The Philippines' advances in emerging frontier technologies
Department of Science and Technology, The Philippines

For Health and the Environment

Green Packaging Laboratory
The DOST, through DOST-ITDI, Green Packaging Laboratory (GPL) was officially introduced to packaging stakeholders in December 2021. In the GPL, researchers develop environmental-friendly packaging through various approaches such as modification of processes or substitution of raw materials to reduce carbon footprint. One of GPL’s ongoing studies, which won first place in the 2021 Socially Relevant Technologies Symposium conducted by the Intellectual Property of the Philippines, was on the development of biofilms produced by bacteria from fruit wastes. Once the performance is assessed and the criteria are met, the developed biofilms may be used as alternatives to moisture-absorbing paper and non-biodegradable plastic packaging materials for food delivery.

Environment, Health and Safety Research on the Risk Assessment of Nanomaterials
Safety guidelines were developed for the nanotechnology industries, including manufacturing, monitoring worker exposure, the ambient release of nanoparticles, and risk evaluations, to promote nanotechnology for its economic incentives and medicinal applications in the Philippines. The project has established capabilities on assessing nanomaterials in terms of safety by acquiring best practices learned from ASEAN and Asia Nano Forum member countries and considering the existing international standard protocols and guidelines of the International Organization for Standardization (ISO). There was a collaboration in the academe, government research institutes, and regulatory agencies to establish guiding principles and policy standards through the Technical Committee on Nanotechnologies (TC-85) of DTI-Bureau of Philippine Standards.

Metrology in Chemistry Laboratory (MiC)
The National Metrology Laboratory (NML) of the Philippines provides local laboratories easy accessibility to reference materials (RM) and accuracy-based proficiency testing (PT) schemes produced and conducted locally. It is currently equipped with RM development facilities and high-order method development for organic and inorganic measurands through its Metrology in Chemistry Laboratory (MiC). MiC could cater to local laboratories' measurement quality control and assurance needs. This Laboratory extends further support to the manufacturing and export sectors and enforces local regulations on food safety and clean drinking water.

Power Back-up System
A power backup system has been developed to be an alternative for commercially available uninterrupted power supply (UPS). It is the solution provided by the DOST – ITDI to address the issues for continuous processing and manufacturing in areas that are highly susceptible to a power outage. It can also be used in combination with a renewable energy source to have a continuous source of electricity without interruption.
The power backup system is highlighted with its features on simplicity yet sturdy design, easy operation, maintenance, and use of locally available materials for fabrication. Parameters such as current, temperature, and relative humidity that may affect the systematic operation of the power backup system are on the prescribed scale and do not affect the reliability, durability, and efficiency of the power backup system.

The power backup system also has been proven to be effective on high consumption load without considering the entailment of cost and variability to its backup storage. The system has been tested on a pressure filter, blast freezer, slicer, grater, and conveyor.

**Data Science**

**The Computing and Archiving Research Environment (COARE)**

The DOST, through DOST-ASTI, developed the COARE which is a supercomputing facility for scientific research that offers three main services — High Performance Computing, Storage and Science Cloud. These services are crucial to research and scientific community. The setup of the COARE Facility was initially targeted to support disaster management funded by the DOST, which includes DOST-ASTI’s projects on the development and deployment of weather monitoring stations. However, the DOST-ASTI’s collaborations grew in other fields such as bioinformatics and genomics, physics, and marine science. Presently, the COARE caters to diverse users that includes meteorologists, weather scientists, climate researchers, marine scientists, bioinformatics and genomic scientists and researchers, and students.

**Philippine Earth Data Resource and Observation (PEDRO) Center**

The DOST, through DOST-ASTI, created the Philippine Earth Data Resource and Observation (PEDRO) Center which established satellite Ground Receiving Station (GRS) facilities in two cities in the Philippines with direct access to a broad range of optical and radar satellite data missions. The facility receives space-borne imagery and provides them to various government agencies for use in various operational and research activities in the areas of disaster mitigation, agricultural monitoring, forest and environmental surveillance, mariculture, urban-change detection, and other similar activities. Since its inception, the PEDRO Center has provided satellite data to 49 government agencies and academic institutions.
The GRS facilities receive imagery and data from the Philippines’ very own microsatellites Diwata-1 (decommissioned in 2020), Diwata-2 (active), and other commercial satellite subscriptions. Aside from the operations aspect, PEDRO Center also researches satellites and other wireless communication to further develop capability and capacity in the area.

**Remote Sensing and Data Science: DATOS Help Desk**

The DATOS Project, funded by the Department of Science and Technology (DOST), builds on and integrates past and ongoing DOST-supported projects and related initiatives on disaster mitigation by providing a help desk pre-, during, and post-disaster events that would provide remote sensing and data science applications support to critical activities on disaster mitigation, analysis, and advice. These activities require on-demand access to data currently available in the DOST-ASTI’s COARE and PEDRO Centers. Aside from the operations aspect, the Project also intends to conduct further research on RS and GIS, and data science in the context of these fields. DATOS products use a combination of data generated from free and commercial satellite images from PEDRO Center such as the Worldview constellation; KOMPSAT-3; Kompsat-5 and Planet; and LiDAR images, to come up with on-demand simulation modeling and analysis using RS/GIS tools. Likewise, DATOS is intended to complement disaster management-related initiatives of other government agencies.

**Geospatial Information Management and Analysis Project for Hazards and Risk Assessment in the Philippines (GeoRisk PH)**

The GeoRisk PH is a multi-agency initiative, led by the DOST-PHIVOLCS and initially monitored by DOST-PCIEERD until it was institutionalized in the former, to serve as the central source of information for hazards and risk assessments. It aims to provide protocols and platforms to share hazards, exposure and other risk information to help people, communities, local governments, and national agencies prepare and plan how to reduce the risks from natural hazards. It has four components:

1. **HazardHunterPH** which quickly generates initial hazard assessments in your selected location for seismic, volcanic, and hydro-meteorological hazards;
2. **GeoMapperPH** which collects hazard and exposure information from the office or field to ensure accurate and efficient updates in the database system;
3. **GeoAnalyticsPH** which generates summaries of hazards and risk assessment and perform analysis and visualization of exposure and elements at risk to natural hazards; and
4. **Map & Feature** which acquires up-to-date and accurate information from mandated agencies with efficiency and ease.

**Robotics and Manufacturing**

**Advanced Manufacturing Center (AMCen)**

To advance the country’s global capability and competitiveness in manufacturing, the DOST established the Advanced Manufacturing Center. AMCen is seen to revolutionize the manufacturing sophistication of the country through the use of frontier technologies primarily the 3D printing technology, development of additive materials, and implementing strong collaborative R&D activities. AMCen is a vital advanced manufacturing hub that aims to chart the
innovation course of local industries to be at par with global manufacturing giants. AMCen is expected to improve the country’s manufacturing capabilities including the MSMEs to drive the growth of the economy.

To showcase the DOST’s capability to produce sturdy structures through 3D printing technology, a 12.5-feet tall monument of the Philippines’ national hero, Dr. Jose Rizal was created and was unveiled during the hero’s commemoration of 125th year of martyrdom on 30 December 2021. The giant sculpture can withstand typhoons and wind velocity of up to 330 kilometers per hour, an earthquake of magnitude 7.0. The development and design of the “Rizal, The Filipino Scientist” monument involved experts from arts, history, and science.

Advanced Mechatronics, Robotics, and Industrial Automation Laboratory (AMERIAL)

The Industry 4.0 is a phenomenon that is out to disrupt global businesses and transform economies. Disruptive technologies such as mechatronics, robotics, and industrial automation primarily drive the transformation towards the realization of the IR 4.0, thus, AMERIAL is the facility that will enable the technological advancement, workforce improvement, and competitiveness of the country’s metals and engineering industries attuned with the new age of industrial advancement. AMERIAL will increase productivity and the country’s economy as it provides technical capacity building and developments in the industrial automation to support the local manufacturing industry’s shift to automation.