispy fried cassava chips were finalized.



Development of Alternative Techniques for Okra Flakes/Sheets Processing

Project leader: M.E.M. Falco

As an alternative to the costly drum drying process, other processing techniques for okra puree to produce okra flakes and sheets were developed.

Trial runs using hot plate method, oven method, and cabinet dryer were performed. Also conducted were trial runs to improve technique of forming the okra sheets, while physico-chemical analyses of products were completed.

Establishment of Food Safety System for High Risk Bakery Products for Public Consumption

Project leader: L.S. Montevirgen

The project aims to validate if cooking/steaming meat-filled bakery products (particularly siopao) under typical conditions delivers the desired lethality to pathogenic microorganisms capable of growing in siopao. The results of the study will provide parameters that can be utilized by siopao processors to help produce microbiologically safe finished products.

The following activities were conducted: standardization of siopao formulation and process, prepared the draft Good Manufacturing Practices (GMP), Hazard Analysis Critical Control Points (HACCP), Sanitation Standard Operating Procedures (SSOP) plans for the guidance manual, and initiated the Microbial Challenge Test (MCT) using surrogate microorganism *B. cereus* ATCC 14579 and sporulation.



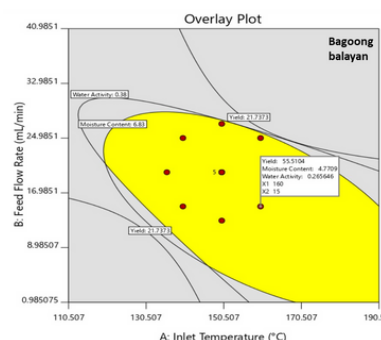
Natural Flavorings from Local Sources as Food Additive

Study 1: Optimization of Spray Drying of Flavors from Fermented Fish and Shrimps

Project leader: M.D.L. Villaseñor

Fermentation of food raw materials is one of the oldest methods of food preservation. The fermentation intensifies the development of typical flavors associated with a given raw material due to the presence of building blocks of foods: carbohydrates, proteins, peptides and amino acids. Spray drying was used to convert liquid flavors of *bagoong* into powdered flavors.

The dynamics in the global market has shown an increasing trend for organic and natural flavors due to health consciousness among consumers, rapid urbanization, introduction of new flavors with more sensational taste, growing disposable income, and increasing emphasis on uniqueness in taste with patents in processed food and beverage products.



Using the ITDI-fabricated spray dryer, a process for extraction of flavors from *bagoong* was developed and the spray drying parameters were optimized. The optimization experiment utilized the Response Surface Methodology (RSM) with two spray drying parameters under study, namely, inlet temperature and feed flow rate. Results of this study showed that the optimum spray drying conditions of the equipment for the *bagoong* flavors were 160 °C inlet temperature at 15 mL/min feed flow rate.

Two powdered *bagoong* flavors will be produced using the centrifugal-type spray drying available at ITDI Main FIC and selected Regional Food Innovation Centers of DOST. Market test runs will be performed as well.

Development of New Shelf-Stable Food Products from Fruits, Grains and Vegetables (GAD Project Phase 3)

Project leader: M.B.A. Macaraeg

Aside from the previously developed mungbean coconut milk drink, beef-filled suman, RTE chicken egg, and isotonic drink; new products sourced from grains, fruits, and vegetables were formulated (e.g., rice drink, freeze-dried soup).

These new innovative products are now offered for transfer and/or adoption which SMEs or even displaced OFWs can avail of for product expansion/livelihood generation or business.

The products are categorized as emergency foods/ration and currently undergoing product costing.

A full-scale production (500 pouches) of RTE chicken egg using the fabricated horizontal water spray retort was conducted. The products shall be used for the series of physico-chemical analyses and shelf life tests. Meanwhile, initial production runs for shelf-stable rice drink and



freeze-dried soup or Filipino viand mixes were also performed to determine moisture content, total soluble solids, viscosity and pH value. Samples of shelf-stable white corn grains from experimental runs were subjected to thermal processing and sensory evaluation tests.

Market Testing of FIC Technologies/ Products through Collaboration with Existing Adopters

Project leader: C.L.D. Moico

Market testing is a stage where a product is tried out in selected market segments and guides the business in making wise decisions over a certain investment or venture. It helps determine whether a product is acceptable or not before commercialization.

RTD coconut mungbean was subjected to a market test through a survey with a sample size of 42 respondents using a structured questionnaire and it was revealed that the product has market potential. However, due to the limited number of respondents, it was recommended to conduct further validation to establish the accuracy of the data and conclusively determine the potential of the product in the market.



Establishment of Halal Assurance System for Processing Selected Banana Products (Banana Chips, Banana Catsup, and Frozen Banana)

Project leader: M.E.M. Falco

Bananas are one of the major export products of the country. As well, the technological advances in food production have led to a huge increase in processed foods. Along with this, the Halal sector has created the need for standards and certification that has expanded to banana food processing, micro ingredients, and additives for food products.

In line with these developments, the project Team had established the Halal Assurance Management System (HAS) of selected banana food products such as banana chips, catsup, and frozen banana. Likewise,



HHCCAP or Halal Hazard Critical Analysis Control Points for the same products was developed. It is envisioned that the HAS for banana products will be adopted by industry partners soon.

Development of Emulsified Meat Products (Sausage, Nuggets and Burgers) for Halal Market

Project leader: M.E. Evaristo

The formulations and process in the production of Halal compliant emulsified chicken meat products namely sausage, nuggets, and patties/burgers were developed and established using Halal chicken and Halal-certified ingredients while applying Halal principles during the development process.

The products were subjected to storage studies to determine the shelf life of the most acceptable formulations while costing and profitability analysis were conducted using the data from the pilot scale production.

A training manual on emulsified chicken products was also developed. The technology was already transferred to KASAMA Halal Cooperative. Information on suppliers of Halal ingredients as well as additional Halal requirements on various processing conditions to avoid contamination with non-Halal meat and ingredients is likewise provided to technology adopters.

It is envisioned that the emulsified chicken technology be adopted by meat processing companies in the near future.



Scale-up Production, Stability, and Application of Natural Colorants for Cosmetics (Year 1)

**Project leaders: R.C. Torres/
M.R.V. Parcon**

This 2-year project aims to produce colorants from natural raw materials, such as beetroot, blue ternate, and dragon fruit, through microencapsulation. The developed natural colorants will then be applied to cosmetic products.

In Year 1, the production parameters of natural colorants from plant extracts using a lab-scale spray dryer were verified and optimized. These optimized parameters, which were determined using a three-factorial Box-Behnken Design (BBD), will be used as a baseline for the scale-up production of natural colorants the following year.

Initial product formulation was also conducted on some cosmetics and personal care products, including shower gel and face masks.



MATERIALS SCIENCE

3D Printed Carbon-based Flexible Piezoresistive Wearable Sensor for Smart Device Gesture to Speech Applications

Project leader: M.C.O. Que

The project aims to develop 3D printed carbon-based flexible piezoresistive wearable sensors for smart device gesture to speech applications. The device helps alleviate psychological and social impacts on blind and deaf persons who experience impaired ability to properly communicate with another person.



The thermoplastic polyurethane (TPU) powder and carbon fiber were used as starting materials, and microstructural observations of TPU powder and carbon fiber using digital optical microscopy were undertaken. 3D printing of test specimens using selective laser sintering machine for mechanical strength determination was carried out using TPU powder.

Development of Bioinspired Composite Membrane Separators for Advanced Rechargeable Lithium-ion Batteries

Phase 1: Fabrication of Bioinspired Composite Membrane Separators from Abaca Fibers

Project leader: M.T. Margarito

The project aims to utilize bioinspiration in the fabrication of smart polymeric membrane separators for advanced rechargeable lithium-ion battery applications. Bioinspiration presents a facile method for fabricating membrane composites with enhanced properties. Cellulose extraction and acetylation using abaca fibers were conducted.

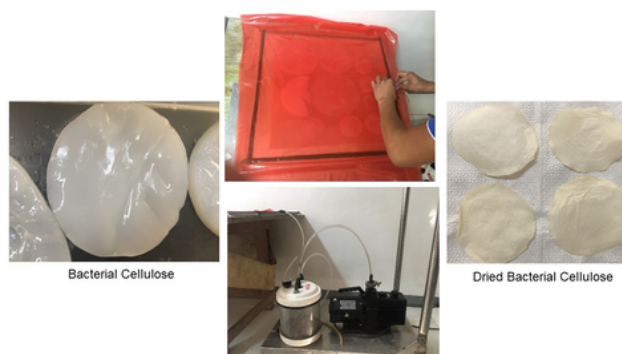


Development of an Antimicrobial Wound Dressing from Bacterial Cellulose-Nanoclay Composite

Project leader: C.S. Emolaga

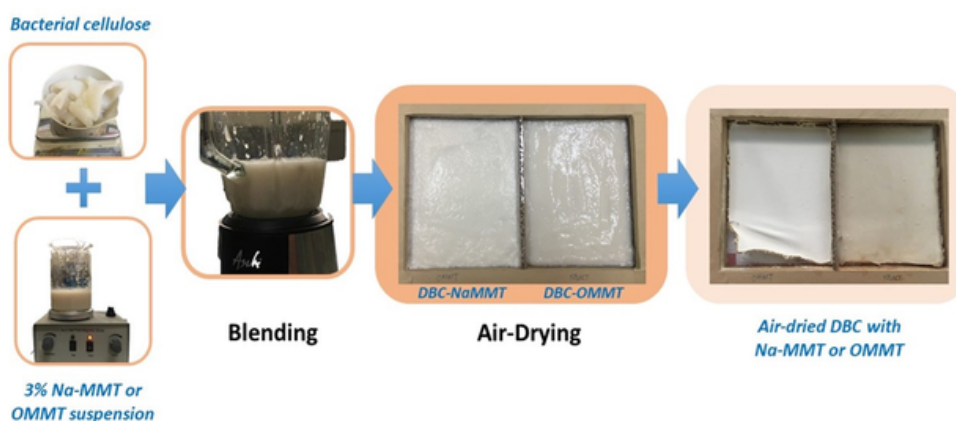
The project aims to develop bacterial cellulose-nanoclay composites for antimicrobial wound dressing application using locally-available bacterial cellulose and sodium-activated nanoclay and organoclay.

A commonly available/sold bacterial cellulose was used to determine the appropriate purification and drying method. The representative bacterial cellulose sample was then characterized through X-ray diffraction (XRD) analysis and atomic force microscopy (AFM) analyses.



Bacterial Cellulose

Dried Bacterial Cellulose



NANOTECHNOLOGY

Porous Nanocarriers for Drug Delivery Applications

Project leaders: J.R. Celorico, A.K. Collera

Porous inorganic nanocarriers from indigenous nanomaterials for drug delivery systems, particularly for anti-inflammatory drugs were developed. Phase 1 of the project deals with the development, characterization, and optimization of parameters of the synthesized nanocarriers. On the other hand, Phase 2 involves the synthesis, characterization, optimization of parameters for the production of, and performance testing of the anti-inflammatory drug loaded nanocarriers.



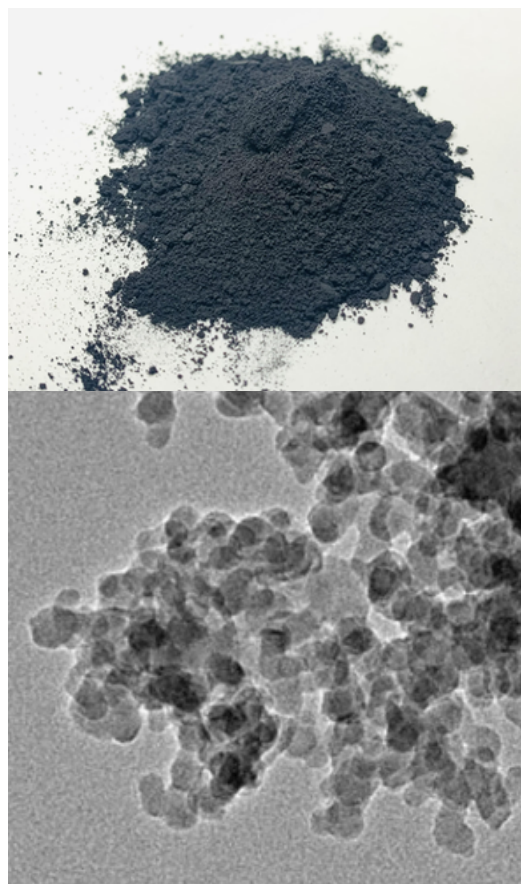
The processing of rice hull to synthesize nanosilica, characterization by X-ray fluorescence (XRF), X-ray diffraction (XRD), and dynamic light-scattering (DLS) to determine chemical composition, mineral content, and particle size, respectively, were completed.

Superparamagnetic Iron Oxide Nanoparticles (SPIONs) from Natural Mineral Deposits for Industrial and Biomedical Applications - Phase 2

Project leader: P.A.N. de Yro

The study aims to produce and functionalize superparamagnetic iron oxide nanocomposites (SPIONs) for industrial applications, as well as beneficiate and develop SPIONs from local iron oxide mineral deposits. The first target application of SPIONs is to treat cancer. This year, the following activities were conducted: continuous grinding of beneficiated black sand to obtain nanoparticles, characterized samples using scanning electron microscopy (SEM), and established the design of experiment for surface treatment.

Beneficiation and development of SPIONs from local iron oxide mineral deposits was explored. It entails material beneficiation studies to remove impurities from the mineral ore, characterization of beneficiated iron oxide ores, surface and structural modifications of the processed iron oxide ores to develop superparamagnetic properties and characterization of the processed iron oxides and evaluation for possible SPIONs development.



Environment, Health and Safety Research on the Risk Assessment of Nanomaterials

Project leader: B.A. Basilia

Through this project, safety guidelines for the nanotechnology industries were developed including manufacturing, monitoring of worker exposure, ambient release of nanoparticles, and risk evaluations, which are mandatory to promote nanotechnology for its economic incentives and medicinal applications.

This year, capabilities on the assessment of nanomaterials in terms of safety were established by acquiring best practices learned from ASEAN and ANF member countries. The project team also coordinated with the academe and regulatory agencies in establishing the guiding principles and policy standards through TC-85 on Nanotechnologies, and gathered primary safety data for nanomaterials in the Philippines.

Seven testing manuals based on the existing international standard protocols and guidelines of the International Organization for Standardization (ISO) were prepared and copyrighted. Also published were two papers in peer reviewed international journals and 40 PNS standards on nanotechnology, while 16 papers were presented in conferences/webinars/seminars/workshops.

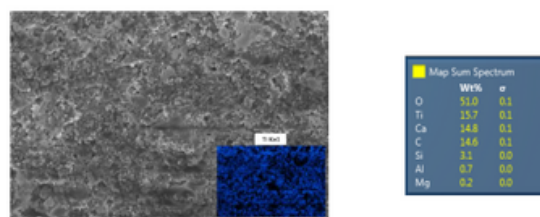


Figure 11: SEM-EDX result of P1 before weathering.

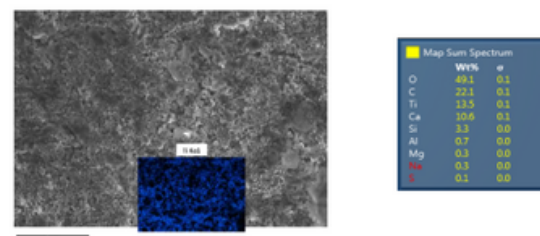


Figure 12: SEM-EDX result of P1 after weathering

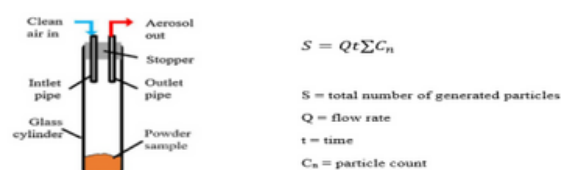
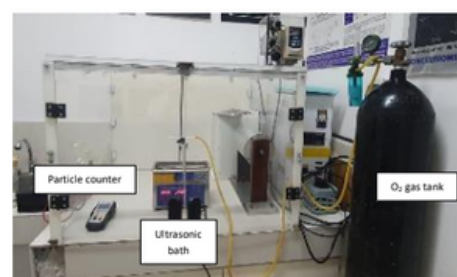


Figure 22. Experimental set-up

PACKAGING TECHNOLOGY

Establishment of Shelf Life and Safety of Chilled Ready-to-Heat and Freshly Cooked Ready-to-Eat Foods Sold in Convenience Stores and Delivery Service

Project leader: C.M. Bihis

The effect of fluctuating storage temperatures on the shelf life and safety of selected chilled ready-to-heat/eat foods sold in convenience stores and delivery service was studied. The study focused on two types of chilled RTH meals (*tocilog* and lasagna) that were stored at 9 °C, 6 °C and 3 °C to simulate the fluctuation of



temperature. Physico-chemical, microbiological, and sensory attributes during storage were monitored periodically. Based on the result, the shelf life of chilled *tocino* and lasagna was significantly affected by fluctuating temperature.

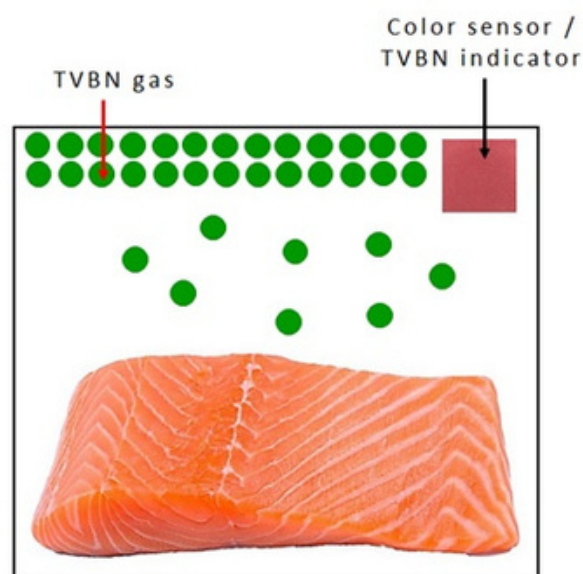
Development of Intelligent Packaging Colorimetric Sensor as Total Volatile Base Nitrogen (TVBN) Indicator

Project leader: R.A.G. Garalde

The project aimed to develop a colorimetric sensor as TVBN indicator. It has two phases: 1) development of fabrication method; and 2) conduct of simulation test.

The intelligent packaging colorimetric sensor contains a component that can inform and communicate the state of the product. It is a visual label containing a chemical-responsive component to total basic volatile nitrogen (TVBN) such as ammonia gas. The colorimetric sensor will change its color depending on the concentration of TVBN content.

The developed colorimetric gas sensor can be used to monitor the freshness of packaged chilled and frozen fish sold in supermarkets, groceries and convenience stores.



Development of Antioxidant Film Based on Chitosan Containing Spent Ground Coffee Extract

Project leader: M.J. Paico

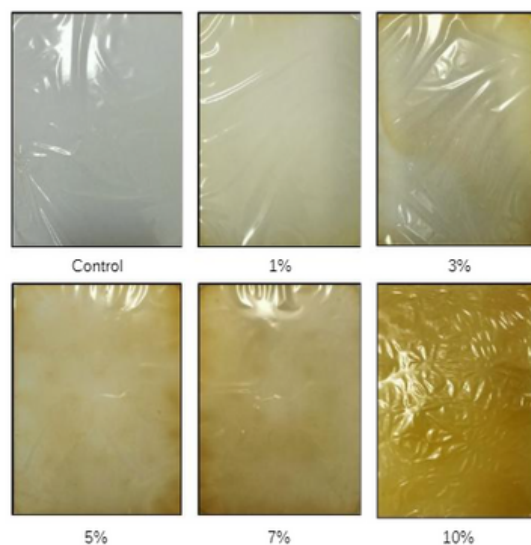


Figure 3. Visual appearance of chitosan-based film mixed with different amount of spent ground coffee extract.

Exposure Assessment of Filipino Consumers to Benzophenones Migrated from Paper and Paperboard Used as Packaging for Food and Beverages

Project leader: D.J. Alcarde, Jr.



The project aims to assess the benzophenone in paper packages that are intended for food contact use. A survey has been administered to more than 200 participants while paper package samples were tested for the presence of benzophenone using gas chromatography-mass spectrometry (GCMS).

The study aims to develop biodegradable chitosan-based active packaging film containing spent ground coffee extract (SGCE) as a natural antioxidant.

An antioxidant chitosan-based film mixed with centrifuged and uncentrifuged SGCE was developed. The film has been evaluated for its physical and mechanical properties.

Shelf Life Extension of Fresh-cut Pineapple Through the Application of Alginate-based Edible Coating with Lemongrass Essential Oil

Project leader: D.J. Ortiz

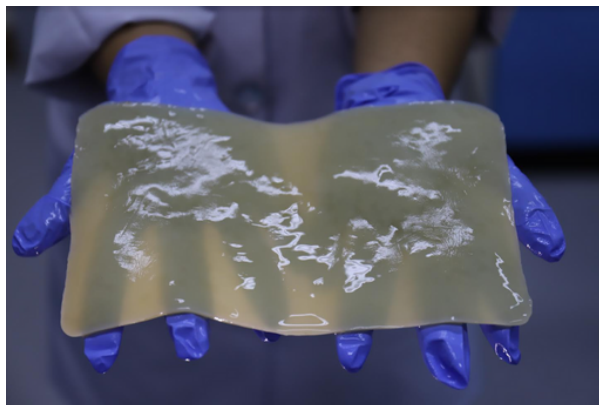


An edible coating solution for fresh-cut fruit based on food grade sodium alginate was developed. Lemongrass essential oil was also incorporated into the coating solution as antimicrobial agent to potentially improve microbial quality hence, the shelf life of fresh-cut pineapple (*Ananas comosus* var. *Formosa*).

The developed edible coating improved the shelf life of fresh-cut pineapples for up to 8 days at 5 °C compared to non-coated pieces which were found to be only acceptable for about 4-5 days at the same storage condition, based on sensory test results. Its application has improved the appearance and gloss, as well as retained the juiciness, taste, odor, and texture of pineapple pieces, whereas non-coated ones were found to be dry and mushy. Extended shelf life of coated fruit pieces was attributable to delayed changes in total soluble solids and pH during storage. More so, significant decrease in microbial load (in terms of aerobic plate and mold and yeast count) on coated fresh-cut pineapples confirmed the effectiveness of lemongrass oil as antimicrobial component of the coating.

Development and Assessment of Bacterial Cellulose Derived from Fruit Waste as a Bio-based Plastic Film

Project leader: C.T. Saldaña



Bacterial cellulose derived from pineapple wastes was developed and its potential as a bio-based plastic film was assessed. Fermentation medium formulation, harvest time, cleaning/disinfecting treatment, and drying time were optimized to produce bacterial cellulose that has properties suitable for use by the packaging sector. The produced film was also characterized in terms of microstructure, tensile strength, water vapor and oxygen permeability, biodegradability, and compatibility as food contact material. Results showed that the produced bacterial cellulose film is biodegradable, has excellent oxygen barrier properties and acceptable tensile strength, and is compatible with dry and oily food products. The product has the potential to be used as an alternative to existing petrochemical-based plastics available in the market. However, more studies are needed to ensure its successful commercialization.

Upgrading and Enhancing the Capacity of the Packaging Technology Division in Packaging Research and Innovation

Project leader: D.E. Tañanra

The project aims to upgrade and enhance the capacity of PTD in developing new packaging technology and innovations, performance evaluation of packaging in the supply chain, packaging testing to assure food safety, and world class packaging design addressing the packaging needs of MSMEs in the country.

In 2021, PTD through this project has established the simulation packaging testing lab (SPTL) and green packaging lab (GPL), upgraded the facility of PTD's R&D & testing labs, pilot plant and design, developed handbook of packaging materials, and enhanced capability of PTD manpower.



LIST OF 2021 COMPLETED PROJECTS

In 2021, ITDI has completed 28 regular or GAA-funded and 6 GIA or externally-funded projects, totaling to 34 projects under the following R&D areas: biotechnology, chemicals, energy, food processing, materials science, nanotechnology, and packaging technology.

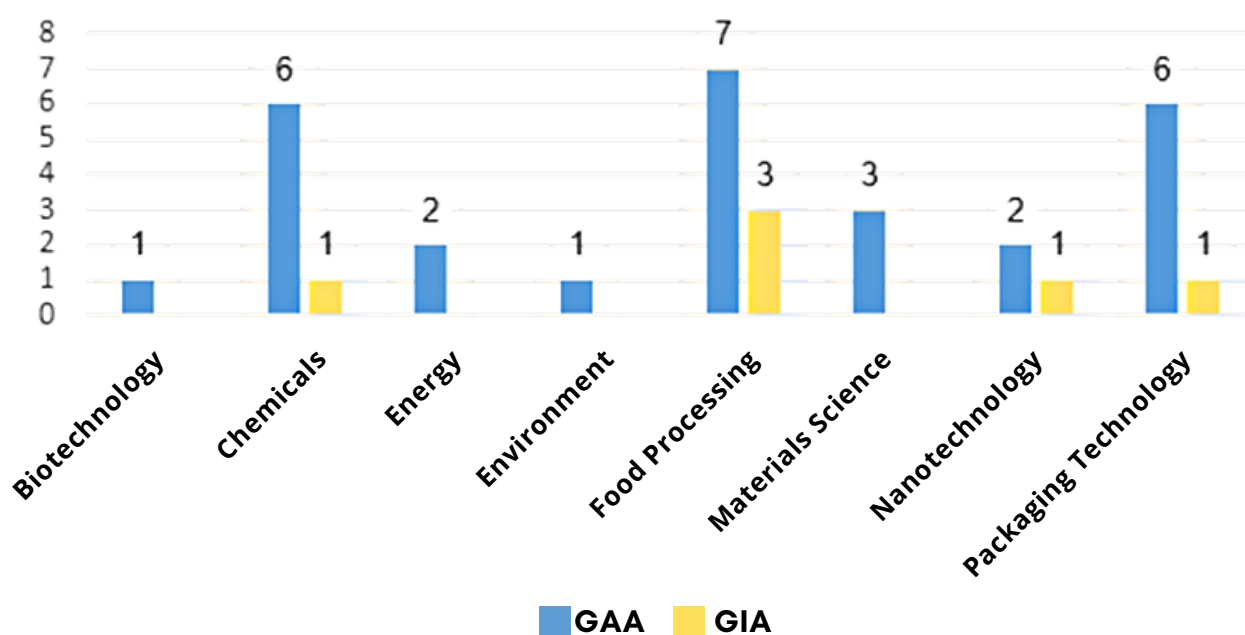


Table 1. GAA-funded projects

PROJECT TITLE	PROJECT LEADER
Development of a Fermentation Product (Kimchi-Filipino Adaptation) from Locally-grown Vegetables Using Indigenous LAB Isolates as Starter Culture	E.G. Panerio
Natural Hydrocolloid as Alternative Emulsifier and Stabilizing Agent from Okra (<i>Hibiscus esculentus</i>) Pods	O.C. Evangelista
Processing of Anti-freezing Agent for Biodiesel	C.A. Bulan
Development of Uninterruptible Power Back-Up System Using Motor Control for Lighting Applications as Sample Electrical Load	F.E. Del Pozo Jr.
Bench-scale Production of Curcumin from Philippine Turmeric Using Different Extraction Methods	E.A. Ongo
Establishment of Shelf Life and Safety of Chilled Ready-to-Heat and Freshly Cooked Ready-to-Eat Foods Sold in Convenience Stores and Delivery Service	C.M. Bihis
Improving the Quality of Deep-Fat Fried Cassava Chips	J.C. Ocasla
Development of Alternative Techniques for Okra Flakes/Sheets Processing	M.E.M. Falco
Establishment of Food Safety System for High Risk Bakery Products for Public Consumption	L.S. Montevirgen
Natural Flavorings from Local Sources as Food Additive Study 1: Optimization of Spray Drying of Flavors from Fermented Fish and Shrimps	M.D.L. Villaseñor
Development of Intelligent Packaging Colorimetric Sensor as Total Volatile Base Nitrogen (TVBN) Indicator	R.A.G. Garalde
Development of Antioxidant Film Based on Chitosan Containing Spent Ground Coffee Extract	M.J. Paico
Exposure Assessment of Filipino Consumers to Benzophenones Migrated from Paper and Paperboard Used as Packaging for Food and Beverages	D. Alcarde, Jr.
Shelf Life Extension of Fresh-cut Pineapple Through the Application of Alginate-based Edible Coating with Lemongrass Essential Oil	D.J. Ortiz
Isolation, Characterization, and Utilization of Waste Lignin in Biobased Adhesives	C.A.G. Bilbao

Table 1. GAA-funded projects (continued)

PROJECT TITLE	PROJECT LEADER
Scale Up of Power Back-Up System for Large Equipment	F.E. Del Pozo Jr.
Bench-Scale Production, Verification of Optimized Parameters and Sensory Evaluation for the Market Research of Halal Cosmetics and Toiletries	R.C. Torres
Ultrasonic Assisted Extraction (UAE) and Microencapsulation of Virgin Coconut Oil (VCO) Phase 1: Development of UAE and Microencapsulation Processes	M.D.L. Villaseñor
Dissolved Copper Removal from Semiconductor Wastewater Effluent by Electrowinning Process	J.C. Tezano
Market Testing of FIC Technologies/Products Through Collaboration with Existing Adopters	C.L. Moico
Development of New Shelf Stable Food Products from Fruits, Grains, and Vegetables (GAD Project Phase 3)	M.B.A. Macaraeg
3D Printed Carbon-based Flexible Piezoresistive Wearable Sensor for Smart Device Gesture to Speech Applications	M.C.O. Que
Porous Nanocarriers for Drug Delivery Applications	J.R. Celorico
Superparamagnetic Iron Oxide Nanoparticles (SPIONS) from Natural Mineral Deposits for Industrial and Biomedical Applications - Phase 2	P.A.N. de Yro
Development of an Antimicrobial Wound Dressing from Bacterial Cellulose-Nanoclay Composite - Phase 1	C.S. Emolaga
Development of Bioinspired Composite Membrane Separators for Advanced Rechargeable Lithium-ion Batteries Phase 1: Fabrication of Bioinspired Composite Membrane Separators from Abaca Fibers	M.T. Margarito
Development and Assessment of Bacterial Cellulose Derived from Fruit Waste as a Bio-based Plastic Film	C.T. Saldaña

Table 2. GIA/externally-funded projects

PROJECT TITLE	PROJECT LEADER
Establishment of Halal Assurance System for Processing Selected Banana Products (Banana Chips, Banana Catsup, and Frozen Banana)	M.E. Falco
Environment, Health, and Safety Research on the Risk Assessment of Nanomaterials	B.A. Basilia
Development of Emulsified Meat Products (Sausage, Nuggets, and Burgers) for Halal Market	M.E. Evaristo
Scale-up Production, Stability, and Application of Natural Colorants for Cosmetics (Year 1)	R.C. Torres/M.R.V. Parcon
Upgrading and Enhancing the Capacity of the Packaging Technology Division in Packaging Research and Innovation	D.E. Tañafranca
Development of Halal Compliant Dehydrated Food Products from Selected Food Materials (Fruits, Vegetables, and Root Crops)	M.E. Falco
DOST-ITDI Strategic Communication Portfolio for Enhanced Promotion and Technology Transfer	V.B. Conoza

PRODUCTS AND PROCESSES DEVELOPED

A total of 26 products and 22 processes were developed by DOST-ITDI from 34 completed projects this year. Amid the ongoing pandemic, DOST-ITDI has produced several innovations capitalizing on its various expertise that advance science, technology, and innovation while addressing the pressing concerns of the country.

In terms of nanotechnology and additive manufacturing for industrial and medical applications, the following products and processes were developed:

- Bacterial Cellulose-Nanoclay Composite as Antimicrobial Wound Dressing
- Silica as Nanocarriers in Drug Delivery Applications
- Nanosized Magnetite for SPIONs as Potential Technology for Cancer Treatment
- 3D Printed Valve Holding Chambers for Respirators
- Abaca Cellulose Acetate for Bioinspired Composite Membrane Separator for Advanced Rechargeable Li-ion Batteries
- 3D Printed Carbon-based Flexible Piezoresistive Sensors for Smart Device Gesture Application



In May 2021, the Advanced Device and Materials Testing Laboratory (ADMATEL) launched IDAS or Intelligent Data Analysis System.

It is a 100% DOST-made web-based software that was developed through the help of the Advanced Science and Technology Institute (DOST-ASTI). It aims to provide a rapid and innovative profiling technique for Philippine Drug Enforcement Agency (PDEA) illegal drug trafficking investigation in the country.

PRODUCT/PROCESS/TECHNOLOGIES

Salt Harvesting Machine



Traditional Method



Using Salt Harvester



Smart Energy Monitoring System (EMS)



Power Back-up System



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INDUSTRIAL TECHNOLOGY
DEVELOPMENT INSTITUTE (DOST-ITDI)

In support of the manufacturing sector, developed technologies include:

- Salt Harvesting Machine, which improves the productivity and efficiency of solar salt processing in deep crystallizer systems.
- Power Back-up System, which acts as an alternative for commercially available UPS and is capable of adapting to any electrical set-up including standby mode, continuous mode and utility-interactive mode.
- Smart Energy Monitoring System (EMS), which tracks live power consumption in real-time for single or multiple devices.

PRODUCT/PROCESS/TECHNOLOGIES

RTD Coconut
Mungbean Drink

Beef-Filled Suman



Shelf-stable RTE Chicken Egg



Isotonic Drink

Halal Compliant Emulsified
Chicken ProductsSpray Dried Fermented Fish
and Fermented ShrimpHalal Compliant
Banana Products

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DEVELOPMENT INSTITUTE (DOST-ITDI)

More products were developed during the year, such as:

Coconut Mungbean Milk

It is a shelf-stable ready-to-drink creamy beverage from mungbean and coconut milk with added vanilla flavor or other suitable flavors; and is a good source of amino acids, protein, fiber, and lauric acid. It is non-dairy, lactose free and vegan-friendly.

Shelf-Stable RTE Chicken Egg

The product is all natural and has no added preservatives. It is packed in a retort pouch for easy distribution during calamities and emergency situations, and is shelf-stable for at least 5 months without refrigeration.

Isotonic Drink

It is a revitalizing and shelf-stable drink that takes inspiration from coconut – the *tree of life*. It is packed with electrolytes that helps prevent dehydration and maintain the body's fluid balance while supplying the body's need for energy. It is formulated to provide hydrating effects similar to those of carbohydrate-electrolyte sports drinks.

Beef-Filled Suman

It is a shelf-stable ready-to-eat *suman* composed of glutinous rice and cooked beef dish component, making it "*Rice and Ulam on the Go!*" It can be eaten as a meal/snack, or emergency food during disasters.

Emulsified Chicken Products

Product formulations and processes were developed under the DOST S&T Halal Program. All ingredients and food additives used are Halal certified and the products were prepared compliant with the Halal requirements.

Spray-Dried Fermented Fish and Shrimp

Extracted flavors of *bagoong balayan* and *bagoong alamang* were spray dried to convert the liquid products into powder form, which is more convenient.

PRODUCT/PROCESS/TECHNOLOGIES

Preserved Vegetables



Rice Milk

Chocolate Liquid Concentrate
Drink from *Tablea* (Dairy Free)

Veggie Suman

Dried Whole Sweetened
BananaCarbonized Cacao Shells
as Possible Colorant for
Textile

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DEVELOPMENT INSTITUTE (DOST-ITDI)

Preserved Vegetables

Underutilized vegetables such as *kangkong* stalks, *ampalaya*, *sigarilyas*, and *labanos* were acidified, packed in pouches, and treated with mild heat to extend their shelf life.

Rice Milk

RTD Rice Milk can be an intermediate raw material, used to prepare food items such as ice cream, milk tea, coffee, and other food products. It is a good alternative to dairy-based drinks and an excellent source of amino acids, protein, fiber, vitamins, and minerals.

Chocolate Liquid Drink Concentrate

A ready-to-mix chocolate concentrate made mainly from local chocolate liquor (*tablea*) and can be offered to institutional sectors such as restaurants and fast food chains.

Veggie Suman

It is a shelf-stable ready-to-eat *suman* composed of glutinous rice and plant-based material component (soy protein), making it "*Rice and Ulam on the Go!*" It can be eaten as a meal/snack or emergency food during disasters.

Dried Whole Banana (*Saba*)

A low fat healthy snack and can be used as a cooking ingredient for sweet and savory recipes.

Carbonized cacao shell

Cacao shells from the roasting and winnowing process were carbonized, which can then be used as possible colorant for non-food applications.

PLACES AND PARTNERSHIPS ESTABLISHED

DOST-ITDI established five state-of-the-art facilities conforming to international standards and guidelines in order to expand its R&D and technical services in support of its vision to be a leading industry partner in Science, Technology, and Innovation.



Launched in February 18, 2021, the **Modular Multi-Industry Innovation Center** or MMIC is the country's first innovation hub that aims to cater the research and development needs of micro, small, and medium enterprises (MSMEs) for advanced scale up of researches on food and nutraceutical products.



The inauguration of the new **ADMATEL Research and Development Laboratory** was simultaneously held with the IDAS launching on May 21, 2021, which will offer new advantageous S&T solutions such as Gas Chromatography - Mass Spectrometry (GC-MS), use of equipment for research activities of students or industry partners, and the application of IDAS Technology. Aside from testing, ADMATEL's customers can now conduct R&D that will enrich their experience.



The **Biosafety Level - 2+ Laboratory**, inaugurated on October 22, 2021, is among the "Big 21 in 2021" that will allow researchers to work on microorganisms that pose moderate hazards to lab staff and the environment. The lab is equipped with state-of-the-art equipment and will strictly adhere to appropriate biosafety and biosecurity protocols as mandated by international standards and ensure that projects of the VIP program are implemented safely and securely.





Also one of "Big 21 in 2021" is the four-story **Metrology in Chemistry (MiC)** facility. Inaugurated on November 9, 2021, it was established to help local testing laboratories comply with traceable chemical measurements by producing reference materials (RMs) for food and water and conducting accuracy-based Proficiency Testing (PT) schemes. Its primary goal is to deliver high quality goods and services for all Filipinos and help local industries comply with international standards and avoid product detention especially for export products.

Two more of ITDI's "Big 21 in 2021" are the ITDI's **Simulation Packaging Testing Laboratory (SPTL)** and **Green Packaging Laboratory (GPL)**, "unboxed" on December 21, 2021.

SPTL expands PTD's existing capability to design and test the performance of transport packaging in the supply chain. It aims to address the growing needs of the different industry sectors to include e-commerce, agriculture, furniture/house decors and food delivery among others in enhancing the design and performance of transport packaging of their products during distribution.

Meanwhile, **GPL** was established to provide alternative packaging or packaging options to the consumers, and not in any way to discriminate any type of packaging materials. Green packaging cannot be directly equated to biodegradable packaging. GPL envisions to do research on the following areas: (1) processes that will reduce energy consumption and solid/liquid waste; (2) materials reduction without compromising product quality and consumer safety; (3) use of indigenous and renewable materials; (4) circular/recycling technologies; (5) waste utilization; and (6) waste disposal.



The institute continues to seek out, broaden its engagements, and forge partnerships with its various stakeholders like industries and industry groups, government agencies, LGUs, academe, and private entities to fulfill its mandate. This year, 66 new partners got engaged with ITDI. Currently, DOST-ITDI maintains a total of 92 partnerships, which include international partners based in Argentina, Canada, Europe, India, Indonesia, Japan, Korea, Malaysia, Singapore, and USA.

1. Additive Manufacturing Society of India
2. Advanced Science and Technology Institute (DOST-ASTI)
3. Agrizkaya Federation of Farmers
4. Agusan Del Sur College of Agriculture and Technology
5. ASEAN Committee on Science and Technology (COST)
6. ASEAN Consultative Committee on Standards and Quality
7. ASEAN Expert Group of Metrology
8. ASEAN MSC Software
9. ASEAN Reference Material Network
10. ASEAN Secretariat and Korea Standardization Association (KSA) – Standard and Conformance Division
11. Asia Pacific Legal Metrology Forum
12. Asia Pacific Metrology Programme (APMP)
13. Association of Official Analytical Chemists (AOAC) International – Southeast Asia Section
14. Benguet State University
15. Bestmark Agro-Industrial Enterprises
16. Bicol University
17. BIPM CIPM MRA
18. Cagayan State University (CSU)
19. Camarines Sur Polytechnic Colleges
20. Cavite State University
21. Central Macaroni Co., Inc. (CENMACO)
22. Compostela Valley State College
23. Department of Agriculture – Bureau of Animal Industry (DA-BAI)
24. Department of Trade and Industry – Bureau of Philippine Standards (DTI-BPS)
25. Department of Trade and Industry – Philippine Accreditation Bureau (DTI-PAB)
26. DOST Region II
27. DOST Region IV-A CALABARZON
28. DOST Region IV-B MIMAROPA
29. DOST Region V
30. DOST Region VIII
31. DOST Region X
32. DOST Region XI
33. DOST Region XII
34. DOST Region XIII CARAGA
35. Dragon Fruit Stakeholders/Producers
36. FEATI University
37. Finite Element Institute of the Philippines (FEIP)
38. Food and Drug Administration – Center for Device Regulation, Radiation Health and Research (FDA-CDRRHR)
39. Heritage Veterinary Corp.
40. Ifugao State University
41. Industrias Metalúrgicas Pescarmona SA (IMPESA)
42. Integrated Chemists of the Philippines (ICP)
43. International Measurement Confederation (IMEKO)
44. Iwate University
45. JNE Personal Care Products, Inc.
46. K&R United Inc.
47. Kai-Anya Foods International Corp.
48. Korea Food Research Institute (KFRI)
49. Korea Institute for Advancement of Technology (KIAT)
50. Korea International Cooperation Agency (KOICA)
51. Laguna State Polytechnic University (LSPU)
52. LEAN Processes Inc.
53. LiveGreen International Inc.
54. Mapua University
55. Mariano Marcos State University
56. Metro Manila Health Research and Development Consortium (MMHRDC)
57. Nanyang Technological University (NTU)
58. National University (NU)
59. Nav's Incorporated
60. NeuBody International Corp.
63. Nueva Ecija University of Science and Technology
64. Nueva Vizcaya State University
65. Oak Ridge National Laboratory
66. Overseas Workers Welfare Administration
67. Palaya Corporation
68. Philippine Alliance of Laboratory Equipment Users (PALEU)
69. Philippine Association for Laboratory Animal Science (PALAS)
70. Philippine Coast Guard (PCG)
71. Philippine College of Laboratory Animal (PCLAM)
72. Philippine Commission on Women (PCW)
73. Philippine Drug Enforcement Agency (PDEA)
74. Philippine National Police (PNP)
75. Philippine Nuclear Research Institute (DOST-PNRI)
76. Philippine Registry of Interpreters for the Deaf
77. Philippine Rubber Technical Working Group
78. Polytechnic University of the Philippines – Manila (PUP)
79. Prestine Pacific Food Management Corporation
80. RS Unitech Manufacturing and Trading Corp.
81. Science Education Institute (DOST-SEI)
82. Siegwark Malaysia Sdn Bhd
83. Singapore University of Technology and Design
84. Suki Trading
83. Unified Products and Services Inc.
84. Universitas Ahmad Dahlan (UAD)
85. Universiti Teknologi MARA (UiTM)
86. University of New Brunswick
87. University of Santo Tomas
88. University of Tennessee, Knoxville, Kentucky (UTK)
89. University Sains
90. UPLB College of Development Communication
91. US Department of Agriculture – Agricultural Research Service (USDA-ARS)
92. Vision College of Jeonju



Following are the highlights of some of these partnerships:

- **ITDI - KIAT:** Dubbed as TASK Program, the Technical Advice and Solutions from Korea which ran for three years (2018-2021) is a program under the Korea Institute for Advancement of Technology (KIAT) which provided special assistance to promote technology cooperation and industrial development in the ASEAN region.
- **ITDI - DOST RO II - PNP:** The Packaging Technology Division also partnered with DOST Region 2 for the implementation of the delivery of fresh and semi-processed agricultural products in the supply chain and with PNP on the development and field testing of ready-to-eat (RTE) foods.
- **ITDI - ASTI - PDEA:** In support to the anti-drug trafficking initiatives of the government through PDEA, DOST-ITDI has developed with DOST-ASTI the program Intelligent Data Analysis System (IDAS) for materials information capitalizing on ADMATEL's advanced equipment and capabilities.
- **ITDI - FEATI - NU - FEIP:** This partnership with the Finite Element Institute of the Philippines (FEIP), National University (NU), and FEATI University aims to promote the use of Finite Element Analysis (FEA) which will benefit the students, engineers, scientists, and researchers in the academe, research institutions, and the industry.
- **DOST - MAPUA:** DOST, through ITDI and SEI, has partnered with Mapua University to implement the PhD program in Materials Science with specialization in Nanotechnology (by research) which is a first in the country. This partnership aims to develop expertise in materials science with focus on nanotechnology and increase the pool of nanotechnology experts in the country.
- **ITDI - Universitas Ahmad Dahlan (UAD) - DOST RO XI:** The three institutions have forged a collaboration on Halal R&D.



- **ITDI - Vision College of Jeonju, Korea - PUP - LSPU:** This cooperation with the three academic institutions focuses on academic and educational exchanges on renewable energy systems.
- **ITDI - CSU:** The DOST-ITDI - Cagayan State University (CSU) provides for the transfer of the abaca fiber composite. This MOA will permit CSU the license to adopt, utilize, make, produce and/or pre-commercialize the technology on the production of abaca fiber composites, especially in the fabrication of the body/cowl of its e-trike. DOST-ITDI will assist CSU in the establishment of the fabrication facility, train its personnel, and provide the necessary assistance during the course of the technology transfer activity.
- **ITDI - D.M. Wenceslao and Associates Inc.:** This is a contract R&D on Bench Scale Fluidized Bed Gasification of Lignite Coal for Indirect Liquefaction Process that aims to produce liquefied fuel from lignite coal through gasification and Fischer-Tropsch process.

- **ITDI - Dr. Dave Centeno:** “Bench-scale production, safety assessment and market research of Halal Cosmetics and Toiletries” Through this project, ITDI-developed halal cosmetics and toiletries (moisturizing lipstick and lip balm, shampoo with hair-growth promoting properties, whitening and moisturizing bath soap, and whitening herbal toothpaste) were subjected to a market study which covered determining the demand potential among consumers including market size, segmentations, potential positioning of Halal cosmetics, price sensitivity, and placement points; identify potential manufacturers, including other factors as cost sensitivity and product competitiveness.

This partnership aimed to promote the ITDI-developed technologies and identify the priority needs of the consumers in terms of sensory attributes and specifications to further improve and standardize the formulated Halal-compliant products.

TECHNOLOGY TRANSFER AND KNOWLEDGE TRANSLATION

Despite the raging pandemic and the constraints that go with it, ITDI through TSD persisted in conducting its knowledge translation initiatives through various channels or tactics such as quad media, webinars, exhibits, consultations, technology pitching, trainings, and technical assistance. In 2021, the institute has transferred a total of 68 technologies, eight of which were commercialized. From these technology transfer agreements, eight product prototypes were developed and will soon be commercialized. In addition, 158 technologies were transferred as public good.

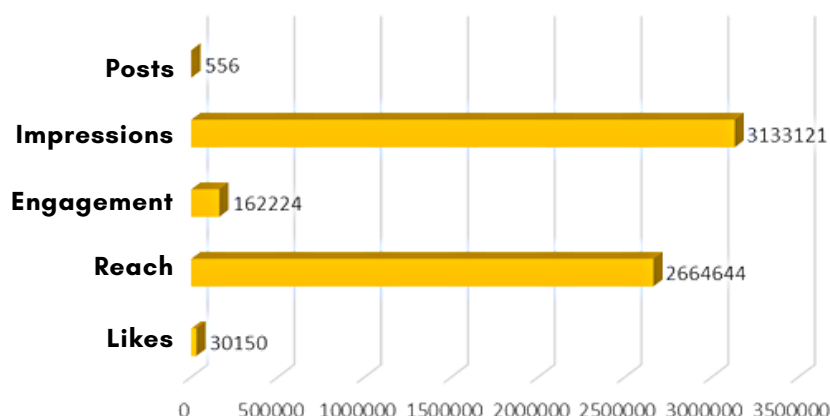
QUAD MEDIA PROMOTION

With the pandemic on its second year, KT initiatives were aggressively pursued capitalizing on the use of the digital media with some form of blended (virtual and face-to-face) transactions whenever practicable. Other channels were also employed to implement projects and achieve targets.

During the year, ITDI's media mileage continued to increase exponentially at 5,211,111. The use of the digital platforms like social media has never been as ubiquitous as during this pandemic while publications were still produced and circulated. Some 301 IEC materials were developed, 232 were produced and disseminated to 2,888 users during conduct of 694 promotion activities. Among these included 181 syndicated press releases of which 485 were published (print, online); 260 radio/TV interviews/guestings, 2 issues of Techno Bulletin, 10 Miscellanews, and 17 Flashnews.



Social Media Metrics (DOST ITDI Updates)



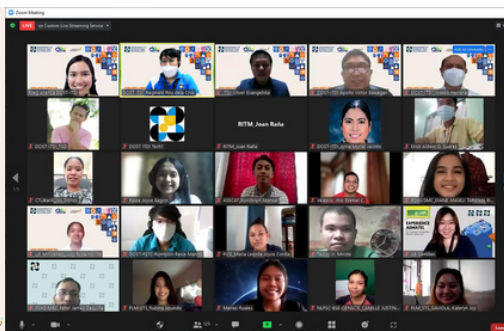
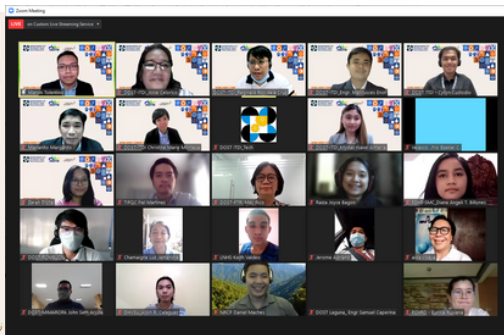
In compliance with FOI, a total of 2,632 emails were processed and attended to diligently while ITDI R&D terminal reports and manuals were also registered with IP, 38 for copyright and 26 for ISBN.

The use of the social media or digital platform has been continually improving DOST-ITDI's presence online and steadily contributing to increasing engagements to various stakeholders; showing substantial increment as against the targets. Particularly this pandemic, it has enabled the institute to continue delivering its mandate and serve its public especially the MSMEs. With constraints on face-to-face transactions, the institute capitalized on livestreams, virtual tours, webinars, and online technology videos.

In 2021, total social media metrics for ITDI registered as: Likes: 30,150; Reach: 2,664,644; Engagement: 162,224; Impressions: 3,133,121; and Posts: 556.

In addition, 34 virtual events were pursued; participating in some, while facilitating, conducting, and covering/documenting others; among which were the following:

- 13 webinars
- VIP-Balik Scientists' courtesy call to Sec FTP
- VIP webinar series-15 sessions
- Fora with various stakeholders
- Halal webinar series
- Technology pitching/offerings
- FGDs, *Pagtatasa sa TNS*



4 launching (facilities, TNS)

- VIP BSL-2+ Laboratory (Biosafety Level-2+ Laboratory)
- Metrology in Chemistry, NML
- Simulated Packaging Technology Laboratory (SPTL) and Green Packaging Laboratory (GPL), PTD
- *TekNegoShow* Special Edition

5 virtual exhibits

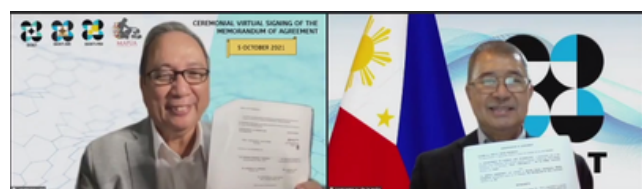
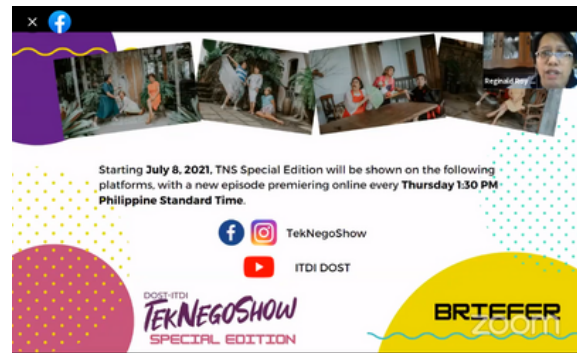
- NSTW – ITDI 2021 virtual exhibit (MMIC, MATDEV, MiC, Halal Food R&D facilities)
- NSTW DOST Region 1 (RTE Arroz Caldo, Emergency Disinfection System, EFR Sagip Nutriflour)
- Taiwan Innotech Expo (CED – Power backup system for large equipment)
- TAPI – SM Nationwide S&T Promotion and Exhibits in SM Supermalls (RTE tablea drink/cacao roaster, i-Salt iodization machine, nipa sap alternative sugar, abaca fiber-reinforced composite)
- IFEX 2021 (CITEM/PCIEERD – Halal chicken, banana, and baked products; FIC technologies; gourmet salt)

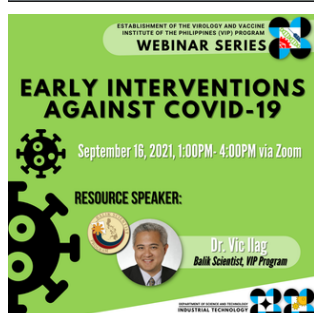
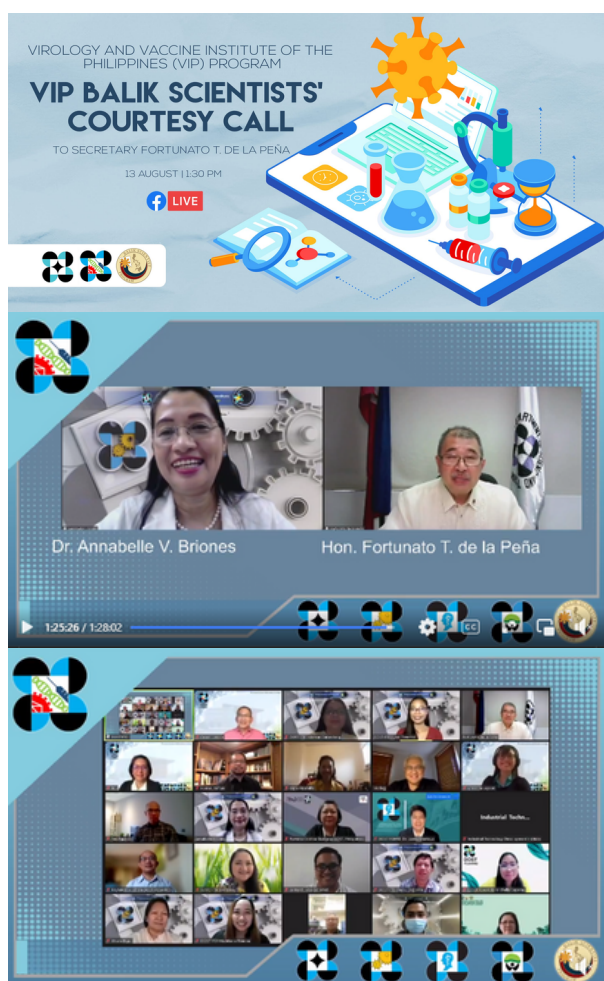
5 physical/virtual study tours

- PNP (Philippine National Police) Directorate
- College of Saint Benilde faculty
- MiC (360 Virtual Tour)
- TASK (Technology Advice and Solutions from Korea for the Food Processing Sector Program)-assisted firms
- NSTW virtual tour of facilities

4 MOA signing

- DOST-Mapua University for the PhD in Material Science with specialization in Nanotechnology by Research Program
- ITDI-ASTI-PDEA (Philippine Drug Enforcement Agency) for IDAS (Intelligent Data Analysis System) launching
- ITDI-CSU (Cagayan State University) on E-trike
- ITDI-AESE CNA



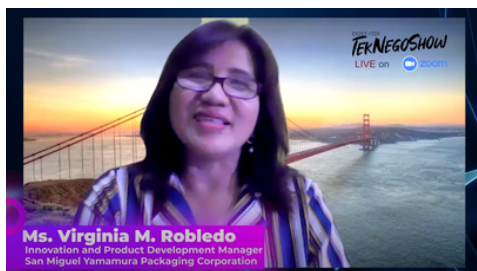


TekNegoShow

These KT initiatives were further complimented with the production and streaming of the *TekNegoShow* or TNS Special Edition, a sequel to TNS Season 1 in 2020. TNS enabled ITDI to keep on being in touch with its clients and still communicate its various technologies and services. TNS Special Edition is part of TSD's project – *"DOST-ITDI Strategic Communication Portfolio for Enhanced Promotion and Technology Transfer"* funded by DOST-GIA and monitored by PCIEERD that was implemented in 2020 and completed in August 2021. This edition comprised of six episodes and focused more on advanced technologies/facilities which included: MMIC, AMCen-MATDEV, Nanoclay, Abaca Fiber-reinforced Composite, Biodegradable Plastics, and I-Salt.

A total of 32 partnerships (1 and 1/2 years duration) were clinched with various clients from industry, academe, DOST regional offices and other government agencies which helped implement production of the show, with some serving as resource persons.

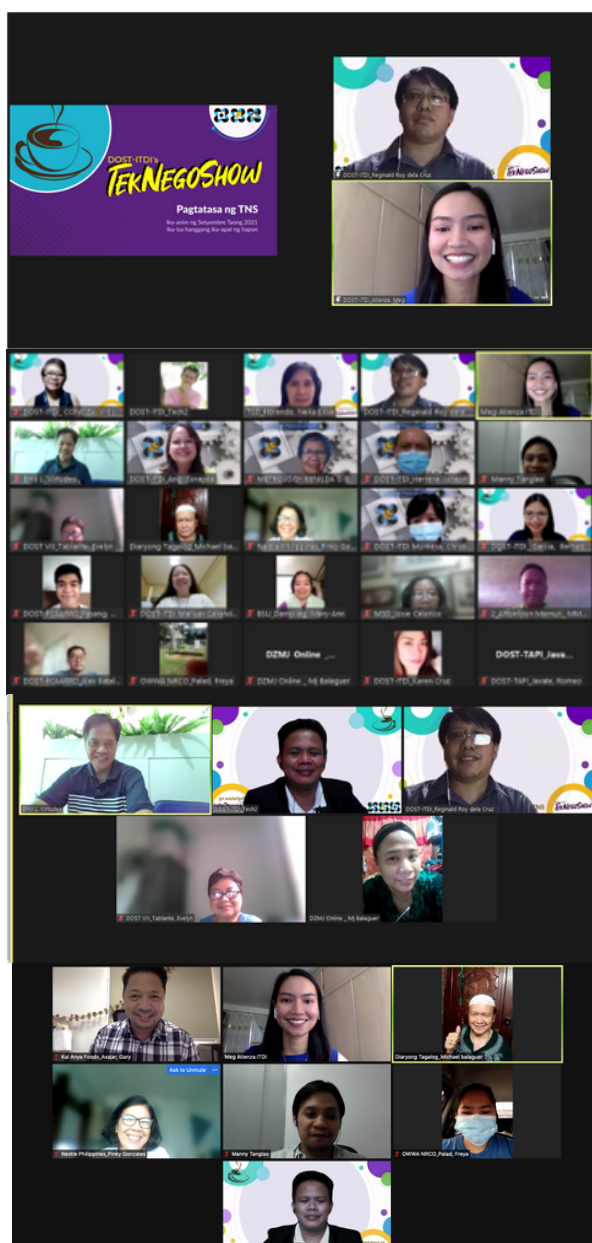
Leads on possible technology adoption (EFR, isotonic drink, VCO/concentrated coco water samples for market testing) were generated. To date, however, the technologies on EFR/SAGIP and VCO had been declared as public good hence, can be acquired free through training. Meanwhile, potential adoption of isotonic drink by two companies is still under negotiation. Net present value of PHP 195,747.67 covering technology transfer fee and royalty fee for a ten year projection per company (or P391,495.34 for both) is estimated to materialize from these transactions. At 85% production of 112,896 pouches per year, each company stands to gain or have a net present value of PHP 1.3M, employing three direct laborers.



Another milestone for TNS is the signing of the DOST-ITDI-PRID (Philippine Registry of Interpreters for the Deaf) Memorandum of Agreement (MOA) that will serve the interest of one sector of the physically challenged, the deaf community. ITDI provides PRID, access to DOST-ITDI's *TekNegoShow* or TNS (TNS 1 and TNS Special Edition) and air or stream the program using their online platform for the benefit of the deaf community. They shall incorporate sign language to facilitate understanding or comprehension to inspire through *TekNegoShow*, the deaf community to learn technologies that can serve as sources of ideas for livelihood generation. It is believed that this initiative can help promote self-esteem and empower the deaf community to be self-sufficient and self-reliable. In the process, DOST-ITDI shall be properly acknowledged or cited.

A follow through project will soon be formalized between ITDI and PRID that will provide livelihood trainings to the community and the incorporation of sign language in ITDI trainings/webinars.

Post surveys and *Pagtatasa* (evaluation) also yielded positive results and recommendations from stakeholders. TNS was rated successful in creating interest and awareness, seen as a good idea/concept in gaining more traction and deeper awareness of ITDI technologies, and was effective in sharing experiences especially with the younger generation. Some saw it as an excellent platform in showcasing ITDI-MSMEs partnership and a good way to promote businesses and the science behind the products, lending integrity and credibility to the products. It was also perceived that TNS managed to show that STI can be good sources of business opportunities which was not the usual reaction of the people. It was recommended that a long term plan (or continuity) for TNS be pursued.



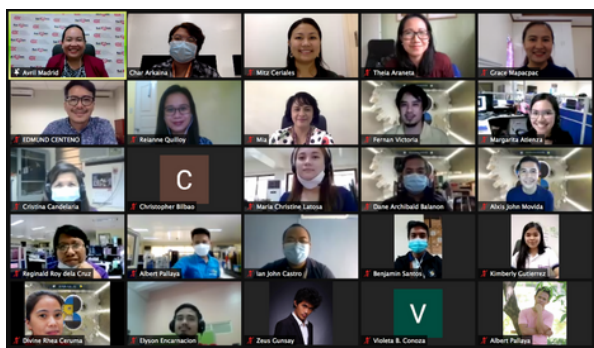
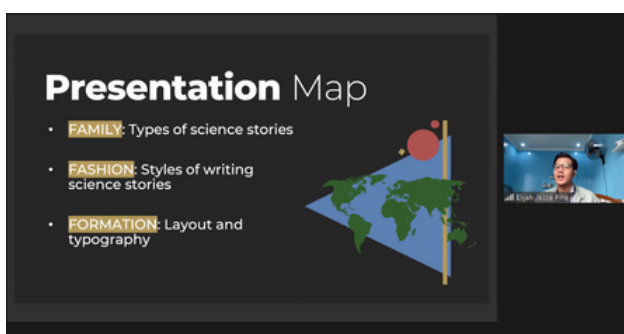
Following are the top performing episodes for TNS 1 and Special Edition in both Facebook and YouTube platforms:

PLATFORM	TNS SEASON 1	TNS SPECIAL EDITION
DOST-ITDI YouTube channel: - Views - Impressions	1. Ginger tea processing 2. Hand sanitizer & alcohol making 3. Emergency food reserve (EFR) 4. VCO processing 5. Isotonic drink 1. Emergency food reserve (EFR) 2. Hand sanitizer & alcohol making 3. Ginger tea processing 4. Reference materials 5. Isotonic drink	1. Abaca fiber-reinforced composite 2. Biodegradable plastics 3. AMCen-MATDEV 1. I-Salt 2. Biodegradable plastics 3. Nanoclay
Facebook - Engagement - Impressions - Reach	1. Taho processing 2. VCO personal care products 3. Pack of Hope 4. Technology transfer Part 2 5. VCO processing 1. Pack of Hope / food safety 2. Technology transfer Part 2 3. Ginger tea processing 4. VCO personal care products 5. Taho processing 1. Pack of Hope / food safety 2. Ginger tea processing 3. Technology transfer Part 2 4. VCO personal care products 5. Reference materials	1. MMIC 2. I-Salt 3. Nanoclay 1. I-Salt 2. MMIC 3. Biodegradable plastics 1. I-Salt 2. MMIC 3. Biodegradable plastics

In addition, the project's 20% target increase of accomplishments on regular programs or activities (tri-media, based on 2019 data) were far exceeded. Press releases went a record high at 354% achievement rate with a total increment of 254%; 259% for radio and television with 159% increment; 232% for digital posters with 132% increment; and 148% for flyers with 48% increment. Two feature stories (ITDI anniversary, July 2020, 2021) were also released in Business Mirror for free.



Furthermore, through this StratComm project, 59 staffs tasked in communicating STI and those in R&D/technical divisions who are more or less involved in communicating/promoting their respective projects and programs were provided training.



TRAINING AND TECHNICAL ASSISTANCE

Amid the current crisis, the institute consistently delivered its training programs whether regular, customized, or regional; employing various modes as webinars, online workshops, blended learning, and face-to-face.

A total of 142 trainings were facilitated and implemented in the areas of calibration, livelihood courses (food and non-food processing), solid waste management technologies (e.g. dual drum composter, bioreactor, portable biogas digester) energy audit, resource efficient and cleaner production (RECP), internal quality audit for PNS ISO/IEC 17025:2017, introductory course on validation of chemical methods of analysis, Halal assurance system and Halal management system, and Halal cosmetics and toiletries.

A total of 12,442 participants coming from MSMEs, LGUs, cooperatives, associations, academe, government offices, and private individuals from different regions of the country participated in these trainings; that generated an income of PHP 903,631.40 for the year.

Additionally, offering of free webinars to the general public was sustained via YouTube. Such offerings included fish processing (dried, fermented, and smoked), vinegar production, hand sanitizer, soap making, and other food and non-food technologies that can be used or applied for livelihood generation amidst the pandemic.

As well, 81 interventions in the form of technical assistance were rendered online to various clients through consultancy, inspection, and assessment on various technologies. These included among others, different food products and processing (EFR, nipa sap sugar, fish products, drinks, root crop based); equipment/facility setup and production training (e.g., spray dryer and related products, salt production and iodization; shelf life facility, VCO); hygiene products; waste disposal and management technologies, wastewater treatment, pyrotechnics, and essential oils and allied products.



Antique Project

Activities for the soft-launched terracotta production facilities in the province of Antique last December 2020 were continued. These included the installation of shuttle-type kiln and repair of facilities for Asosasyon ng Manininhon ng Brgy. Bandoja (AMABBA) at Tibiao; and the installation of gas kiln for University of Antique at Sibalom. ITDI staff were deployed from March to June 2021 to oversee, monitor and inspect the repair of facilities at Tibiao, Antique; and also, to conduct performance tests of the installed equipment. Furthermore, each of the said project beneficiaries to include Manugkoron Cooperative received electric potter's wheel which were also inspected and tested by the ITDI team.



Corporate Social Responsibility

Alongside GAD ideals, the institute through TSD and ADM conducted its CSR (Corporate Social Responsibility) activity at the Correctional Institution for Women. Carrying ITDI's year end assessment and thanksgiving theme "*Siyensya, Teknolohiya at Inobasyon: Kaakibat sa Pagbangon sa Bagong Panahon*" a training through lecture and demo/hands-on on liquid handsoap, hand sanitizer, and dishwashing detergent was conducted for the beneficiaries. There were 42 beneficiaries/trainees identified and pre-selected by CO1 Maricel Berongoy, In-Charge for Work and Livelihood Program of the Correctional Institution for Women. The training can be applied by the women for livelihood generation in consonance with the ideals of the institution.

TECHNOLOGY TRANSFER/TECHNICAL ASSISTANCE AGREEMENTS

In 2021, 13 agreements were forged with various clients for the institute, categorized as follows: five trainings, four technical assistance, one pre-commercialization, and three technology licensing agreements. Of these, eight technologies are for commercialization. From these activities, a total income of PHP 10.9M was collected from licensing and royalty fees. Table 4 is a summary of these agreements.

Table 4. Technology Transfer/Technical Assistance Agreements

TECHNOLOGY / ASSISTANCE	COMPANY	TYPE OF AGREEMENT
1. Vacuum Fried Langka	Bounty Harvest	MOA (Training)
2. Calamansi Processing Plant Set-Up	Campfarms, Inc.	MOA (Assistance)
3. Calamansi Processing Plant Set-Up	Maryland Manufacturing Corp.	MOA (Assistance)
4. Setting up of a Start Up and Operation of a Trickling Filter System for the Removal of Nitrates and Phosphates from Wastewater Effluent	CENMACO	MOA (Assistance)
5. Acetator Kit, Wine Kit, and Ebulliometer	Lozada Machineries Corp.	MOA (Licensing)
6. DFA-TCCP for Livelihood Training Program for Filipinas in Sri Lanka – Ube Powder, Ube Chips, Ube Butterscotch, Ube Halaya, Nata	Filipinas in Sri Lanka through the Philippine Embassy in Sri Lanka	MOA (Training)
7. Pre-Commercialization of Halal Lipstick, Halal Shampoo and Halal Soap	Affection8 Consumer Goods Trading	MOA (Pre-Commercialization)
8. Establishment of an Integrated Coconut Processing Model Facility for VCO, Coconut Flour, Coconut Skim Milk	Poverello Farms	MOA (Assistance)
9. Salt Washer and Salt Iodization Machine Design	NSB Engineering Design & Fabrication Incorporated	TLA (Licensing)
10. Halal Chicken Sausage, Halal Chicken Burger Patty, Halal Chicken Nuggets	Kasama Halal Producers Cooperative	MOA (Training)
11. Training on VF Technologies (Okra, Squash, Mushroom)	Jannah's Food House	MOA (Training)
12. Technology Transfer of Abaca Fiber Composite to Cagayan State University	Cagayan State University	TLA (Licensing)
13. Technical Assistance on Essential Oil Extraction	Onset Cooperation	MOA (Training)

Moreover, 57 support services were conducted to facilitate technology transfer and commercialization through various events such as consultative meetings, technology pitchings, webinars, inspections, technology audit, fairness opinion evaluation participation, technology offerings, and IP management trainings.

In line with the Institute's technology transfer program, two guidelines were approved and implemented this year, namely: 1) Guidelines on the Management, Delivery and Transfer of ITDI Generated Information, Knowledge and Technologies involving Foreign Entities or Parties; and 2) Guidelines on the Conduct of Technology Review and Assessment (TRA) for ITDI Generated Technologies and Intellectual Properties (IPs). Said guideline involves a three-stage process which include: technology audit, market review, and technology and investment readiness level (TRL) assessment. The first stage process, technology audit, was conducted from July to August 2021, covering 34 technologies.

MODERNIZING THE PHILIPPINES' NATIONAL MEASUREMENT SYSTEM

A modernized National Measurement System will provide industries and manufacturers in the Philippines unparalleled local access to world-class measurement services they need to expand and compete in global trade.

**FEBRUARY 16, 2021
9AM-12NN
ZOOM MEETING ROOM**

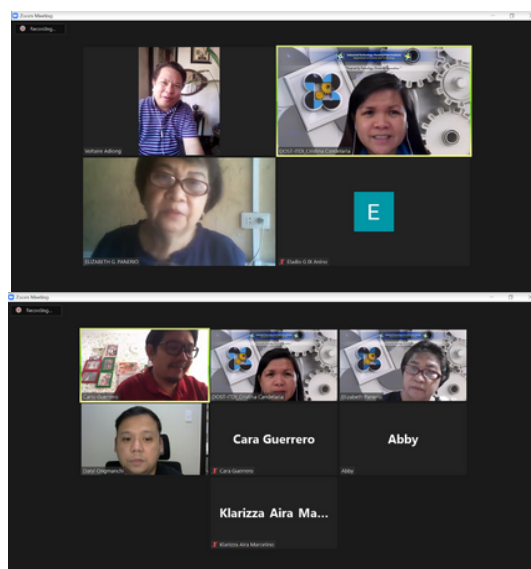
IP APPRECIATION SEMINAR

November 3-4, 2021 | 9:30AM-4:00PM

Program	
9:45 AM	Prayer / National Anthem / About DOST-ITDI (AOP)
9:50 AM	Welcome Remarks Dr. Annabelle V. Solones, Director, DOST-ITDI
9:55 AM	Message Dr. Rosanna Calinao L. Guasada, Undersecretary for R&D, DOST
10:00 AM	Keynote Address Secretary Emmanuel C. de la Peña, DOST
10:05 AM	Event Introduction Ms. Nella C. Pineda, Chief, Technology Services Division (TSD)
10:10 AM	Introduction to the Organization, MSD, ADMATTEL and its services Ms. Josephine S. Delacruz, OIC & Supervising OIS, Materials Science Division (MSD)
10:15 AM	Overview of ADMATTEL Dr. Wilmar A. Baldo, Former Chief, MSD
10:20 AM	Additive Manufacturing and its Application Engr. Maricela C. Margallo, Senior OIS, MSD
10:25 AM	MATDEV Facilities Engr. AJ Arancillo, Science Research Specialist II, MSD
10:30 AM	MATDEV Services Mr. Carlo D. Enrileaga, Senior OIS, MSD
10:35 AM	Virtual Tour of MATDEV Facility
10:40 AM	Plenary Session: Q&A
10:45 AM	Synthesis
10:50 AM	Concluding Remarks Ms. Daisy S. Tanalanka, OIC, Deputy Director for R&D & Chief, Packaging Technology Division (PTD)
10:55 AM	

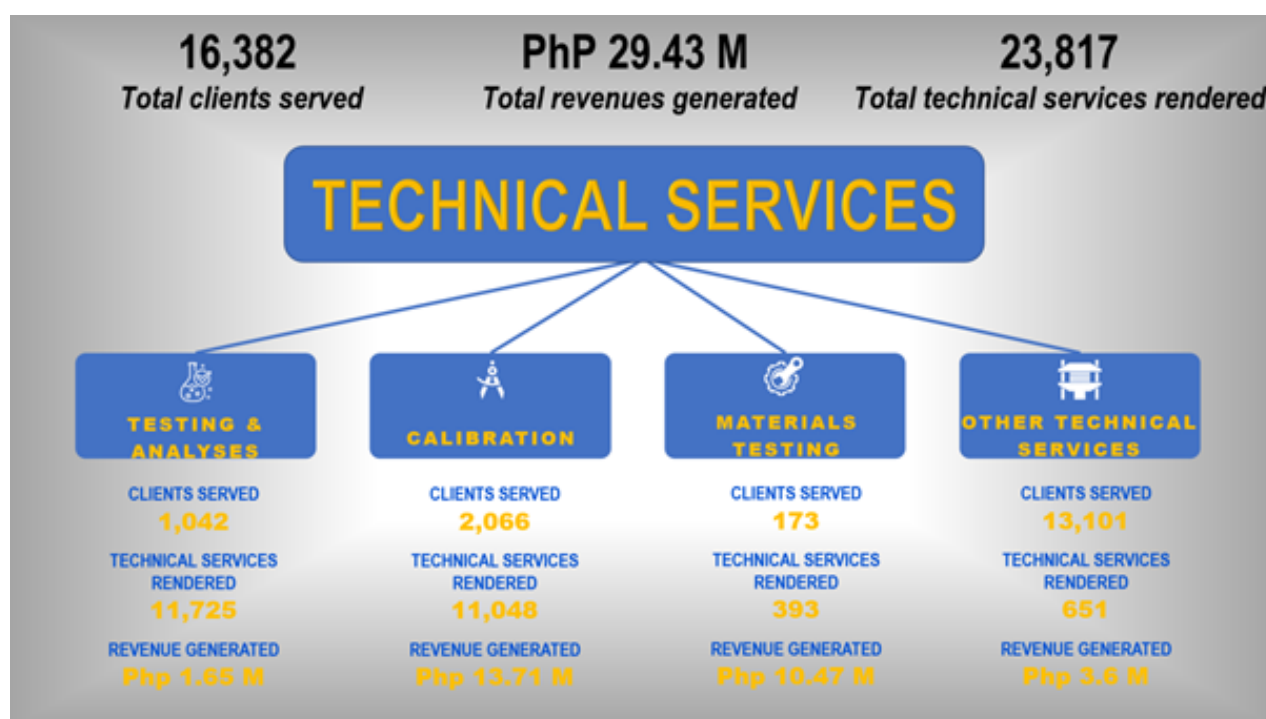
Ms. Marguerite V. Arnesen
Moderator

Inspired by Technology
Driven by Innovation



TECHNICAL SERVICES

DOST-ITDI continuously offers a diverse array of technical services through its state-of-the-art laboratories and facilities helping improve processes and productivity of its various stakeholders from the industry, government, academe, and individuals. A total of 23,817 technical services involving testing & analyses, calibration, materials testing, and R&D services were rendered to 16,382 customers nationwide this year that generated a total revenue of PHP 29.43 million. This revenue however has been markedly reduced by 4.6% compared to last year's PHP 30.86 million.



This year, additional services were offered by DOST-ITDI as follows:

1. Metrology in Chemistry Proficiency Testing Interlaboratory Comparison (PTILC)
2. Metrology in Biology Proficiency Testing Interlaboratory Comparison (PTILC)
3. 2D X-Ray Single Scan/Qualification Scan
4. 2D X-Ray Bulk Scan with Analysis (Subsequent)
5. 2D X-Ray Scan Only (Consequent)
6. Compositional (Elemental Analysis) by Handheld XRF (X-Ray Fluorescence)
7. Sample Preparation: Laser Decapsulation with 2D X-Ray (IC device)

PAPERS PUBLISHED AND PRESENTED

For this year, DOST-ITDI published a total of 11 technical papers in peer-reviewed journals and proceedings, and presented 52 R&D papers in various conferences and technical events.

PUBLICATIONS

***Piper betle* L. Leaf Extracts Inhibit Quorum Sensing of Shrimp Pathogen *Vibrio harveyi* and Protect *Penaeus vannamei* Postlarvae against Bacterial Infection**

J.P.M.D. Guzman, P. Yatip, C. Soowannayan, and M.B.B. Maningas

DOI: 10.1016/j.aquaculture.2021.737452

ABSTRACT

Vibriosis, including the luminescent shrimp disease and acute hepatopancreatic necrosis disease (AHPND), with *Vibrio harveyi* as one of their causative agents, is a major shrimp disease causing huge economic losses in the Philippines, Thailand, Vietnam and other Southeast Asian countries. It is induced through the formation of biofilm as a result of bacterial cell-to-cell communication or quorum sensing (QS). Hence, this mechanism may be used as a target for bioactive compounds in controlling *V. harveyi* infections in shrimp. In this study, crude ethanolic extract (CE) and crude alkaloids (CA) from Ikmo (*Piper betle* L.), a plant native to Southeast Asia, were observed to significantly ($p < 0.05$) inhibit biofilm formation of wild-type strains *V. harveyi* VH0, VH1 and BAA-1116 in chitosan-coated microtiter plates without inhibiting their growth.

Confocal laser scanning microscopy revealed thinner biofilms formed upon treatment with both extracts. Furthermore, both CE and CA significantly ($p < 0.05$) inhibited bioluminescence in QS reference strain *V. harveyi* BAA-1116 and was found to interfere with QS by modulating autoinducer (AI) activities as observed in both phenotypic and gene expression analyses. Both extracts also did not negatively affect shrimp growth and pre-infection mortality rate. Despite the in vitro results however, in vivo analysis showed that only *P. betle* CE, when supplemented to shrimp feed, protected *Penaeus vannamei* post larvae against *V. harveyi* infection after seven days. These suggest the potential supplementation of shrimp feed with *P. betle* crude extract as protection against vibriosis.

Powder Loading Effects on the Physicochemical and Mechanical Properties of 3D Printed Polylactic Acid/Hydroxyapatite Biocomposites

C.L. Custodio, P.J.M. Broñola, S.R. Cayabyab, V.U. Lagura, J.R. Celorico, and B.A. Basilia

DOI: 10.18063/ijb.v7i1.326

ABSTRACT

This study presents the physicochemical and mechanical behavior of incorporating hydroxyapatite (HAp) with polylactic acid (PLA) matrix in 3D printed PLA/HAp composite materials. Effects of powder loading to the composition, crystallinity, morphology, and mechanical properties were observed. HAp was synthesized from locally sourced nanoprecipitated calcium carbonate and served as the filler for the PLA matrix. The 0, 5, 10, and 15 wt. % HAp biocomposite filaments were formed using a twin-screw extruder. The resulting filaments were 3D printed in an Ultimaker S5 machine utilizing a fused deposition modeling technology. Successful incorporation of

HAp and PLA was observed using infrared spectroscopy and X-ray diffraction (XRD). The mechanical properties of pure PLA improved with the incorporation of 15% HAp; from 32.7 to 47.3 MPa in terms of tensile strength; and 2.3 to 3.5 GPa for stiffness. Moreover, the preliminary in vitro bioactivity test of the 3D printed PLA/HAp biocomposite samples in simulated body fluid (SBF) indicated varying weight gains and the presence of apatite species' XRD peaks. The HAp particles embedded in the PLA matrix acted as nucleation sites for the deposition of salts and apatite species from the SBF solution.

Properties of Styrene-Ethylene-Eutylene Styrene Block Copolymer/Exfoliated Graphite Nanoplatelets Nanocomposites

M.A. Paglicawan and J.R. Celorico

<https://doi.org/10.1177/0967391121991290>

ABSTRACT

Three different types of styrene-ethylene-butylene-styrene block copolymer (SEBS) with varying ratios of styrene and rubber were melt-compounded with exfoliated graphite nanoplatelets at different loadings. The morphological, thermal, and mechanical properties of the nanocomposites were studied and compared. Morphological observation under SEM and AFM found that the xGnPs were dispersed at the sub-micron level throughout the SEBS matrix. Good interfacial adhesion between the xGnPs and the matrix was also observed. However, the behavior of dispersion was dependent on the styrene/rubber content. SEBS with higher styrene

content showed better dispersion and strong interfacial adhesion between the xGnPs and SEBS matrix. These results contributed to the enhancement of the tensile strength of the nanocomposites. Low styrene content behaved like rubber that resulted in low tensile strength but higher elongation compared to SEBS of different amounts of styrene. The XRD patterns indicated that the melt compounding process did not change the d-spacing of xGnPs in all types of SEBS. From the thermal analysis, there was no change in the glass transition of the polymer and no improvement in the thermal stability of the nanocomposites.

Synthesis and Characterization of Electrospun Carbon Quantum Dots – Polyacrylonitrile/Polycaprolactone Composite Nanofiber Membranes for Copper (II) Adsorption

C.M.P. Mabborang, J.N.B. Padrido, G.M.O. Quiachon, and P.A.N. de Yro

<https://doi.org/10.4028/www.scientific.net/KEM.878.3>

ABSTRACT

Polyacrylonitrile / Polycaprolactone nanocomposite membranes are synthesized by electrospinning which is intended for HMA of Cu²⁺. The nanofiber mats were characterized using SEM, FTIR, and Contact Angle. Batch adsorption process were performed and to utilize the AAS for kinetic adsorption behavior analysis. SEM micrographs revealed the addition of CQD in PAN and PAN/PCL membrane matrix shifted the fiber size distribution from 50–100 nm to 150–250 nm indicates the decrease in effective surface area. FTIR analysis exhibited vibrational peaks and binding of distinct functional groups such as amine, nitrile, carboxylic, hydroxyl, and carbonyl for CQD, PAN and PCL, respectively. CQD in aqueous form further increases

the hydrophilicity of PAN/PCL membrane matrix which is essential for HMA of Cu²⁺ ions. The increase of nanofiber mat's adsorption capacity with respect to contact time obtained a maximum at 63.45 mg/g with a maximum efficiency of adsorption at 90.74%. Kinetic adsorption studies show that the pseudo-first order kinetic model best fits the data for CQD – PAN/PCL nanofiber mat in Cu²⁺ ions obtaining a correlation value of R² = 0.9418 and a rate constant k = 0.0172 min⁻¹ indicating the adsorption behavior follows the physical adsorption process involving Van der Waals forces and hydrogen bonding between the adsorbent and adsorbate.

Characteristics and Performance of PTU-Cu Composite Membrane Fabricated through Simultaneous Complexation and Non-Solvent Induced Phase Separation

M.T. Margarito, A.B. Beltran, and A. Huelgas-Orbecido

DOI: 10.3390/polym13111743

ABSTRACT

This study aims to integrate copper (Cu) during membrane formation by a facile simultaneous phase separation process to alleviate biofouling and improve membrane performance. Polythiourea (PTU) polymer synthesized through condensation polymerization of 4,4-oxydianiline and p-phenylene diisothiocyanate in dimethyl sulfoxide was used in the preparation of dope solution. By incorporating different concentrations of cupric acetate in the non-solvent bath, both non-solvent induced phase separation and complexation induced phase separation occur instantaneously. Scanning electron microscopy-energy dispersive X-ray, Fourier-transform infrared spectroscopy and time-of-flight

secondary ion mass spectroscopy analysis accompanied by color change of the membrane surfaces-confirms the interaction of the polymer with Cu. Interaction of Cu at the interface during membrane formation results in a decrease in contact angle from 2 to 10° and a decrease in surface roughness from 30% to 52% as measured by atomic force microscope analysis. Pure water flux of PTU-Cu membrane increased by a factor of 3 to 17 relative to pristine PTU membrane. Both the pristine PTU and PTU-Cu membrane showed antibacterial characteristics against *E. coli*.

Effect on Thermal Stability of Microstructure and Morphology of Thermally-modified Electrospun Fibers of Polybenzoxazines (PBz) Blended with Sulfur Copolymers (SDIB)

R.P. Parreño, Y. Liu, and A.B. Beltran

DOI: 10.1039/D1RA00705J

ABSTRACT

Simple modification by thermal treatment is the commonly used approach to enhance the performance of electrospun fibers. This was investigated in the thermal treatment of polybenzoxazine (PBz) fibers blended with sulfur copolymers (SDIB) to determine the effect of varying treatment conditions on the microstructure and morphology of PBz fibers with the effect of incorporating sulfur functional groups on resulting properties. Mechanical properties of PBz are greatly improved by thermally-induced ring-opening polymerization (ROP) of the oxazine ring. Blending with sulfur copolymers (SDIB) could have beneficial effects on endowed features on fibers but could also affect the resulting properties of SDIB-blended PBz fibers during crosslinking reactions. Fiber mats were fabricated by electrospinning of PBz (10 wt%) blended with SDIB (10 wt%). Physical modification with varying conditions of sequential thermal treatment were evaluated and compared to the conditions applied on pristine PBz fibers. Changes in morphology and microstructure of fibers after modification were analyzed through scanning electron microscopy (SEM)

while elemental compositions were identified after varying the conditions of thermal treatment. Adjustment of treatment conditions using two-step temperature sequential thermal treatment with higher temperatures of 160 °C and 240 °C showed significant changes in microstructure and morphology of fibers. Lower temperatures of 120 °C and 160 °C exhibited microstructure and morphology of fibers which affected the fiber diameter and fiber networks. Cross-sectional SEM images also confirmed the adverse effect of high-temperature treatment conditions on fibrous structures while low-temperature treatment retained the fibrous structures with more compact and stiff fiber networks. SDIB-blended PBz fibers were also evaluated by TGA and DSC to correlate the changes in structure and morphology with the thermal stability and integrity of blended SDIB/PBz fibers as compared to pristine PBz with the effect of change in treatment conditions. Fiber strength indicated slower weight loss for blended fibers and higher onset temperature of degradation which resulted in more thermally stable fibers.

Effect of Modified Cassava Starch in Reduced-fat Mayonnaise by Correlating Emulsion Stability with Anti-oxidation Reaction Using Gas Chromatography–Mass Spectrometry (GC-MS)

R.P. Parreño and M.B. Carandang

Philippine Journal of Science 150 (4): 753-763, August 2021 ISSN 0031 - 7683

ABSTRACT

Modified starches are essential firming additives in many food processes as they act as emulsion stabilizers. Presently, they are produced mostly from corn and potatoes, but cassava is a good alternative source to augment the rising global demand for starch. In this work, cassava starch from a native variety called *Manihot esculenta* Crantz, modified by facile heat-moisture treatment (HMT) method was used in reduced-fat mayonnaise to retain product consistency and texture but, more importantly, to contribute to the stabilizing effect of emulsions. Varying amounts of modified cassava starch in mayonnaise formulation were evaluated to correlate emulsion stability with a reduction in the amount of oil and the presence of anti-oxidation compounds that slow down chemical processes. The anti-oxidation process resulting from starch composition in the emulsion was measured by an analytical method using the combined gas chromatography and mass spectrometry (GC-MS). Twenty-two complete factorial experiments were conducted in determining the significant effects and interactions between the amount of modified starch and oil.

Correlations of these two factors with resulting stability as response variables were analyzed. Two-way ANOVA showed significant relationships in emulsion stability as directly proportional to the amount of oil in the emulsion as well as the modified starch. The results confirmed that individual factors both influenced the slowing down of emulsion breakdown of mayonnaise. However, it also revealed that modified starch had a greater influence on the concentration of acetic acid as an antioxidant than the effect of oil on the emulsion stability. Thus, this study confirmed that increasing the amount of modified cassava starch correlates to a significant occurrence of anti-oxidation reaction in reduced-fat mayonnaise. The combination of 0.60 wt% modified starch with 50 wt % oil achieved a higher stabilizing effect on emulsions as compared to other combinations. The results proved that predictive analysis of the capacity to prevent the auto-oxidation process is one way of predicting the long-term stability of the mayonnaise after 24 h.

Superhydrophobic μ -Pillars via Simple and Scalable SLA 3D Printing: The Stair-case Effect and their Wetting Models

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DOI:10.1039/D1SM00655J

ABSTRACT

In nature, superhydrophobic surfaces (SHSs) exhibit microstructures with several roughness scales. Scalable fabrication and build-up along the X-Y plane represent the promise of 3D printing technology. Herein reported are 3D printed microstructures with a dual roughness scale that achieves SHS using a readily available Formlabs stereolithography (SLA) printer. Pillar-like structure (PLS) arrangements with a wide range of geometrical shapes were 3D printed at three resolutions and two printing orientations. It was discovered that a tilted printing direction enables a staircase pattern on the μ -PLS surfaces, conferring them a μ -roughness that reduces the

solid-liquid contact area. The programmed resolution governs the number of polymerized layers that give rise to the stepped pattern on the μ -PLS surfaces. However, this is reduced as the printing resolution increases. Also, all samples' experimental contact angles were consistent with theoretical predictions from Cassie-Baxter, Wenzel, and Nagayama wettability models. The underlying mechanisms and governing parameters were also discussed. It is believed that this work will enable scalable and high throughput roughness design in augmenting future 3D printing object applications.

Investigating the Mechanical Behavior of 3D Printed PLA-Coco Coir Composites

P.E.C. Maglalang, B.A. Basilia, and A.M. Monsada

<https://doi.org/10.4028/www.scientific.net/msf.1046.125>.

ABSTRACT

It is quite amazing that the use of 3D printing techniques, especially the Fused Deposition Modelling (FDM) has delivered such significance in terms of cost reduction, time saver features where a different variety of thermoplastic and composite materials (Biodegradable and Non-biodegradable) are well developed. Different sectors have continually developed natural organic materials that are also both structurally composite in nature. Similarly, the use of different fibers that are abundantly accessible and considered as renewable resources which can be optionally combined with other biodegradable materials is a great challenge through the use of the FDM printing method. The study aims to determine the effect of different particle size and raster angle at a certain fiber concentration which could affect the mechanical properties of the composite by developing a printable composite filament made of Polylactic Acid

(PLA) and Coco Coir materials using a filament maker and FDM printer. The composite filament was fabricated and optimized using a twin-screw extruder and 3D Devo Filament maker. 3D printing of samples for mechanical testing was conducted using three (3) raster angles (45°, 60°, and 75°) and various particle sizes of coco coir fiber reinforcement in the PLA matrix. Results showed that the < 74µm particle size of the coco-coir exhibited a 24% and 175% increase in tensile strength and izod impact strength compared to the pure PLA at 60° and 75° raster angles, respectively. Likewise, the reinforcement of <149µm particle size coco coir at 45° raster angle contributes to an increase of 4.8% flexural and 176% compressive strength compared to pure PLA. The study concludes that the mechanical properties of the PLA-Coco Coir composite is improved at a certain particle size and raster angle in 3D printing.

PAPERS/POSTERS PRESENTED

Table 3. Paper/poster presented at convention/conferences

TITLE OF PAPER PRESENTED	CONFERENCE/EVENT
Molecular and Morphometric Characteristics of <i>Zea mays</i> Derived Xylanase-Producing Fungi: Comparison of Internal Transcribed Spacer (ITS) with Homologous Clinical Isolates (Oral Presentation)	4th International Conference on Research Trends in Bioengineering (MITBIO ICRTB 2021)
Emergency Disinfection System: Contaminated to Potable Water	17th International Agricultural Engineering Conference and the 70th PSABE Annual National Convention
Effect of Storage Conditions on the Migration Characteristics of Benzophenone in Paper-based Food Packaging	1st International Conference on Engineering, Social and Humanities
Chemical Characterization of Tephra Particles from January 2020 Eruption of Taal Volcano, Philippines	IUPAC CCCE 2021 - 104th Canadian Chemistry Conference and Exhibition
Data Acquisition of Shock and Vibration Values in the Last Leg Delivery (Motorcycle and Closed Van) of Small Products within Metro Manila	7th APN International Packaging Symposium
Evaluation of Acetaldehyde Content in Different Brands of PET-Bottled Drinking Water in the Philippines	7th APN International Packaging Symposium
Development of Polyamide/Polysulfone Thin Film Composites with Copper-treated Zeolites as Additives for Enhanced Hydrophilicity	2021 The 6th International Conference on Smart Materials Technologies
Synthesis and Characterization of PSf-CQD Nanocomposite Membrane via Non-Solvent Induced Phase Separation Technique	2021 The 6th International Conference on Smart Materials Technologies
Establishment of Metrological Traceability of Nanomaterial Size Measurement in the Philippines through the Conduct of a Local Interlaboratory Comparison Using Polystyrene Nanosphere Standards	NanoThailand 2021
Mock Proficiency Test (PT) Scheme for Aerobic Plate Count in Flour: A Pilot Study for the Establishment of Food Microbiological PT Schemes in the Philippines	PSM 50: 50th Annual Convention and Scientific Meeting and 8th Asia Pacific Biotechnology Congress
Application of Dextran and Concentrated Fructose from <i>Weissella cibaria</i> to Halal Soft Breads, Gelato, and Ready-To-Drink Calamansi Juice	PSM 50: 50th Annual Convention and Scientific Meeting and 8th Asia Pacific Biotechnology Congress
Development of Loop-Mediated Isothermal Amplification (LAMP) Assay for Rapid Detection of Pathogenic and Non-pathogenic <i>Escherichia coli</i> Isolates	PSM 50: 50th Annual Convention and Scientific Meeting and 8th Asia Pacific Biotechnology Congress

Table 3. Paper/poster presented at convention/conferences (continued)

TITLE OF PAPER PRESENTED	CONFERENCE/EVENT
Effect of Particle Size, Raster Angle and Chemical Treatment on the Mechanical Properties of PLA-Coco Coir Composites	2021 ASEAN Conference on Additive Manufacturing
Additive Manufacturing of Polyetheretherketone (PEEK) and its Application in Medical Implants	2021 ASEAN Conference on Additive Manufacturing
The Effects of 3D Printing Parameters on Mechanical Properties of 3D Printed Burley and Native Tobacco PLA Composites Using X-Ray Tomography	2021 ASEAN Conference on Additive Manufacturing
A Review of Utilizing Geopolymer on the Advancement of the Construction Industry in Additive Manufacturing	2021 ASEAN Conference on Additive Manufacturing
From PET Bottles to 3D Printing Filament Nanocomposites Selective Laser Melting of Aluminum Alloys Based on Pre-alloyed and In-situ Alloyed Powder Feedstock: A Review	2021 ASEAN Conference on Additive Manufacturing
Influence of Powder Loading on the Physicochemical Mechanical and Printability in Extrusion-based 3D Printing of Polypropylene/ Nano Precipitated Calcium Carbonate	2021 ASEAN Conference on Additive Manufacturing
Understanding the Thermo-mechanical Behavior of 3D Printed Al ₂ O ₃ Reinforced Polylactic Acid Nanocomposite	2021 ASEAN Conference on Additive Manufacturing
Carbon Fiber-Polyamide 3D Printed Metal-Free Electric Motor	2021 ASEAN Conference on Additive Manufacturing
Effect of Different Fiber Loading on Mechanical, Morphological, and Thermal Properties of Glass Fiber/Polypropylene Composite Filament for Fused Deposition Modeling	2021 ASEAN Conference on Additive Manufacturing
Void Content Measurement of the 3D Printed PEEK Materials by X-ray Micro Computed Tomography	2021 ASEAN Conference on Additive Manufacturing
Influence of Philippine Halloysite on Thermal and Mechanical Properties of Polylactic acid Filament for FDM 3D Printing Applications	2021 ASEAN Conference on Additive Manufacturing
Assessment of Microstructural and Mechanical Properties of 420 Stainless Steel Fabricated by Laser Powder Bed Fusion	2021 ASEAN Conference on Additive Manufacturing
Post-Treatment of Food Processing Wastewater Effluent for Nutrient Removal	NAST Scientific Poster Sessions
Risk Assessment and Nanosafety Initiatives in the Philippines	NSA Comm: Forum on Nanosafety for Lab to Society

Table 3. Paper/poster presented at convention/conferences (continued)

TITLE OF PAPER PRESENTED	CONFERENCE/EVENT
Metrological Traceability of Nanomaterial Size Measurement in the Philippines through the Conduct of a Local Interlaboratory Comparison Using Polystyrene Nanospheres	Nanometrology Conference 2021
Halal-Compliant Personal Care Products: Promoting Health and Hygiene Amidst COVID-19	Metro Manila Health Research and Development Consortium
Emergency Water Disinfection System	NAST Annual Scientific Meeting
Applicability of External Calibration with Bracketing Using ICP-MS and HVG-AAS for Arsenic in Drinking Water Proficiency Testing Studies	70th Philippine Association for the Advancement of Science and Technology (PhilAAST) Annual Convention
Overview of the Phytochemical, Pharmacological, and Toxicological Properties of <i>Citrofortunella microcarpa</i> (Rutaceae) Plant as Therapeutic or Preventive Measure in Response to Current and Future Pandemics	70th Annual PhilAAST Convention
Revisiting the Phytochemical, Pharmacological, and Toxicological Screening of <i>Origanum vulgare</i> (Lamiaceae) as a Medicinal Plant to Combat Future Pandemics	70th Annual PhilAAST Convention
DOST-ITDI Survey Results on Testing Needs of Filipinos During the Pandemic	70th Annual PhilAAST Convention
Bench-scale Production of Halal-compliant Personal Care Products: Addressing COVID-19 Through Personal Hygiene	70th Annual PhilAAST Convention
Alcohol-based Hand Sanitizers Amid COVID-19: Profiling of Commercially-available Isopropyl Alcohol	70th Annual PhilAAST Convention
Immunity Boosters Amid COVID-19 Pandemic: Evaluation of Vitamin C Content in Fresh Fruits and Fruit-flavored Drinks Using HPLC	70th Annual PhilAAST Convention
VCO Based Products for Hair and Skin Care and Their Antimicrobial Properties	70th Annual PhilAAST Convention
Phytochemical Screening and Antioxidant Activities of Philippine <i>Beta vulgaris</i> , <i>Clitoria ternatea</i> , and <i>Hylocereus polyrhizus</i> Ethanolic Extracts	70th Annual PhilAAST Convention
Oxidized Starch Nanocrystals as Potential Antimicrobial Agents	70th Annual PhilAAST Convention
Advanced Manufacturing Center - Materials Development Laboratory (AMCen-MATDEV) Initiative in Response to COVID-19 Through 3D Printing Technology	70th Annual PhilAAST Convention

Table 3. Paper/poster presented at convention/conferences (continued)

TITLE OF PAPER PRESENTED	CONFERENCE/EVENT
Iron Modified Nanozeolite Sorbent for Ceramic Water Filter	70th Annual PhilAAST Convention
Validation of Photometric Titration Methods for the Assignment of Certified Concentrations of Lead, Cadmium, and Zinc in Standard Solutions	35th Philippine Chemistry Congress (PCC)
Reference Material Production and Characterization of Arsenic in Drinking Water for Proficiency Testing Studies	35th Philippine Chemistry Congress (PCC)
A Comparative Study on the Method Development and Validation for the Determination of Chlorpyrifos in Philippine Mango in Gas Chromatography-Nitrogen Phosphorus Detector (GC-NPD) and Gas Chromatography-Isotope Dilution Mass Spectrometry (GCIDMS)	35th Philippine Chemistry Congress (PCC)
Performance Evaluation for Using Mass Balance Approach for the Determination of Water, Residual Organic Solvent and Total Non-volatiles in Organic Compounds in the ASEAN Reference Material Network Interlaboratory Comparison	35th Philippine Chemistry Congress (PCC)
Bench-scale Production of Curcumin from Philippine Turmeric Using Different Extraction Methods	82nd Philippine Institute of Chemical Engineers (PIChE) National Convention
Differential Scanning Calorimetry Techniques: Applications in Environment, Energy and Food System Sustainability	82nd PIChE National Convention
IDAS, An Intelligent Solution for Industry 4.0	82nd PIChE National Convention
Accuracy and Repeatability of Linear Measurements Using the Field Emission Scanning Electron Microscope (FE-SEM) Built-in Measurement Tool for Nanomaterials and Nano-enabled Products	82nd PIChE National Convention
Abaca Fiber for the Construction of Boats	Conduct of Briefing and Institutional Support Mechanism Workshops on the provisions of MC No. 2016-02 "Revised Rules on the Phase-Out of Wooden Hulled Ships carrying passengers in Domestic Shipping"

LOCAL AND INTERNATIONAL CONFERENCE



DOST-ITDI Hosts Hybrid International Conference on Additive Manufacturing 2021 and Winnovation Techfest

The DOST-Industrial Technology Development Institute (DOST-ITDI) in cooperation with the Department of Science and Technology, Philippine Association of Microscopists (Microsphil), and DOST-Metals Industry Research Center (DOST-MIRDC) made history by hosting the 2021 ASEAN Conference on Additive Manufacturing (ACAM 2021), a hybrid international conference held amidst the pandemic, at the Dusit Thani Hotel Manila last October 28-29, 2021. This hybrid conference is part of the President's Philippine Development Plan (PDP) 2017-2022 and Ambisyon 2040, and is funded through the Office of the President and the Department of Foreign Affairs.

The 2021 ASEAN Conference on Additive Manufacturing with the theme *"3D Printing: Revolutionizing the Manufacturing Industry"* brought together students, experts, enthusiasts and additive manufacturing stakeholders in the ASEAN region and the world for possible collaboration and sharing of knowledge on advances in research, materials, prototyping and application of Additive Manufacturing including COVID-19 responses of the 3D printing community.

The two-day conference featured high caliber lectures from notable experts in additive manufacturing from Singapore, United States of America, Canada, and Mexico. It was also at the conference where winners of the Winnovation Contest were recognized for their exemplary and innovative designs in the industrial/functional and aesthetics and novel objects category using 3D printing technology.

As well, the ACAM participants witnessed how additive manufacturing is revolutionizing the industry with leading-edge advances in the use of high-performance polymers, metals, and other new materials for applications in food, medicine, and various industries.

The distinguished speakers included Dr. Rigoberto C. Advincula, Research Professor at Case Western Reserve University and the University of Tennessee, as well as Group Leader at Oak Ridge National Laboratory and Editor-in-Chief of MRS Communications, who discussed about high performance polymers and nanostructured materials in 3D printing; Dr. Chee Kai Chua of Singapore University of Technology and Design, who shared his experiences on 3D food printing and additive manufacturing standards development in Singapore; Dr. Clodualdo Aranas Jr. of University of New Brunswick, Canada, who

discussed the physical and mechanical metallurgy of new commercial alloys designed for additive manufacturing; and Dr. Rafael Bundoc of the Philippine General Hospital, who presented his work and the promise of 3D printing for biomedical applications.

Dr. Blessie A. Basilia, RD Leader of AMCent-MATDEV, also gave a lecture on Additive Manufacturing Standards in the Philippines along with the other speakers who talked about AM Standards in their countries, and Dr. Alex Liu, Head of Additive Manufacturing Programs – APAC Region of ASTM International.

The Best Presentors for the Parallel Sessions and the Poster Session were also recognized during the event. Harveen Bongao of MAPUA University and Lora Jose Hernandez of UP Diliman were awarded as Best Oral Presentors for Parallel Sessions A and B, respectively, while Mark Anthony Agbayani of ITDI's MATDEV was chosen as the Best Poster Presentor.

Likewise, the most ingenious and creative entries for the 3D Printing Winnovation Techfest were recognized during the Closing Ceremonies of ACAM 2021. The grand prize for

the Industrial Category was awarded to Engr. Jason Pechardo of MedEco from UP Diliman for the *"3D Printed Metered-Dose Inhaler (MDI) Adapter for Ventilator as Emergency COVID Response"*, an indigenous 3D printed MDI for local hospitals especially during the time of pandemic, while the grand prize for the Aesthetics Category was given to designer Christian Noel Lim Chua for the *Fully Articulated Robot Action Figure Collectible Toy, "Sentinel"*, an original design, fully 3D printed in parts, and is super poseable.

People's Choice Awards were also given to the *"Ilawá Fishing Buoy"* by Dr. Drandreb Earl Oracion Juanico of the Technological Institute of the Philippines and the *"Customized Protective Personal Equipment (PPE) Add-ons"* by Dr. Mark Christian Manuel of the Mapua University. The *Ilawá Fishing Buoy* is a self-powered fishing buoy with a water-activated metal-air battery as its payload, a submerged fish lure, and an indicator night light while the customized PPE add-ons featured an original p100 particulate filter cover design that was meant to be lightweight, fully functional, but at the same time has a large area for making customizations (names, graphics, etc.).



INTELLECTUAL PROPERTIES

In 2021, DOST-ITDI has been granted approval of nine intellectual properties (IP) for its various developed technologies while 14 IP applications for patents, utility models, and trademarks were filed.

GRANTED

TITLE OF IP	TYPE OF IP	REGISTRY NUMBER
1. Continuous Screw-Type Salt Washer	Patent	1/2019/000386
2. CrispyTech Solutions	Trademark	4/2020/00511760
3. Kalamansi Fresh	Trademark	4/2019/00017654
4. QualiRub	Trademark	42020515011
5. Standardized Process of Formulating Halal-Compliant Moisturizing and Whitening Bath Soap through Cold Saponification Technique	Utility Model	22020050671
6. Standardized Process of Formulating a Clay Shampoo with Hair-Growth Promoting Properties Using Halal Ingredients with the Application	Utility Model	22020050743
7. Improved Formulation of Halal-Compliant Moisturizing and Whitening Bath Soap through Cold Saponification Technique	Utility Model	22021050167
8. Standardized Process of Formulating a Halal-Compliant Bar Shampoo with Hair-Growth Promoting Properties	Utility Model	22021050222
9. Standardized Process for the Formulation of Moisturizing Lip Balm with Halal Ingredients	Utility Model	22021050898

APPLIED

TITLE OF IP	TYPE OF IP
1. A Wastewater Treatment Apparatus for Subsequent Polishing Using Biological Filter System	Patent
2. Development of a Low-cost Blackbody Target/Source for Infrared Radiation Thermometer Calibration from Sub-zero to Below Ambient Celsius	Patent
3. Improved Portable IBC Biogas Digester for Biodegradable Solid Waste Patent Production of High-maltose Sugar Syrup from Rice Bran Using Enzymatic Method	Patent
4. Design and Fabrication of 3D Printed Mold for Production of Bioscaffolds	Patent
5. Production of Shelf-stable Chicken Egg in Brine Patent Process of Producing Thermoplastic Composite from Philippine Wood Species	Patent
6. Oxidized Starch Nanocrystals and the Process of Production Thereof	Patent
7. Filter Cartridge for Pellet Adsorbers in Household Purification System Patent Hybrid Natural Fiber Based Composites for Boat Structures and the Manufacture Process of the Same	Patent
8. Thermoset Composite Panel Structure with Thermoplastic Honeycomb and Natural Fiber	Patent
9. Standardized Process of Formulating A Halal-Compliant Herbal Whitening Toothpaste	Utility Model
10. Standardized Process for the Formulation of Moisturizing Lipstick Using Halal Ingredients	Utility Model
11. Upland Peak	Trademark
12. Coco Bukayo	Trademark
13. Primera	Trademark
14. IDAS	Trademark

POLICIES

For this year, a total of 46 policies were developed by DOST-ITDI contributing to legislative policies/bills, management policies, and product technical standards.

Legislative Policies and Bills - 5

- Senate Bill No. 1331 (Extended Producer Responsibility)
- Senate Bill (Single-Use Plastic Products Regulation Act)
- Senate Bill No. 1456, House Bill No. 08954 (An Act Prohibiting the Development, Production, Stockpiling, and Use of Chemical Weapons, Providing for their Destruction, and Providing Penalties Therefor)
- Proposed NSWMC Resolution and Poster Against Open Burning of Waste
- DAO on MRF Clustering for HHW and HCW Management
- PNS ISO/TS 17466:2021: Use of UV-VIS Absorption Spectroscopy in the Characterization of Cadmium Chalcogenide Colloidal Quantum Dots
- PNS ISO/TS 18827:2021: Nanotechnologies — Electron Spin Resonance (ESR) as a Method for Measuring Reactive Oxygen Species (ROS) Generated by Metal Oxide Nanomaterials
- PNS ISO/TS 19006:2021: Nanotechnologies — 5-(and 6)-Chloromethyl-2',7' Dichlorodihydrofluorescein Diacetate (CM-H2DCF-DA) Assay for Evaluating Nanoparticle-induced Intracellular Reactive Oxygen Species (ROS) Production in RAW 264.7 Macrophage Cell Line

Management Policies - 6

- DOST AO 003 Series of 2021: Updated Guidelines on the Computation of Fees and Charges for Specialized DOST Testing, Calibration, and Other Technical Services
- DOST-ITDI Public Service Continuity Plan
- Creation of the Crisis Management Team
- Energy Efficiency and Conservation (EE&C) Program including Implementing Guidelines
- Designation of Energy Conservation Officer (Enercon) and Energy Audit Team (EAT) for the Implementation of the EE&C Program of ITDI in Compliance with the EE&C Act of 2018 and the Government Energy Management Program (GEMP)
- Designation of Continuing Professional Development (CPD) Manager in Relation to Republic Act No. 10912 – Continuing Development Act of 2016
- PNS ISO 19007:2021: Nanotechnologies — In Vitro MTS Assay for Measuring the Cytotoxic Effect of Nanoparticles
- PNS ISO/TR 19057:2021: Nanotechnologies — Use and Application of Acellular In Vitro Tests and Methodologies to Assess Nanomaterial Biodurability
- PNS ISO/TR 19601:2021: Nanotechnologies — Aerosol Generation for Air Exposure Studies of Nano-objects and their Aggregates and Agglomerates (NOAA)
- PNS ISO/TS 19808:2021: Nanotechnologies — Carbon Nanotube Suspensions — Specification of Characteristics and Measurement Methods
- PNS ISO/TS 21237:2021: Nanotechnologies — Air Filter Media Containing Polymeric Nanofibres — Specification of Characteristics and Measurement Methods
- PNS 2161:2021: Halal Cosmetics and Toiletries – General Requirements
- BPS TC 87/ SC 1: Coconut Shell Products - DPNS 2149 on “Coconut Shell Charcoal Briquettes – Grading and Classification”
- PNS ASTM D2652:020: Standard Terminology Relating to Activated Carbon
- PNS ASTM D2854:2020: Standard Test Method for Apparent Density of Activated Carbon

Technical Standards - 44

- PNS ISO/TS 11251:2021: Nanotechnologies — Characterization of Volatile Components in Single-wall Carbon Nanotube Samples Using Evolved Gas Analysis/Gas Chromatograph Mass Spectrometry
- PNS ISO 17200:2021: Nanotechnology — Nanoparticles in Powder Form — Characteristics and Measurements

Technical Standards - 44 (continued)

- PNS ASTM D2862:2020: Standard Test Method for Particle Size Distribution of Granular Activated Carbon
- PNS ASTM D2866:2020: Standard Test Method for Total Ash Content of Activated Carbon
- PNS ASTM D2867:2020: Standard Test Methods for Moisture Content in Activated Carbon
- PNS ASTM D3802:2020: Standard Test Method for Ball-Pan Hardness of Activated Carbon
- PNS ASTM D3838:2020: Standard Test Method for pH of Activated Carbon
- PNS ASTM D4607:2020: Standard Test Method for Determination of Iodine Number of Activated Carbon
- PNS ASTM D5029:2020: Standard Test Method for Water Solubles in Activated Carbon
- PNS ASTM D5742:2020: Standard Test Method for Determination of Butane Activity of Activated Carbon
- PNS ASTM D5832:2020: Standard Test Method for Volatile Matter Content of Activated Carbon Samples
- PNS ASTM D6851:2020: Standard Test Method for Determination of Contact pH with Activated Carbon
- PNS ASTM C1222: Standard Practice for Evaluation of Laboratories Testing Hydraulic Cement
- JMC 01 Series of 2021: Guidelines on the Classification, Certification, and Safe Handling/Transport of Coconut Shell Chips, Coconut Shell Powder, Coconut Shell Raw Charcoal, Coconut Shell Granulated/ Powdered Charcoal, Coconut Shell Charcoal Briquettes and Coconut Shell Activated Carbon
- PNS ISO 13528:2015: Statistical Methods for Use in Proficiency Testing by Interlaboratory Comparisons
- PNS ASTM C1222: Standard Practice for Evaluation of Laboratories Testing Hydraulic Cement
- ISO 19861:2015: Buildings and Civil Engineering Works — Sealants — Determination of Curing Behavior
- ISO 19862:2015: Buildings and Civil Engineering Works — Sealants — Durability to Extension Compression Cycling under Accelerated Weathering
- PNS ISO 15509:2021: Adhesives – Determination of the Bond Strength of Engineering-Plastic Joints
- PNS ISO 17178:2021: Adhesives – Adhesives for the Bonding Parquet to Subfloor – Test Methods and Minimum Requirements
- PNS ISO 17194:2021: Structural Adhesives – A Standard Database of Properties
- PNS ISO 19212:2021: Adhesives – Determination of Temperature Dependence of Shear Strength
- PNS ISO 21368:2021: Adhesives – Guidelines for the Fabrication of Adhesively Bonded Structures and Reporting Procedures Suitable for the Risk Evaluation of Such Structures
- PAB-DTI LA/SR03 – Requirements on the Use of PAB Laboratory, Inspection Body and Proficiency Testing Participation Accreditation Symbol and Reference to PAB Accreditation
- PAB-DTI LA/GD01 – Accreditation Process
- PNS ISO 11528:2021: Buildings and Civil Engineering Works - Sealants - Determination of Craze and Cracking Following Exposure to Artificial or Natural Weathering
- PNS ISO 7389:2021: Building Construction - Jointing Products - Determination of Elastic Recovery of Sealants
- PNS ISO 7390:2021: Building Construction - Jointing Products - Determination of Resistance to Flow of Sealants
- PNS ISO 9047:2021: Building Construction - Jointing Products - Determination of Adhesion/Cohesion Properties of Sealants at Variable Temperatures

GOVERNANCE

Industry Advisory Committee (IAC)



Virtual Internal Quality Audit conducted for the Planning and Management Information Systems Division last 24 June 2021.

To increase industry engagement and boost the Philippine economy, DOST-ITDI created an Industry Advisory Committee (IAC) consisting of a group of industry experts and business leaders from both private and public sectors that will provide expert's advice on R&D, business development, and technology transfer.

During the 5th IAC meeting with Execom held on 10 December 2021 via Zoom, the various products, processes, and generated technologies of ITDI were presented and discussed. After the presentation, the IAC members expressed interest on the following technologies: Halal cosmetics and personal products such as lipstick, lotion, and feminine wash; 3D printing of light materials for construction, and preserved foods. Further discussions and coordination may soon commence.

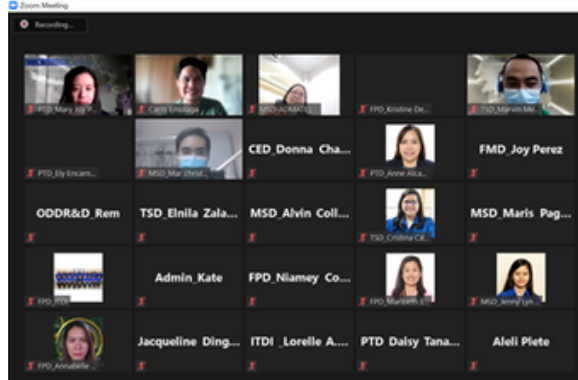
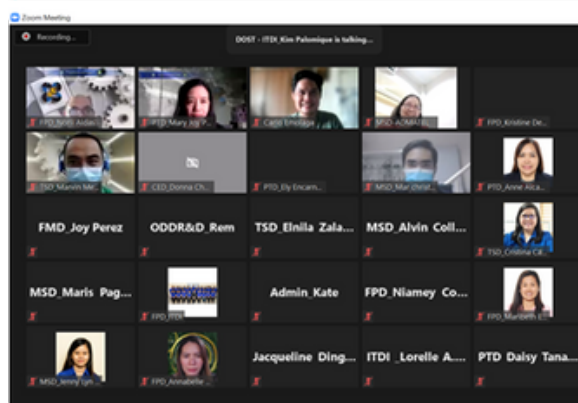
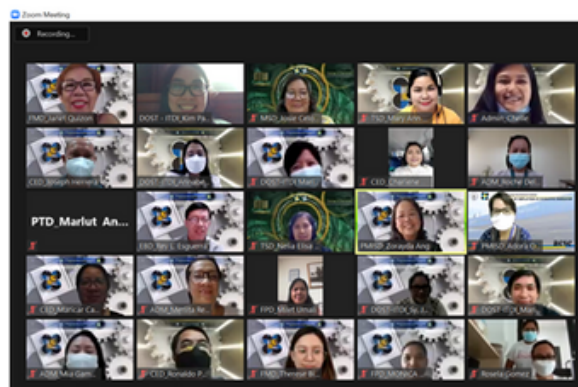
International Organization for Standardization (ISO)

To comply with the requirements of ISO 9001:2015, the ITDI conducts a yearly Internal Quality Audit for all of its divisions and process areas. This 2021 as in the past year, the Internal Quality Audit (IQA) group faced a few challenges due to the pandemic. As most of auditing activities are best done face to face, the group had been limited with the use of online platform or virtual audit.

To prepare for the virtual audits, the IQA group conducted in June 2021 an echo / re-echo seminar on ISO 9001:2015 as well as Risk-Based Thinking for all internal quality auditors (IQAuditors), whether new, returning, or those continuing their duties as IQAuditors. In addition, another seminar was conducted on how remote auditing is usually practiced. To enforce the lesson from both seminars, a mock virtual audit was then conducted to prepare for questions that would be asked, or difficulties that could be encountered in the conduct of the actual virtual audit.

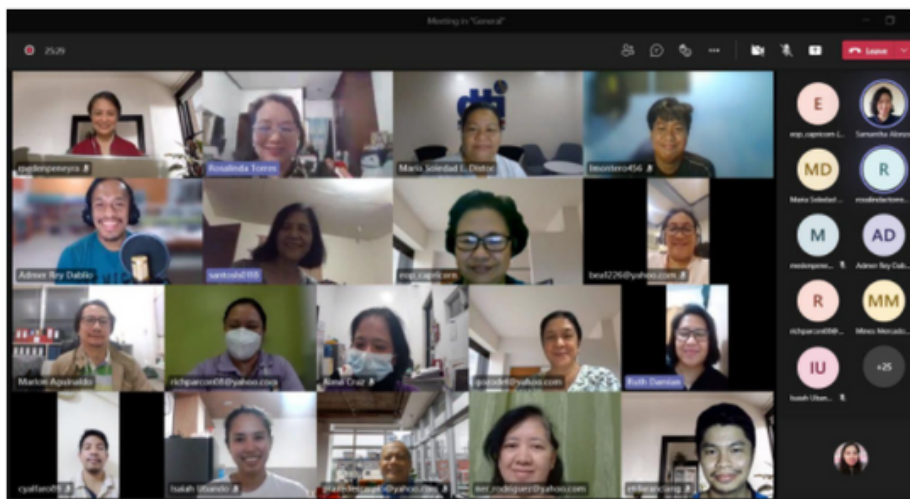
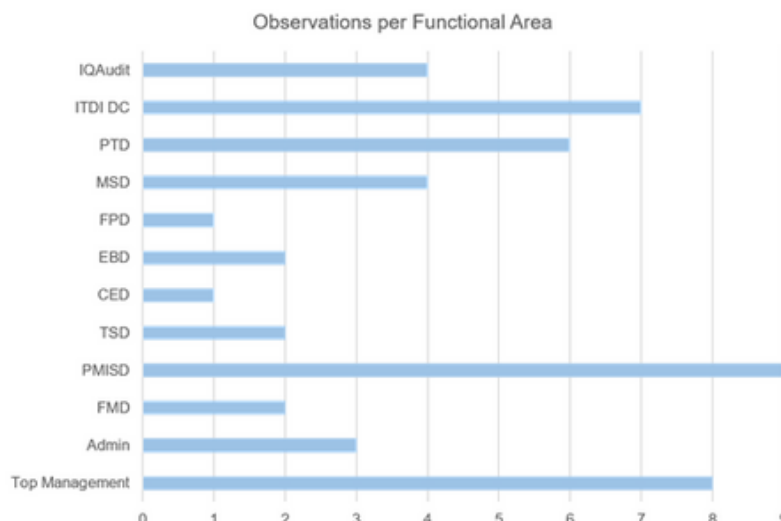
Last June to July 2021, a series of virtual internal quality audits were conducted for 12 divisions / functional areas. Since the IQAs conducted the virtual audits for the first time, reactions/feedback were mixed. Some agreed that virtual audit was good to ensure that the minimum health safety protocols would be followed, while others commented that technical issues affected the virtual audit experience. The Management Review was then conducted virtually on 16 July 2021, to present the IQAs' findings.

In total, the IQAuditors issued 49 observations and 2 potential nonconformities for 12 functional areas.



Virtual ITDI Management Review conducted on 16 July 2021.

On the other hand, ITDI had its 1st follow-up external audit last 19 August 2021 and was also conducted virtually. From this, ITDI received 6 positive findings and 9 opportunities for improvement distributed among different functional areas.



Remote assessment of the Standards and Testing Division on 12-14 October 2021 for PNS ISO/IEC 17025:2017 Laboratory Accreditation of its 4 Testing Laboratories

The Standards and Testing Division successfully completed its 3-day remote assessment for PNS ISO/IEC 17025:2017 laboratory accreditations for chemical, microbiological and mechanical testing on 12-14 October 2021 conducted by the assessment team from the Philippine Accreditation Bureau of the Department of Trade and Industry (PAB-DTI). A total of 23 technical staff from the Chemistry Laboratory, Microbiology Section, Biological Laboratory and Physical and Performance Testing Laboratory were recommended as approved signatories for the PAB-endorsed test reports. The Division proudly announced that it had a total of 138 test parameters for various sample matrices handled by the STD testing laboratories recommended as the scope of accreditation.

Recommendation for renewal to PNS ISO/IEC 17025 accreditation was not just the accomplishment of STD in 2021. It has also successfully renewed its accreditation as drinking water testing laboratory granted by the Department of Health – Health Facilities and Services Regulatory Bureau (DOH-HFSRB) on 22 September 2021. The Laboratory is accredited in the chemical testing for Arsenic (As), Cadmium (Cd), Copper (Cu), Iron (Fe), Lead (Pb), Manganese (Mn), Total Mercury (Hg), Nickel (Ni), Sodium (Na), Zinc (Zn), Fluoride, Chloride, Nitrate, Nitrite, Sulfate, Silicon, pH, Turbidity, Total Dissolved Solids, and Disinfectant Residual Chlorine. This renewal of accreditation greatly helps the drinking water stakeholders ensure compliance to the 2017 Philippine National Standard for Drinking Water.



Furthermore, the STD also successfully renewed its laboratory recognition for the mechanical and physical testing of rubber inner tubes and uPVC pipes under the Bureau of Philippine Standards – Department of Trade and Industry (BPS-DTI) on 22 November 2021. The Division got no nonconformities and had received 6 positive findings. This is the first on-site assessment ever conducted since the period of the COVID-19 pandemic. This renewal of laboratory recognition by BPS-DTI strengthens partnership of DOST-ITDI and BPS-DTI, and the latter's regulatory mandate as well.

Philippine Quality Award (PQA)

In 2020, ITDI was challenged to apply for the Philippine Quality Award (PQA). The PQA is a global competitiveness template aimed to, ultimately, improve an organization's performance by optimizing the systems and processes it has in place. It promotes organizational performance standards comparable to leading businesses abroad, ensuring that Philippine organizations, whether public or private, once awarded by the PQA have performance that is at par with global organizations.



A PQA echo seminar conducted on 5 May 2021 via Zoom.

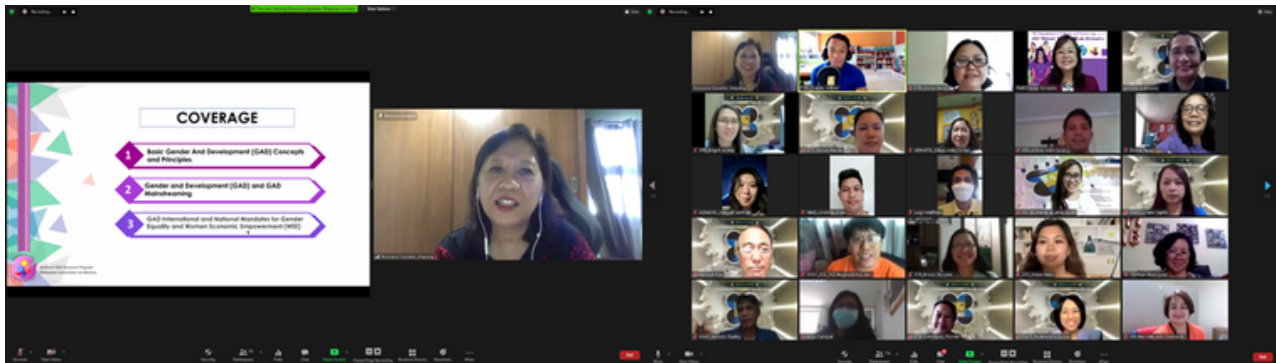
Answering the call to this challenge, ITDI, in 2020, sent a representative to a week-long training on the Philippine Quality Award, which covered a wide range of topics such as the background on the PQA, and how to prepare organizations applying for the PQA. As a follow-up to this activity and in preparation for ITDI's application, from 5-7 May 2021 a series of echo seminars were conducted for all divisions of ITDI. These echo seminars discussed what the PQA is, and, at the same time, study the current systems and practices in place, which resulted in the gathering of important employee feedback.

On 8-10 September 2021, the PQA assessors visited ITDI to whom its organizational structure and systems and processes overview were presented. A series of employee interviews were also conducted to determine the awareness of the employees on ITDI, as well as to assess the systems and processes through an employee's perspective and not just from a Top Management perspective. A virtual visit to ITDI's laboratories and facilities was also conducted.

As of this writing, ITDI is awaiting the results of its PQA assessment.

Gender and Development (GAD)

The ITDI Gender and Development (GAD) Focal Point System (GFPS) through the Technical Working Group conducted a total of six (6) GAD learning and development webinars on basic GAD concepts (3 batches), mental health and wellness, basic gender sensitivity, and health and wellness after retirement. ITDI employees participated in these webinars, regardless of sex, age and employment status, ensuring that GAD advocacies and ideals are well practiced in the institute.



One of the webinars organized by ITDI GAD FPS TWG: Basic Gender Sensitivity Training



Vitamin C with zinc capsules distributed to ITDI Employees

To help ensure the good health of all ITDI employees, regardless of employment status (regular, contract of services, job orders, janitors and guards) which is one of GAD's objectives, Vitamin C with zinc capsules were provided to help boost their immune system against COVID-19 that has been threatening the health and safety of everybody.



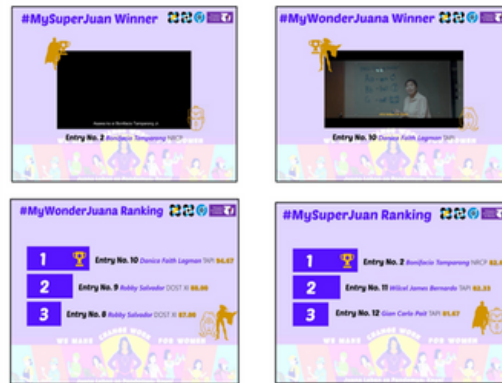
DOST-wide #MyWonderJuana and #MySuperJuan Video Making Contest

The DOST-ITDI has organized various contests to encourage creative minds of ITDI and even from other DOST agencies in showcasing GAD mainstreaming efforts/initiatives. During the celebration of the Women's Month on March 2021, the Institute spearheaded the *#MyWonderJuana* and *#MySuperJuan* Video Making Contest for a 1-minuter video on the role of men (Super Juan) and women (Wonder Juana) during the pandemic. This DOST-wide contest was well participated by the DOST agencies, wherein winners for *#MyWonderJuana* came from TAPI and *#MySuperJuan* came from NRCP.

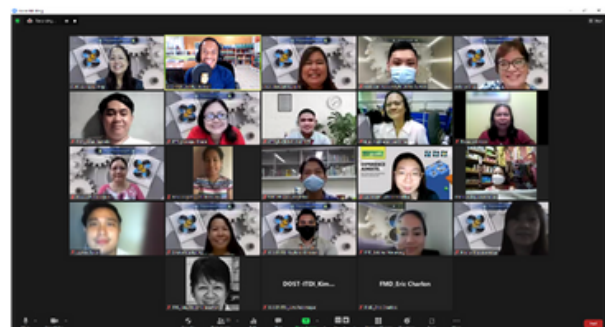


Winners (left) and other participants (right) of the GAD Monologue 1-Minuter Video Making Contest

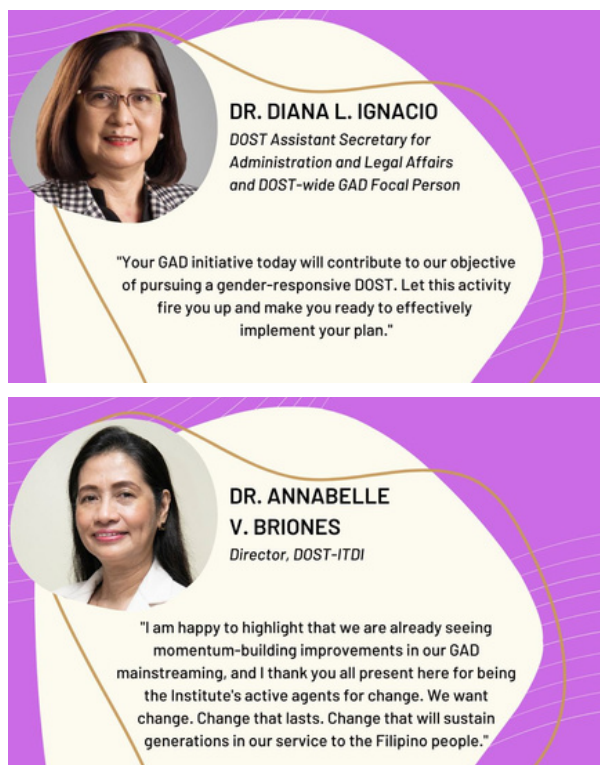
Moreover, to prepare the Institute for the implementation of GAD mainstreaming initiatives and activities for 2022, the members of the ITDI GAD FPS TWG had undergone virtual training workshop (echo-training) on Mainstreaming GAD Elements in Project Development Cycle, on 28 September 2021. The TWG members through this workshop got refreshed on the use of the project design checklist for the conceptualization of an R&D project and the use of the Harmonized Gender and Development Guidelines (HGDG) for the evaluation of program, project or major activity relative to GAD mainstreaming. This enabled them to evaluate their existing R&D projects and technical services in terms of GAD mainstreaming, as well as identify gaps in terms of the Institute's GAD policies, people, enabling mechanisms, and programs, projects and activities (PPAs).



Meanwhile, on the 120th Founding Anniversary of DOST-ITDI on 01 July 2021, the ITDI GFPS organized the GAD Monologue 1-Minuter Video Making Contest with the theme "*Kababaihan at Kalalakihan sa Pagkamit ng Pantay na Hinaharap sa Panahon ng Pandemya.*" All divisions participated in the contest with MSD's (Material Science Division) entry emerging as grand winner.



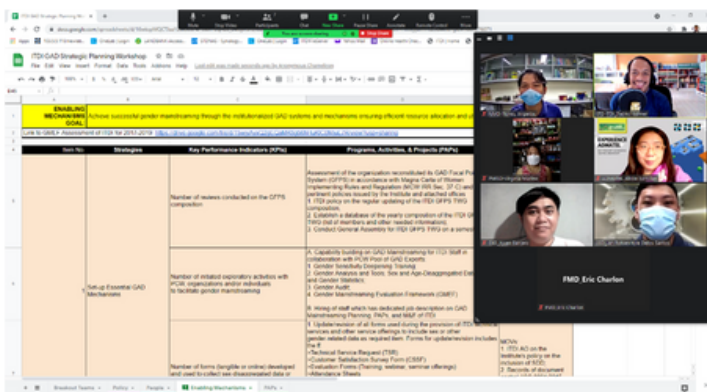
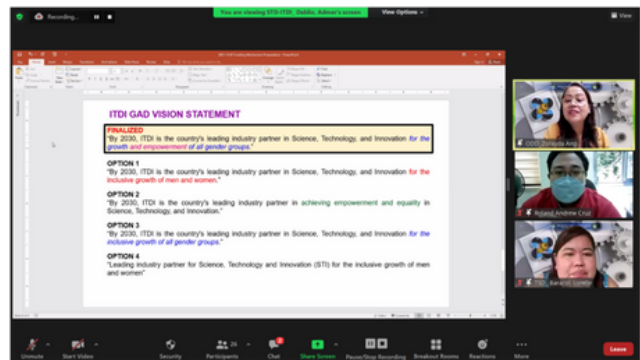
ITDI-GAD Online Echo Training on Mainstreaming GAD Elements in Project Development Cycle



Excerpts from the GAD Commitment Statements by DOST ASec. Diana L. Ignacio and Director Annabelle Briones during the ITDI GAD Strategic Planning Workshop

Afterwards, the TWG members participated in the Strategic Planning Workshop for the ITDI GAD Plan and Budget (GPB) for 2022. This was the first time that strategic planning was applied to the preparation of the GPB. The TWG members were grouped with assigned breakout rooms and they revisited the Institute's mission, vision, goals, and core values. They checked on the current status of the Institute's GAD mainstreaming for the policies, people, enabling mechanisms, and programs, projects and activities (PPAs), and were able to identify key goals, key result areas, key performance indicators, and strategies per pillar of the GAD Mainstreaming Evaluation Framework (GMEF). From the efforts of the TWG members and the ITDI GAD FPS Secretariat, the Institute was able to come up with its GPB for 2022. This was submitted to DOST GRSS and was endorsed to PCW. With this initiative, DOST-ITDI was invited to share its best practice/s in the DOST GAD FPS General Assembly conducted online on 10 December 2021, which was presented by Zorayda V. Ang, DBA and ITDI's GAD FPS TWG Chairperson.





ITDI GAD Strategic Planning Workshop on 07-08 October 2021

DOST-ITDI also participated in the celebration of the 18-Day Campaign to Violence Against Women (VAW). VAW streamers were posted at the NML and Executive Office building and at the STD building. The celebration focused on the implementation of the RA 11313 or the Safe Spaces Act. Streamers and posters were posted on official ITDI service vehicles and at strategic public places within the ITDI premises, reminding all ITDI employees, customers, and guests that ITDI strongly adheres to ensuring that spaces are safe for everyone. A Safe Space Pledge video was also prepared by the ITDI ExeCom, documenting the commitment of the Institute to diverse, inclusive, accepting, welcoming, and safe spaces for everyone.



Safe Spaces Streamers and Posters

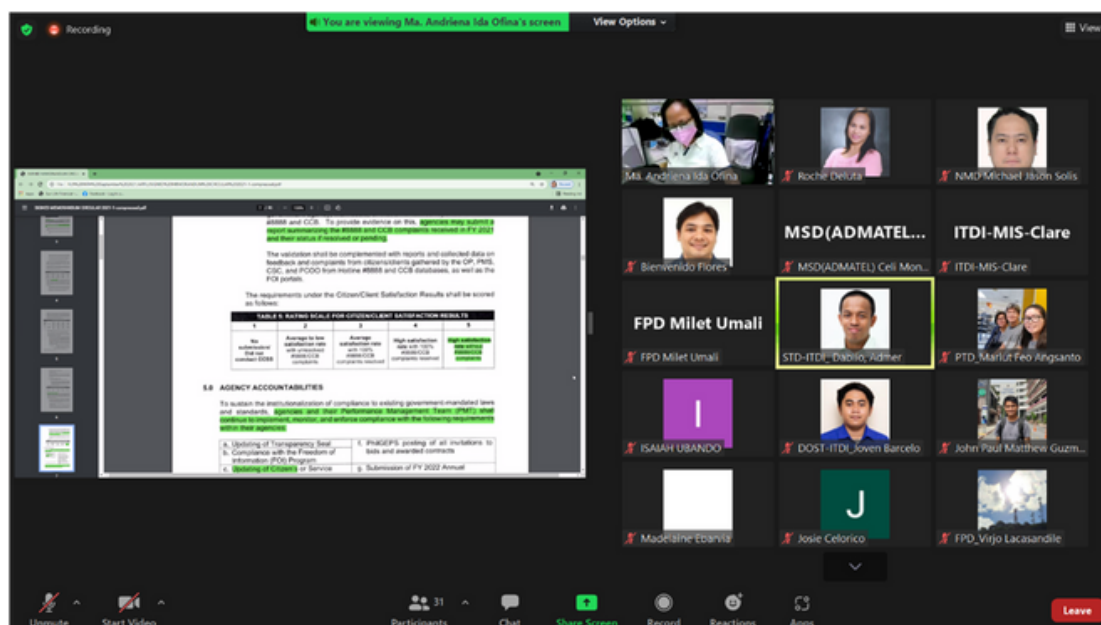


ITDI Safe Spaces Pledge Video

Anti-Red Tape Unit (ARTU)

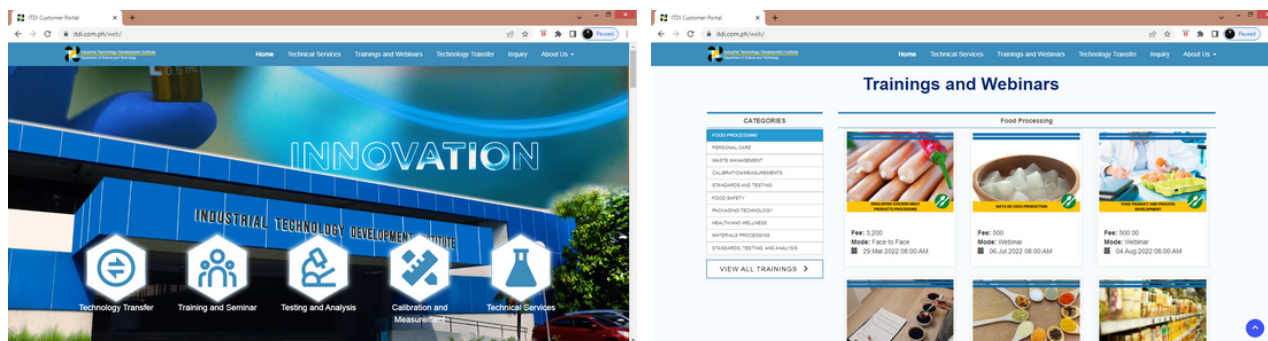
This year marks the second year of ITDI's Anti-Red Tape Unit (ARTU) that was created in 27 January 2020 in compliance to Republic Act (RA) 11032 or the law on "Ease of Doing Business and Efficient Government Service Delivery Act of 2018." ARTU's primary goal is to reengineer the systems and procedures as well as craft the Citizen's Charter to further streamline the bureaucracy. Among its notable accomplishments were the following:

- Implemented the new Customer Satisfaction Survey Forms (CSSF) using the eight (8) service quality dimensions recommended by ARTA namely, responsiveness, reliability (quality), access and facilities, communication, cost, integrity, assurance, and outcome;
- Discussed the revision of the service specifications based on the observations in the 2020 edition of the ITDI Citizen's Charter;
- Updated Citizen's Charter for 2021 to include protocols and measures relative to COVID-19 and posted at the ITDI Transparency Seal;
- Updated the ITDI Complaints Processing video to incorporate latest contact details of the Contact Center ng Bayan (CCB);
- Recommended to all ARTU representatives to do a time and motion study (TMS) of their service specification processes;
- Presented the results of the TMS of the cashier process as it affects almost all services of the Institute (Issuance of official receipts);
- Discussed the incorporation of e-payment platform as part of service specifications and customer portal; and
- Crafted and submitted to ARTA the reengineering report in the Citizen's Charter like testing analysis for some R&D services, measuring instrument calibration and measurement services, and issuance of OR, among others.



ARTU Chairperson M.A. Ofina with the Divisional representatives during their meeting on 27 September 2021 via Zoom

DOST-ITDI Information System Initiatives



In support to RA 11032 otherwise known as the *Ease of Doing Business and Efficient Government Service Delivery Act of 2018*, DOST-ITDI continues to innovate and develop systems such as online transactions with e-Payment System that help expedite business transactions, reduce turn-around time, and create an environment that facilitates seamless transactions and enhances the overall experience of customers availing DOST-ITDI services. ITDI also developed several information systems to support its internal operations accessible both on intranet and internet. The need for this kind of service has never been more pronounced at this time of the pandemic, driving various organizational activities to progressively and radically shift to digitization and online processing. Further, the developed system is a tool to ensure the continuity of delivery of services for a wider customer base of DOST-ITDI as the risk of transmission of COVID-19 remains high.

The DOST-ITDI Online Customer Portal (www.itdi.com.ph) is a single touch point website which enables customers to send their requests and inquiries about ITDI's various services such as technical services, webinars, trainings, and seminars. For a completely contactless transaction, DOST-ITDI launched its electronic payment (e-Payment) system in September 2020 and started gaining the trust of its customers in 2021. ITDI has a total of PHP 189,100 online payment transactions for this year. The ITDI e-Payment system was also adopted and implemented by other DOST agencies, the MIRDC and the PNRI.

For internal organizational operation, ITDI developed several information systems to capture, process, and maintain data. The Technical Services Information Systems facilitates customer's request on technology transfer, use of facilities, extractions, shelf life, and other technical services offered by our R&D division. The Order of Payment (OP) under the accounting section facilitates creation of OP from validated transactions of Technical Services Information Systems. The Cashier System facilitates both e-payment and over-the-counter mode of payment.

For compliance and safety of everyone during this pandemic, ITDI has an online Daily Time Record of employees for both reporting physically in the office or in WFH arrangement. A health declaration system and building entry logs were also established to properly and timely monitor the health status of all employees. These are web-based applications accessible via intranet and public internet.

The ITDI divisions have also upgraded their various information systems. At STD, the Unified Laboratory Information Management System (ULIMS) extension for work order assignment was upgraded to incorporate automatic documentation of the storage location of the samples for testing and the establishment of the linkage of the sample/request remarks reflected in the Technical Service Request (TSR) form and the work order form for the test assignment for more efficient dissemination of testing instructions to laboratory analysts. Module for the data retrieval was also upgraded for faster collection of sex disaggregated data, value of assistance rendered to customers and types of customers.

Annual Planning Workshop

DOST-ITDI conducted its planning workshop at One Tagaytay Place Hotel Suites on 2-3 December 2021. During this two-day event, the 2021 Operations Plan and Budget (OPB) targets and accomplishments, divisions' issues and concerns, as well as the 2022 OPB targets were discussed.

Resulting from their deliberations, the ExeCom crafted the 2022 plan that is anchored on DOST agency goals among which include: increasing the funding sources for R&D initiatives; promotion and acceleration of technology transfer; engaging startups, MSMEs and industries in STI initiatives; expanding laboratory and testing capacities; developing and delivering disaster risk reduction and climate change-related technologies and products; and implementing effective and efficient internal management systems for good governance.



The ExeCom members and Secretariat during the 2021 Planning Workshop held at One Tagaytay Place Hotel Suites on 2-3 December 2021.

The ExeCom members as they discussed the Institute's operations plan and budget (OPB) targets and accomplishments during their 2021 Planning Workshop.



AWARDS AND RECOGNITION



Dr. Briones: 2021 Asian Scientist 100

DOST-ITDI Director Dr. Annabelle V. Briones was recognized as among this year's *Asian Scientist 100* by Singapore-based Asian Scientist Magazine for developing a mosquito ovicidal/larvicidal trap system that aimed to curtail the burgeoning threat of dengue in the Philippines.

The 2021 Edition listing named Dr. Briones as one of eight Filipino scientists honored by the Asian Scientist Magazine. It placed her along other scientists from China, India, Malaysia, Singapore, Japan, South Korea, Bangladesh, Hong Kong SAR, Sri Lanka, Indonesia, Thailand, and Vietnam - scientists who made a significant stride amid COVID-19. Last year, she also received the 2020 Gregorio Y. Zara Award for Applied Science Research for the same project.

Dr. Ang: Deputy Director for ATS

Reaping the fruits of her labor, Dr. Zorayda V. Ang, took her oath to office on 12 August 2021 as the new *Deputy Director for Administrative and Technical Services* of DOST-ITDI. The oath taking ceremony was led and administered by DOST Secretary Fortunato T. De La Peña together with Assistant Secretary for Human Resource Management, Management Services, and Special Concerns Dr. Diana L. Ignacio, and ITDI Director Dr. Annabelle V. Briones.

She obtained her Master's and Doctorate degrees in Business Administration from the Ateneo de Manila University (gold medalist), and De La Salle University, respectively, as a DOST scholar. Dr. Ang also has a technical background on agriculture as her undergraduate degree and graduated cum laude. As former Chief of the Planning and Management Information Systems Division, she introduced improvements and innovations in key operational processes such as agency strategic planning, project management, policy development / implementation / reinforcement, ICT infrastructure and information systems, external stakeholder engagement and feedback, and learning-by-doing (LBD) interventions. During her stint as OIC of the Office of the Deputy Director for ATS, she instituted employee performance management



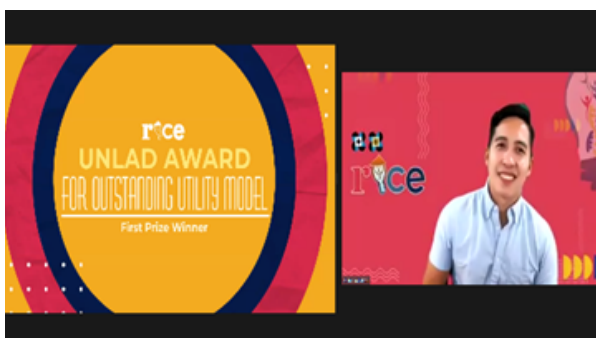
and monitoring mechanisms for the implementation of alternative work arrangements at the onset of the state of national emergency due to COVID-19. She is currently the ISO 9001:2015 quality management representative and also led the institute in its pursuit of the Philippine Quality Award for Performance Excellence for the 24th cycle of the PQA in 2021.



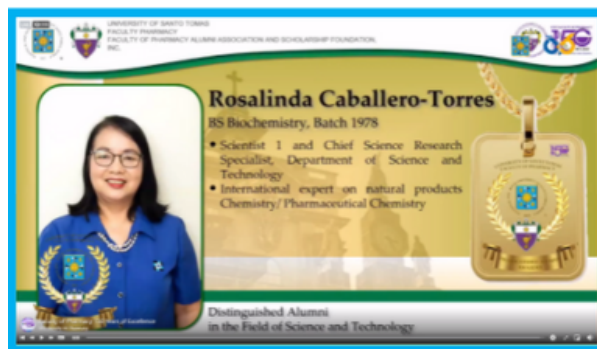
Dr. Montesa: Deputy Director for R&D

On 15 April 2021, a licensed chemical engineer and technology transfer expert, Dr. Christine Marie C. Montesa took her oath before DOST Secretary Fortunato T. De La Peña as the new ITDI *Deputy Director for Research and Development*. Present during the oath taking ceremony were R&D Undersecretary Dr. Rowena Cristina L. Guevara and ITDI Director Dr. Annabelle V. Briones.

With a Doctorate degree in Materials Engineering from Tokyo University, she will be bringing in to the research post her academic background on materials science engineering and experiences in quality service assurance and product development at Intel Technology Philippines Inc. and JEOL Asia Pte. Ltd. of Singapore.



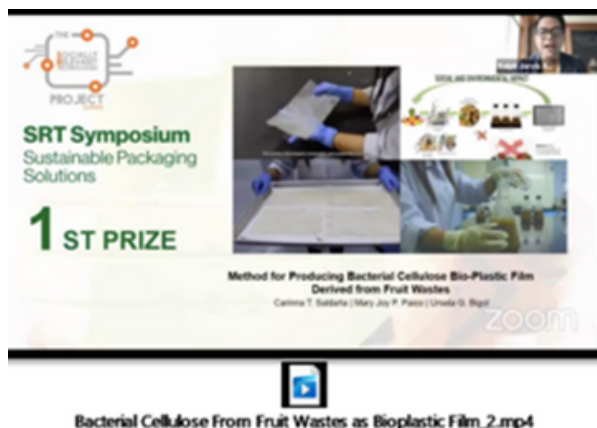
CED: DOST-TAPI RICE Unlad Award Outstanding Utility Model for its project entitled, "*Power Back-up System for Small and Large Equipment*".



Dr. Torres: Distinguished Alumna in the Field of Science and Technology Award

On 29 May 2021, Dr. Rosalinda C. Torres was awarded with the *Distinguished Alumna in the Field of Science and Technology Award* by the University of Santo Tomas (UST) Faculty of Pharmacy.

Dr. Torres is a Scientist 1 and Chief Science Research Specialist of DOST-ITDI's Standards and Testing Division. She studied Biochemistry at the University of Santo Tomas, Philippines. After finishing college, she joined the R&D team of ITDI and conducted diverse research work on natural products and pharmaceutical chemistry including essential oils, medicinal plants, natural colorants, natural larvicides and others for the development of healthcare and personal care products. She finished her MS in Chemistry degree in 1993 and PhD in Chemistry degree in 2009 in the same university.



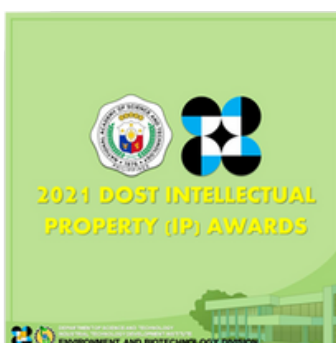
PTD: 1st Prize SRT Symposium for Sustainable Packaging Solutions (Video on Bacterial Cellulose Bio-Plastic Film Derived from Fruit Wastes)



PTD: Top 8 out of 217 entries nationwide of the National Commission for Culture and the Arts (NCCA) ASEAN Philippine Digital Art Contest 2021 - "Lit"



EBD: Best Poster Presentation and Young Researchers Grant (Philippine Society of Microbiology 50)



MSD: 12 DOST International Publication Awards and **5 DOST Intellectual Property Awards**

EBD: 7 DOST Intellectual Property Awards



PTD: Posters Bronze and Silver Awards (7th APN Packaging Conference)



PTD: Gawad Kintal First Prize & People's Choice for Commercialization for the success story of RTE Chicken Arroz Caldo

CED: Gawad Kintal Best Commercialization Award 3rd Prize

MSD: 1st and 2nd Place Best Poster
(70th PHILAAST Convention and ACAM 2021)



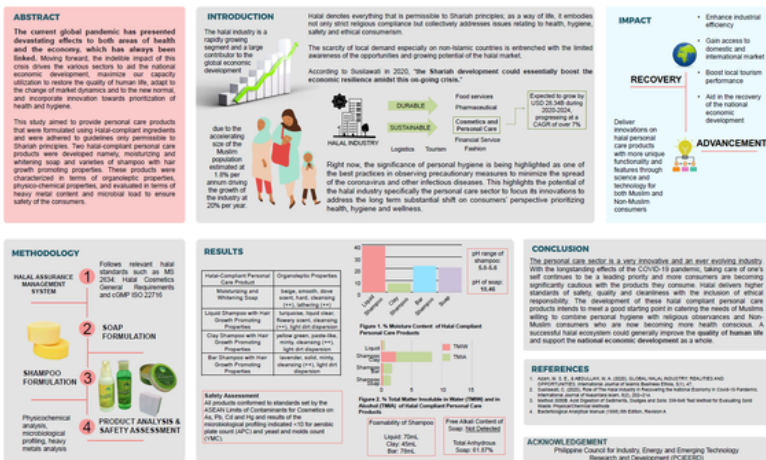
**Halal-Compliant Personal Care Products:
Promoting Health and Hygiene Amidst Covid-19**

Chelsea Kate F. Jose, Danielle Camille P. Canillo, Dana A. Taladro, Harvy Jay N. Esmundo,
Ma. Rachel V. Parcon, and Dr. Rosalinda C. Torres

Industrial Technology Development Institute, Department of Science and Technology, Bicutan, Taguig City, 1631

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STD: Halal-Compliant Personal Care Products: Promoting Health and Hygiene amidst Covid-19, First Prize

Metro Manila Health Research and
Development Consortium
(MMHRDC) 5th International
Symposium and 12th Annual
Scientific Conference

FMD: Outstanding Accounting Office

The Commission on Audit has chosen the DOST-ITDI as one of the *Outstanding Accounting Offices* for CY 2019 and 2020 for having met the criteria of Accuracy, Timeliness, Reliability and Compliance to accounting rules and regulations.



FPD: 1st Place (Best Presentation and Best Abstract) Classification of Coconut Water using Microfiltration

3 awards in Integrative Research and Education Summit (1st, 2nd, 3rd Place)



STD: Laboratory of Excellence, Chemistry Laboratory

The STD laboratories performed well in various local and international Proficiency Testing (PT) schemes participated in 2021, attesting to its competence that is at par with other testing laboratories globally.

A Laboratory of Excellence Certificate was awarded to the Chemistry Lab in October for an excellent PT result in the analysis of chloride and nitrate in water organized by South Korea's accreditation body, Korea Laboratory Accreditation Scheme (KOLAS).

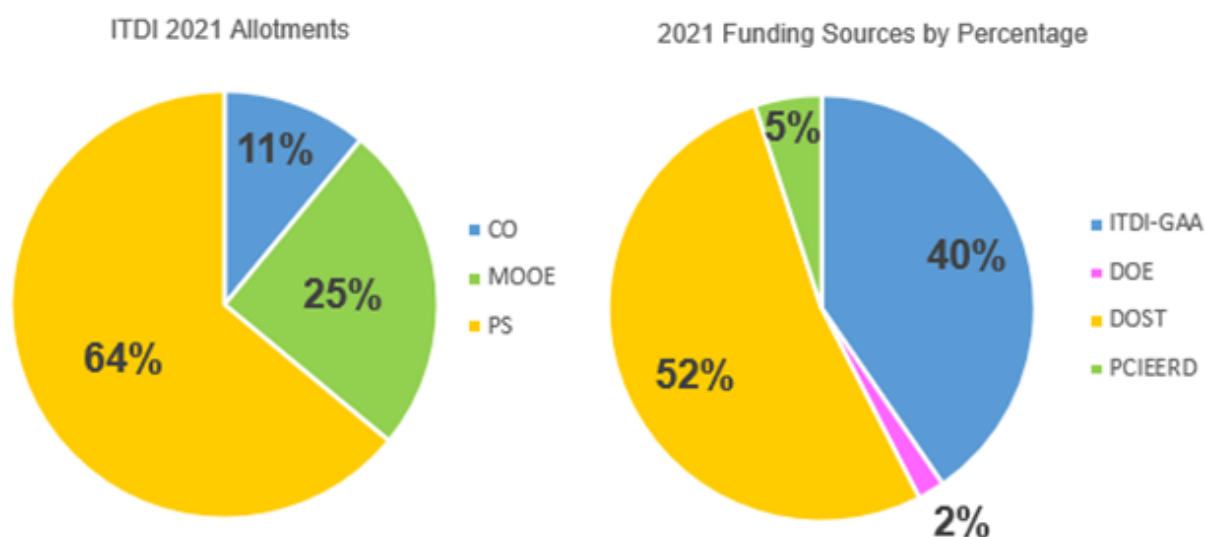


The laboratory also obtained excellent performance in the Proficiency Testing Schemes organized by the Metrology in Chemistry of the National Metrology Laboratory (NML).

These include the PT on benzoic acid in mango juice with z'-score = 0.03 and the PT on trace metals in lipstick reference material with z-score = -0.30 for arsenic, with the latter jointly organized with HAS Singapore through the ASEAN Reference Material Network (ARMN).

FINANCIAL MANAGEMENT

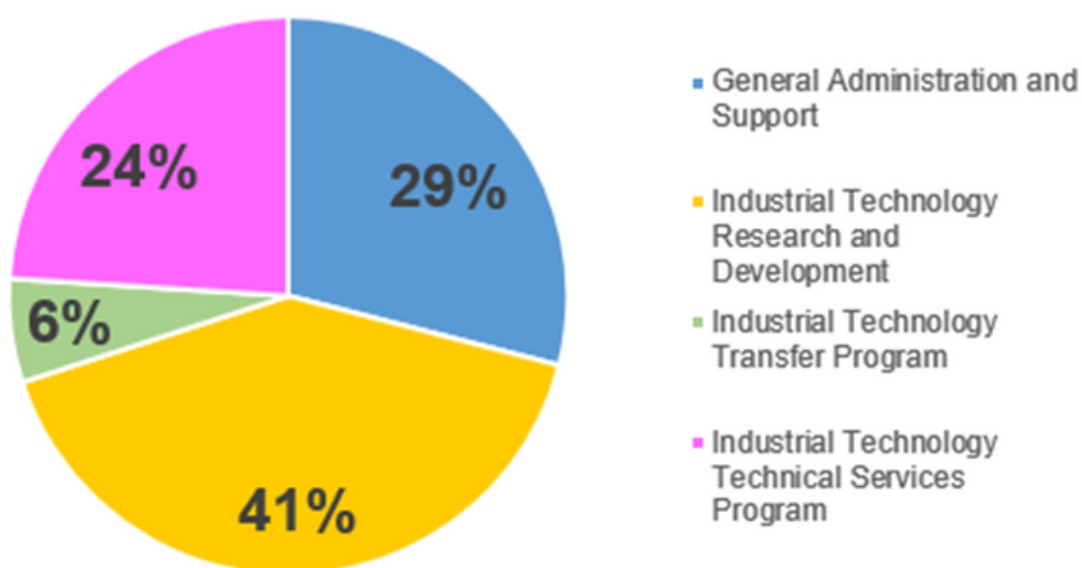
Alongside the continuing effects of the pandemic, the institute dealt with the unprecedented pressures of managing its limited financial resources. The institution received PHP 421.07 million funding from the Department of Budget and Management (DBM) General Appropriations Act (GAA) but was able to generate additional resources from project proposal-based funding of the DOST Grants-In-Aid (DOST-GIA) program in the amount of PHP 553.05 million; PHP 56.6 million from the Philippine Council for Industry, Energy, and Emerging Technology Research and Development (PCIEERD), PHP 5.61M from the Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development (PCAARRD), and PHP 16.77 million from the Department of Energy. From a Memorandum of Agreement (MOA) signed for the training of Philippine Women in Sri Lanka, the Department of Foreign Affairs (DFA) gave PHP 0.3 million. Meanwhile, through the Community Empowerment thru Science and Technology (CEST) program of DOST, DOST-National Capital Region (NCR) provided additional funding of PHP 0.66 million through a signed MOA. Altogether, a total of PHP 695 million was generated to sustain operations of DOST-ITDI in 2021.



For 2021 ITDI-GAA, the Personnel Services (PS) component received the largest allotment with PHP276.58 million; the second largest is Maintenance and Other Operating Expenses (MOOE) with PHP99.11 million, and the smallest allotment is for Capital Outlay (CO) with PHP45.37 million.

ITDI's allotment for Programs, Projects, and Activities, is divided into four, namely General Administration and Support (GAS), Industrial Technology Research & Development, Industrial Technology Transfer Program, and Industrial Technology Technical Services Program.

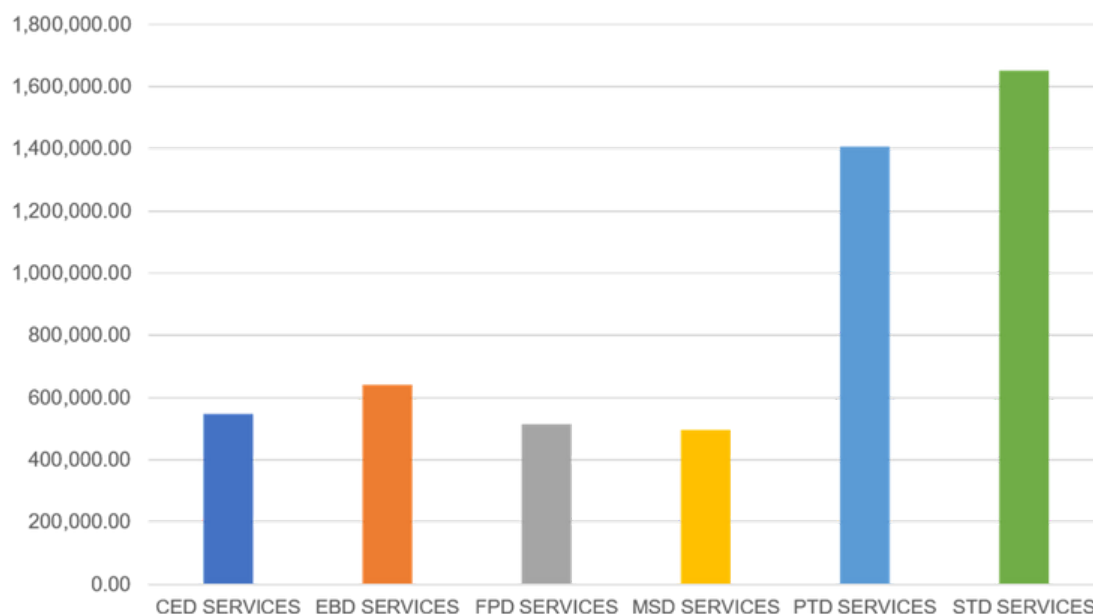
2021 Allotments by PPA



For this year, the agency's R&D program received the largest budget with PHP 169.35 million, followed by the GAS with PHP 118.59 million, then by the Technical Services program with PHP 97 million, and lastly, the Technology Transfer Program with PHP 26.65 million.

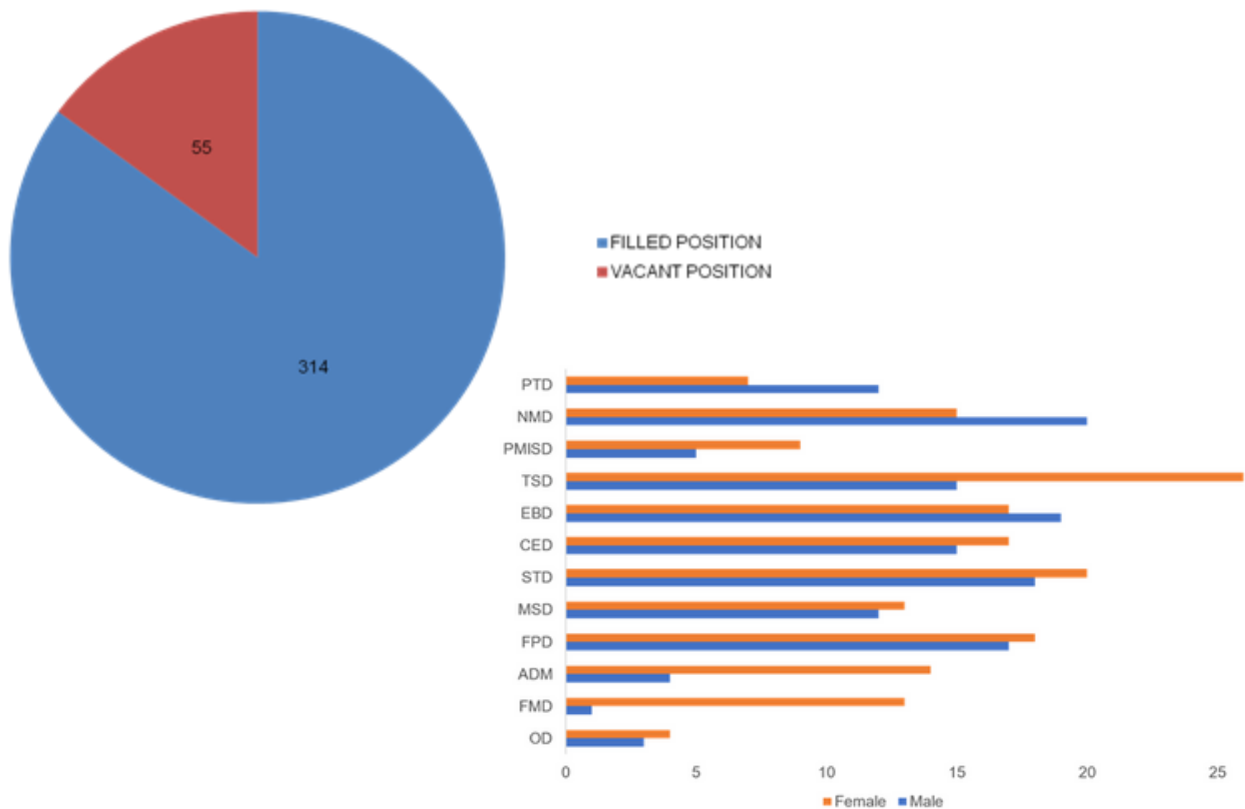
Amid the devastating effects of the pandemic, ITDI was able to provide technical services to its stakeholders, and generated an amount of PHP 5.25 million. Of this, the majority came from the testing services of both STD and PTD.

Funds Received in 2021 from Test Services

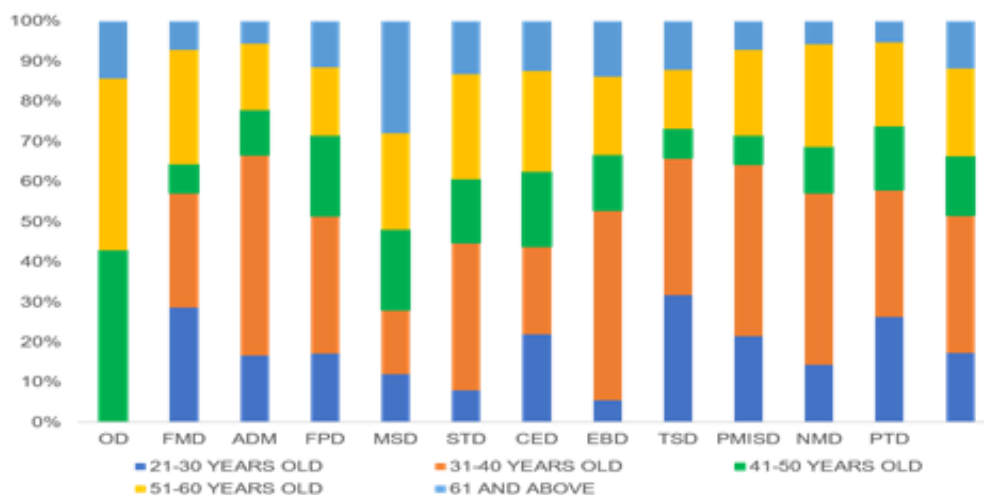


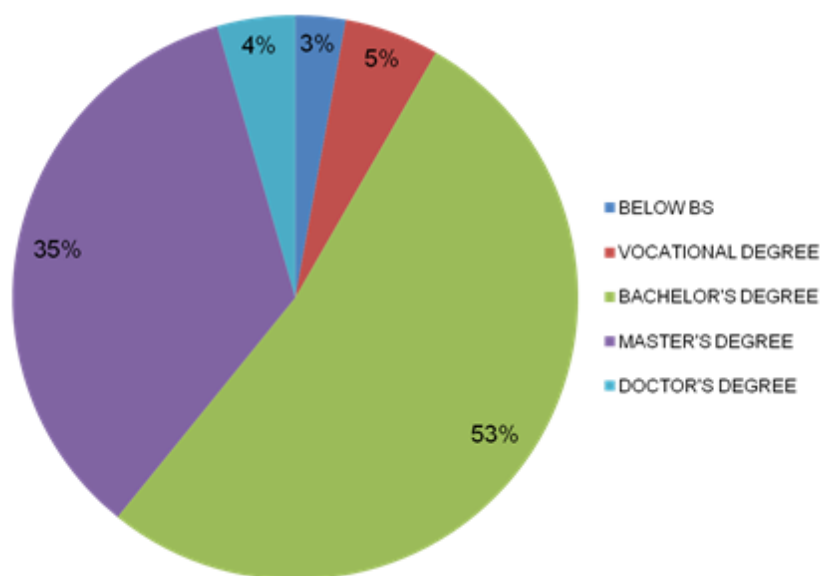
HUMAN RESOURCE

As of December 2021, the Institute has a total of 314 employees out of 369 authorized positions. In terms of number, female employees dominate the male employees accounting for 55% or 173 employees with the largest share at 15% from the Technological Services Division. The National Metrology Division is male-dominated and accounts for 14% of the total number of male employees of the Institute.



A large portion of the current DOST-ITDI human resources falls within the 31-40 age bracket with 108 employees, or 34% of the whole ITDI workforce. This is followed by the 51-60 and 21-30 age brackets with 69 and 54 employees, respectively. Majority of the divisions are composed of employees within the 31-40 age bracket, with the exception of MSD having an almost equal distribution among the age brackets.



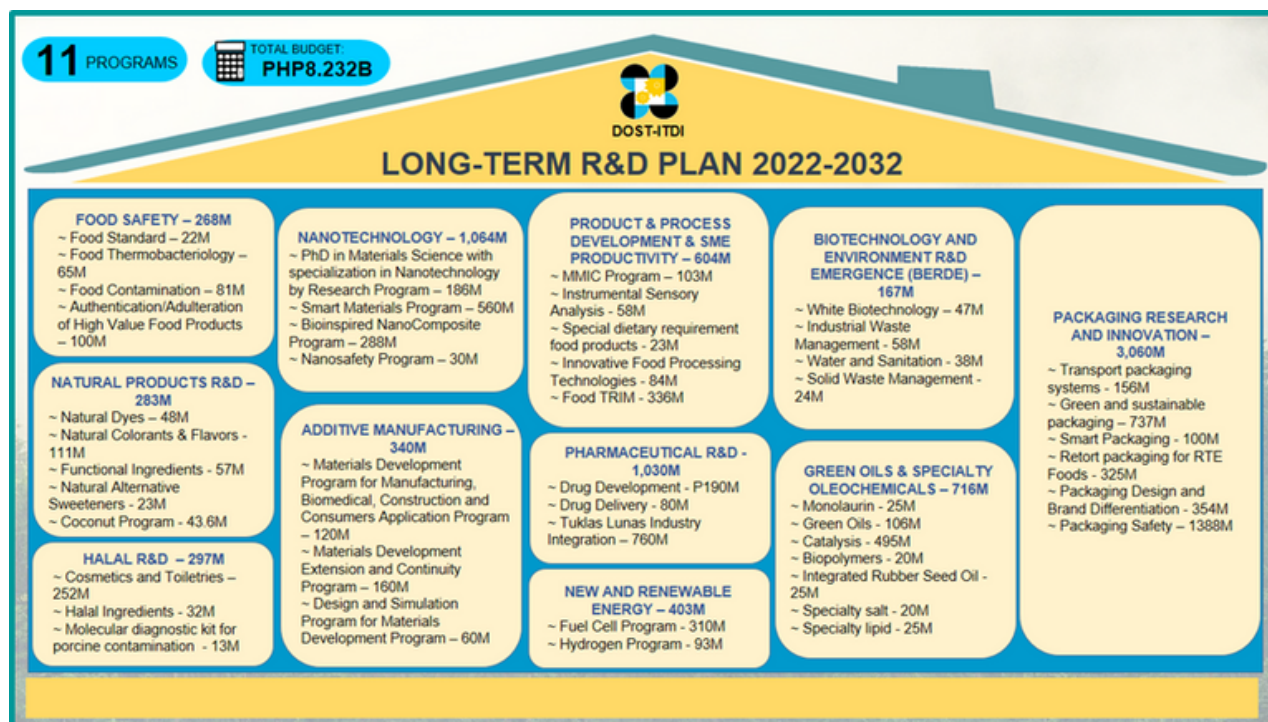


To continually uphold excellence and professionalism as an R&D institute, DOST-ITDI aggressively pushes its staff to pursue higher learning. To date, 53% comprise those with Bachelor's degrees, 35% have Master's degrees, while 4% with Doctor's degrees with some still actively pursuing their advanced studies.

In 2021, four staffs, two each from the Technological Services Division (TSD) and Standard and Testing Division (STD), completed their graduate studies.

DEGREE HOLDER	FIELD OF SPECIALIZATION
Engr. Bernadette B. Garcia (TSD)	Master of Science (MSc) in Industrial Engineering and Management
Ms. Aleli Cornelia R. Plete (TSD)	Master of Science (MSc) in Management Technology
Ms. Cyril C. Ramil, RCh (STD)	Master of Science (MSc) in Chemistry
Engr. Paul Eric C. Maglalang (STD)	Master of Science (MSc) in Material Science Engineering

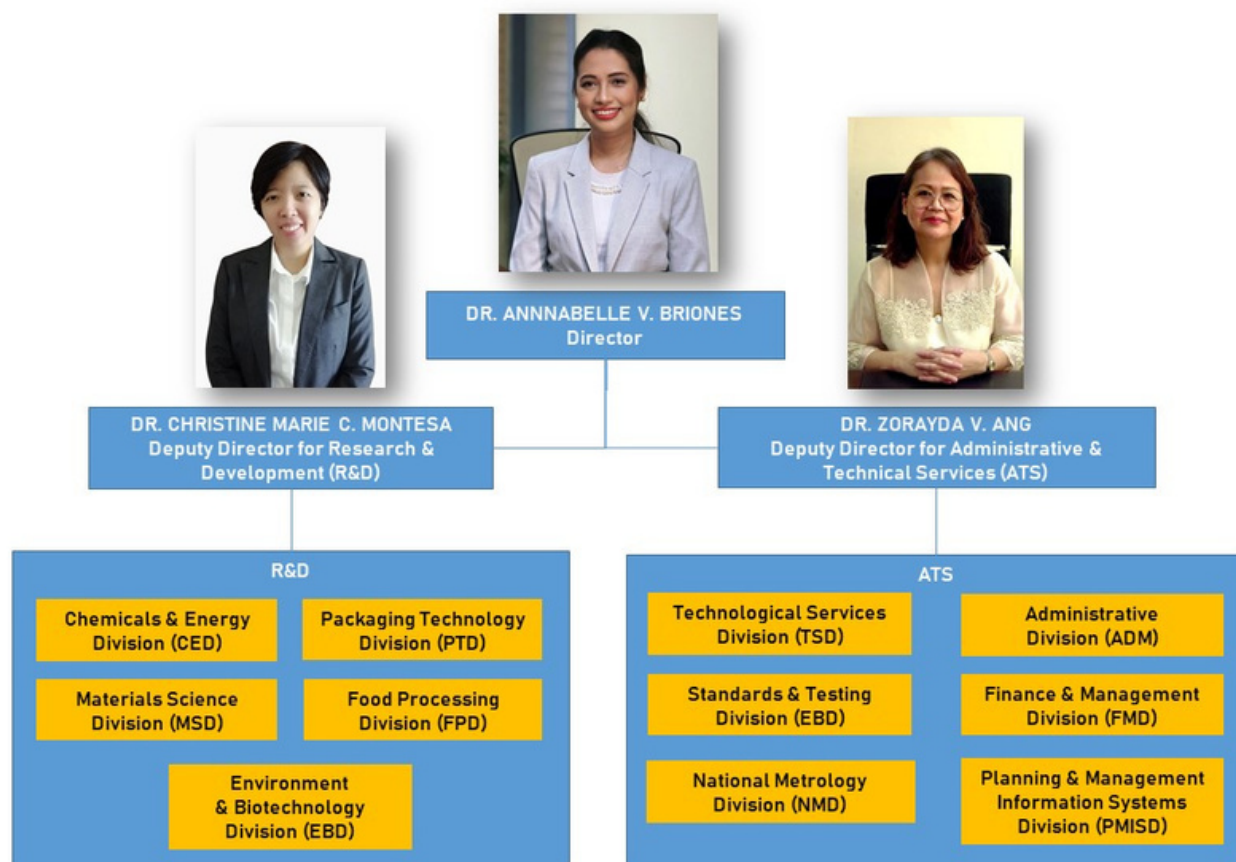
ITDI LONG-TERM PLAN



DOST-ITDI recognizes that innovation is a key driver of higher productivity, sustainable growth, and economic progress. It is in this light that the Institute conceptualized a 10-year long-term R&D and S&T plans which presents its strategic directions and overall goals to improve the country's global innovation index, benefitting all Filipinos.



ITDI ORGANIZATIONAL CHART



*Office of the Director
Office of the Deputy Directors for R&D and ATS*

Research & Development



Chemicals and Energy Division



Environment and Biotechnology Division



Food Processing Division



*Materials Science Division and
Advanced Device and Materials Testing Laboratory*



Packaging Technology Division

Technical Services



National Metrology Division



Technological Services Division



Standards and Testing Division

Administrative Services



Administrative Division



Finance and Management Division



Planning and Management Information Systems Division



Front row (L-R): Engr. R.L. Esguerra, Dr. A.V. Briones, Dr. C.M.C. Montesa, Dr. J.F. Quizon

*Middle row (L-R): Dr. N.G. Ambagan, Engr. M.M. Ruiz, Engr. A.V.O. Bawagan,
Dr. Z.V. Ang, Ms. N.E.C. Florendo*

Back row (L-R): Dr. R.C. Torres, Dr. B.A. Basilia, Ms. D.E. Tañafranca, Ms. M.M. Regonda

2021 DOST-ITDI Executive Committee

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Director

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OIC, Chemicals & Energy Division

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Systems Division

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Chief, Finance Management Division

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OIC, Administrative Division

**Inspired by
Technology**

**Driven by
Innovation**



DOST



DOST-ITDI

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