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CREATIVITY IN

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Re-energizing the Philippine nuclear machinery Mycowood Violins: a different kind of time machine DOST'S COARE supercomputing facility continues to support COVID-19-centric initiatives Japanese organization lauds silkworm rearing houses in Misamis Oriental

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I often wonder if science and the art can be mixed together when these two disciplines seem to be apart in the spectrum. Are they really two separate worlds or do they have things in common where science can be art and art can be science?

For the 2nd Quarter issue of the S&T Post, we worked around the theme "Creativity in Science" and surprisingly, when we were sifting through the many articles written and submitted to us, we found an obscure reality. Science + Art or Art + Science = Creativity!

A number of stories featured in this issue mirrors reality with the element of science, a dash of art, and a bucketful of creativity to which the latter, I believe, is the common ground. A scientist harnesses creativity, passion, and curiosity to perform experiments and do research. On the other hand, the artist who is oozing with creativity carry the same passion, curiosity, and flair to try new things, methods, and media to make a masterpiece that is unique. Both the scientist and the artist are breaking barriers to produce a new creative reality.

A quote from Albert Einstein says, "Where the world ceases to be the scene of our personal hopes and wishes,

Creativity in Science

where we face it as free beings admiring, asking, and observing, there we enter the realm of art and science. If what is seen and experienced is portrayed in the language of logic, we are engaged in science. If it is communicated through forms whose connections are not accessible to the conscious mind but are recognized intuitively as meaningful, then we are engaged in art. Common to both is the loving devotion to that which transcends personal concerns and volition."

Our quest to find convergence in science and in art paid off in this issue with stories of scientific creativity: a Pisay student named Natalia Araña, a violinist and winner of the 2nd STEM Writing contest of the New York Times; Fr. Nicanor Austriaco, O.P., the priest-scientist and author whose curiosity brings him to find solutions to COVID-19; the AMCEN-MATDEV 3D printing facility; research on bamboo musical instruments; Likhang Maragondon, a social enterprise that produces artistically designed face masks; Jea Natural Coffee's ground corn beverage; and an OFW turned shrimp farmer in Oriental Mindoro; among others.

As you flip through the pages of the Post, enjoy and be inspired by the stories of our scientists, researchers, engineers, entrepreneurs, and students who are living in the best of both worlds - science and art!

NORLY/B. VILLAR Executive Editor



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ABOUT THE COVER

The cover of the 2nd Quarter issue of the S&T Post reflects a combination of simplicity and elegance as it presents the theme "Creativity in Science" -- using the bold graphic letter "C" that envelopes the single focus photograph of a young science student by the name of Natalia Araña playing the violin. This composition represents the blend of science and art in pitch perfect harmony. Araña, a multi-talented student of the Philippine Science High School-Main Campus, recently won the prestigious The New York Times STEM Writing Contest with her entry titled, "Mycowood Violins: a different kind of time machine". A violinist herself, Natalia chose to write about the rare and famous Stradivarius and how it was able to replicate its sound through science. Her story is just one of several articles in this issue that proves that there is science in art and art in science.

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AI PINAS: how are we trying to catch up on artificial intelligence in the Philippines

By Jachin Jane O. Aberilla, DOST-ST//

An intelligent robot to monitor agricultural farms? A multi-lingual chatbot for health monitoring? A system to control and manage road traffic? These are some of the technologies applying artificial intelligence that will be soon available in the country.



(photo from Forbes.com)

But first, what is artificial intelligence or AI?

Al is globally defined as the capability of machines to imitate human cognitive functions in doing simple to complex tasks.

In simple terms, it is the intelligence of machines that can perceive their environment and take needed actions in a given situation to carry out a positive outcome.

Al vs. Robotics

Is robotics part of AI? Is AI part of robotics? What is the difference between the two? Robotics and AI serve very different purposes. However, people often get them mixed up. According to Robotiq.com, AI is the brain while robotics is the body. Robots have existed without AI in the past. As without robots, the implementation of AI is nothing but software interaction. An artificially intelligent robot is a term for the combination of these two technologies.

Al and robotics are potent combinations for automating tasks inside and outside of the factory or industry setting. In recent years, Al has become an increasingly common presence in robotic solutions, introducing flexibility and learning capabilities in previously rigid applications.

In what other fields can AI be used?

Undeniably, the use of AI technology is wide-ranging "from medical diagnosis, stock trading, robot control, law, remote sensing, scientific discovery, and toymaking." In the global market, significant AI investments are in business and health care, followed by finance and cybersecurity.

Al manifests in several forms. Here are some examples:

TECHNOLOGY & INNOVATION

- chatbots that understand customer problems faster and give practical answers
- intelligent assistants that analyze critical information from large free-text datasets
- recommendation engines that can automate recommendations for TV shows and films based on users' viewing habits
- Other AI applications that include recreation, sports, social network, education, smart home, and public safety

Al is everywhere and can be applied anywhere.

Will AI replace humans in the future?

With the recent developments in Al, most people expect that technology may reshape the nature of the working environment in many economic sectors by automation of many white-collar jobs.

According to the Philippine Statistics Authority (2017), AI poses threats of job obsolescence in several industries, particularly for a labor-abundant country such as the Philippines. With human capital as one of its most significant resources, the services sector is a substantial contributor to the country's economy, contributing around 60% of the total gross domestic product and employing about 22.8 million workers.

How do we address this?

There is a need to develop industries that may benefit from the rise of AI. According to the De La Salle University Angelo King Institute (2017), challenges are posed to the government and the education sector to achieve antifragility in the labor force.

Automation may be viewed as a threat as it harms employment, such as job displacement and reduction in investments. However, it may also provide opportunities for new jobs arising from automation, with the aim of improving productivity.



(Photo from https://corporatefinanceinstitute.com/)

Al may be more correctly defined as "augmented intelligence" as it does not necessarily eliminate the human input to production. It complements human input (De La Salle University Angelo King Institute, 2017).

Oracle (2020) highlighted that AI is much more about the process and the capability for superpowered thinking and data analysis than it is about any particular format or function. Although AI brings up images of high-functioning, humanlike robots taking over the world, AI is not intended to replace humans. AI is meant to enhance human capabilities and contributions significantly.

How is the country trying to catch up on AI?

Knowing the AI applications mentioned above and discrediting the threat that it will replace the human workforce, how is the Philippines faring in adopting AI technologies?

According to the Zendesk report in 2020, Filipino companies 4.8 % are slow adopters of Al-enabled customer support for resolving support tickets compared to their regional peers. It may be attributed to the lack of facilities and laboratories to support Al development in the country. For instance, the Philippines internet speed ranked the "second slowest" among the 10-member Association of Southeast Asian Nations (ASEAN) and 110th among 139 countries. Given this, the country is still catching up with the adoption of AI technologies. It is essential to beef up the performance and scale-up AI strategies, as well as provide support to this promising sector to boost economic growth and development effectively.

The government should target the education and industry sector to maximize Al's potential for the country to accelerate and fair among other Southeast Asian countries in innovation and development.

Are we doing something about this?

The Department of Science and Technology (DOST), through, the Philippine Council for Industry, Energy and Emerging Technology Research and Development (DOST-PCIEERD), has been investing in AI in the last ten years. DOST has included AI as one of the priority programs in the HNRDA (Harmonized National R&D Agenda) in 2016.

In 2017, the DOST through DOST-PCIEERD started building the capacity of young researchers and scientists to help redefine the future of artificial intelligence in the Philippines through the AI Pinas Summer School.

The summer school trained college professors, students, and government information technology practitioners on the theory and applications of machine





learning methodologies. It ran for 7.5 days, including a one-day conference on AI for 52 participants aiming to introduce AI's fundamental algorithms and practical applications.

The conduct of summer school has spurred more Al training programs from 2017-2019, which boosted the capabilities of Filipinos.

In 2020, DOST-PCIEERD then launched Project SPARTA or the Smarter Philippines through Data Analytics R&D, Training, and Adoption in partnership with Development Academy of the Philippines, Automobile Association of the Philippines, and Coursebank, in support of the digital transformation.

As of present, there are 24,204 scholars/ grantees under Project SPARTA, 38% of which comes from the NCR, 24% from Region 4-A, and the rest are from the other regions.

More SPARTA scholars will be supported by up to 50,000 by 2029. It is expected that 80% of the graduates will be offered new employment opportunities matching the industry needs. Homegrown talents will also be developed and increased ten-fold within this duration.

The future of AI in the country

By "trying to catch up" on the country's AI R&D (research and development) investment, the DOST has officially launched AI PINAS or the DOST-PCIEERD Artificial Intelligence Program on 08 April 2021. According to DOST-PCIEERD, AI PINAS represents the AI R&D roadmap from 2019 to 2029 that includes five targets of R&D framework:

- universal and affordable access to Al infrastructure
- upskilling the workforce and sciencebased solutions for socio-economic opportunities;
- unprecedented innovation for the industry sector, and
- enhanced policy support and stakeholder engagement.

During the launch, DOST-PCIEERD presented nine "mission-driven" AI R&D projects amounting to almost PHP316 million from AI applications in agriculture to the education sector (See illustration above).

These AI projects will be implemented by the DOST-Advanced Science and Technology Institute (DOST-ASTI), University of the Philippines Mindanao (UPMin), De La Salle University (DLSU), University of the Philippines Los Baños (UPLB), and Caraga State University (CarSU).

 DOST-ASTI and UPMin will develop Al-enhanced, mission-driven robots working autonomously or with humans. The program comprises two projects; UPMin will primarily conduct R&D towards the development of core technologies necessary for autonomous drone deployment. The team will develop UAVs (unmanned aerial vehicles) for easy monitoring, object detection, and mapping with minimal human control. On the other hand, DOST-ASTI will focus developing prototypes of unmanned ground vehicles (UGV) that will help increase the productivity of different industries in the country, especially agriculture. The technologies are envisioned to monitor, survey, and map agricultural farms for better decision-making and management.

- SkAI-Pinas or the Philippine Sky Artificial Intelligence Program by UPMin and DOST-ASTI will bridge the gap between the availability of massive remote sensing data and the lack of a sustainable technology-based framework that will facilitate widespread processing systematically and effectively. A component project will utilize Al-based techniques to enable Filipino development and deployment of relevant applications and services.
- The Intelligent Structural Health Monitoring via Mesh of Tremor Sensors (meSHM) project implemented by DLSU will develop a low-cost, wireless structural health monitoring system with visualization. The system will be made up of less than 50 sensors and will utilize internet of things (IoT) technology and mesh networks that can be installed in buildings, bridges, or metro rail systems.
- DLSU will create a system that can interpret audio input and converse with students using two major Philippine languages with: Filipino and Bisaya. They will develop speech and natural language processing models that can provide appropriate and intelligent responses to questions or suggestions. The information gathered by the healthcare chatbot will be extracted to update the health database of the students stored in the cloud. Health analytics and visualization of the collected data will also be provided for decision-making.
- To help protect the environment and reduce marine pollution, UPMin will develop a simple, cost-effective technology to monitor and quantify the marine litter in shallow coastal areas.

The technology will be based on an existing towed optical camera array system for deep-sea monitoring that has undergone sea trials. They will redesign and improve this by adding sensors and cameras to be efficiently used in shallow coastal water surveys. It will also have a built-in image processing and deep learning or machine learning capability that can identify marine litter, compute the map area covered by debris, and build models for predicting future marine litter scenarios.

- UPLB will develop an automated software that accepts values from a standard impedance spectrometer and uses a machine-learning algorithm to identify electrical, mass, and temperature parameters by looking into the time series plot and plot library. The system involves properly fitting a spectrum with sufficient parameters that minimize common errors in existing numerical fittings. The program will be integrated with a simple user interface that anyone can conveniently use. One does not need to be familiar with the specifics of the program. It can be treated like a black box. The user can input the values or parameters that s/he intends to use. The academe. particularly research, and industries involving electronics, semiconductors, food, medicine, and agriculture are targeted to benefit from this project.
- CarSu will design and develop intelligent traffic control and management using an IoT sensor network and deep learning. It will monitor traffic in a selected area by using various devices that can measure several physical traffic parameters like flow, density, volume, headway, waiting for time, throughput, and pollution. The base station will be established and equipped with intelligent behavior and direct policy search capabilities using reinforcement learning to automatically and efficiently manage traffic and avoid congestion. To make this possible, the CarSU team will design a road and vehicle traffic simulation with traffic lights based in Butuan City. They will also develop and test a prototype of

intelligent mobile traffic lights and design web-based or mobile-based applications that will enable easy access to traffic conditions.

"We recognize that these cutting-edge Al projects, if adopted by government agencies and higher education institutions (HEIs), will be a huge leap for the Philippines as we deep dive into the Al industry and harness its full potential. These projects are a testament to our shared goal of uplifting our nation by making innovations work for the Filipino people," said DOST-PCIEERD Executive Director Dr. Enrico C. Paringit during the launch of the Al PINAS projects.

Al is one significant field that can boost and usher the country to the fourth industrial revolution. Al can disrupt traditional processes and provide solutions and opportunities that Filipinos can maximize.

"DOST started investing in its AI program seven years ago, but even then, we have been trying to catch up, and within our available resources, we can catch up," highlighted during the launch.

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TECHNOLOGY & INNOVATION



PRINTING better now than later

By Rosemarie C. Señora, DOST-ST//

Endless possibilities.

Back in the old days, we only think of "printing" as putting words or images in flat surfaces like papers or T-shirts but with the advent of the fourth industrial revolution or FIRe, printing is now synonymous to creating.

Additive manufacturing, or more commonly known as 3D printing, is one of the leading emerging technologies of Industry 4.0. It entails the creation of three-dimensional objects by adding layers and layers of materials until the whole object is formed, hence the name "additive".

The earliest record of 3D printing through the additive process was the Japanese inventor Hideo Kodama of the Nagoya Municipal Industrial Research Institute in 1981. He created a product that used ultraviolet lights to harden polymers and create solid objects.

Since then, the technology has evolved to become more accessible and affordable, with varying use of hardware and materials to match market opportunities and demands.

Now, the most common form of 3D printing today is the fused geposition modeling (FDM), which was developed by Scott Crump.

To form an object, the printer heats a cable of thermoplastic into liquid form and extrudes it layer by layer.

The waiting process ranges from five minutes to as much as 200 hours depending on the size of the project.

While there are a lot of companies in the Philippines that offer 3D printing services, specialized projects would require a trip overseas just to get it right. But look no further, as the Department of Science and Technology (DOST) recently opened a laboratory under the Industrial Technology Development Institute or DOST-ITDI.

One of the DOST's priority programs, the Advanced Manufacturing Center–Materials Development (AMCen-MatDev) is the first 3D printing research and development (R&D) institution that features two state-ofthe-art research facilities that allow rapid fabrication of various three-dimensional objects–ranging from small parts to structures as big as bridges.

It is funded by the DOST Grants-In-Aid Program, a project under the Advanced Additive Manufacturing R&D Program, and was established under the auspices of DOST- Philippine Council for Industry, Energy, and Emerging Technology Research and Development.

This means endless possibilities of applications—from small parts to big structures—that can be used in aerospace, defense, biomedical, healthcare, printed electronics, agricultural machinery, and automotive industries.



Scott Crump

Response to COVID-19 pandemic

One of these applications came in handy when various parts of the Philippines were placed under enhanced community quarantine last year.



Responding to the need for personal protective equipment of our Filipino health workers when attending to patients infected by COVID-19, DOST-ITDI started producing 3D printed face shield holders based on FDM technology.

"In this time of the pandemic, brought about by coronavirus-2 (SARS-CoV-2), additive manufacturing played a great role in providing 3D printed devices to fill in the shortage of medical devices and personal protective equipment to include face shields, face masks, and valves," said DOST Sec. Fortunato T. de la Peña in a recent AMCen-MatDev stakeholder's forum.

He added that until now, a year after the entire world is hit by the pandemic, DOST-ITDI is still distributing face shields to hospitals and clinics in Metro Manila.

"Thanks to the 3D printers available at the Multiple Materials Development Facility at ITDI."

In fact, as of writing, the facility was able to print a total of 3,201 face shields donated to 46 hospitals and 10 health centers; 3,170 ear relief bands donated to 46 hospitals and nine health centers; two sets of telepresence module covers donated to the Surgical Innovation and Biotechnology Laboratory or SIBOL project of DOST-Philippine Council for Health Research and Development and University of the Philippines Manila; and seven units of VHC (valved holding chambers) donated to Philippine Children's Medical Center.

MatDev, however, not only employs AM. It also undertakes R&D (research and development) on materials for use in additive manufacturing abled or AMabled products. Their aim is to reduce cost of raw materials by using local resources and increase effective use of AMabled products.

AM market opportunities

Additive manufacturing is truly the way to go for companies heavily relying on manufacturing goods on demand. DOST-ITDI foresees that in the long run, AM can completely change the way products are designed and built—as well as distributed, sold, and serviced. This is the reason why it is important that various industries are acquainted with the technology as early as now.

DOST-ITDI Director Dr. Annabelle V. Briones said that local businesses, most of which are into subtractive manufacturing, should fast track its adaptiveness on AM as the rest of the world are now catching up on its use.

Subtractive manufacturing involves cutting away from a solid block of material. A milling machine cutting/hollowing out a piece of metal or plastic is an example of subtractive manufacturing.

Furthermore, it is interesting to note that according to the forecast made by Frost & Sullivan's Global 360 Research Team in 2016, global additive manufacturing market by value is expected to grow at a compound annual growth rate of around 15% from USD5.31 billion in 2015 to USD21.50 billion by 2025, due to increasing demand for 3D printing from industries such as automotive, dental, manufacturing, and health care.

"Likewise, during the forecast period, the market will shift from prototyping to mass production of parts and accessories. By 2025, it is predicted that additive manufacturing technologies will enable companies to produce finished products on a large scale," says Sec. de la Peña.

He added that in the era of additive manufacturing, it is no longer necessary to use welding machines to fuse steel sheets or to employ cutting machines to mill components, as the job is done by industrial 3D printers.

Truly, 3D printing unlocks a world of endless possibilities—and it's better now than later.



Dr. Annabelle V. Briones, DOST-ITDI director, during the inauguration of the AMCen facility.

Re-energizing the Philippine nuclear machinery

By Allyster A. Endozo, DOST-STII

"Out of clutter, find simplicity. From discord, find unity. In the middle of difficulty lies opportunity."

These are the three rules by which Albert Einstein's revolutionary scientific mind conceptualized his now immortally famous equation: $E = mc^2$. Since then, the world has felt the impact of his idea in action—either through the ability to decimate humanity with terrifying weapons or to sustain it with a clean, albeit risky, energy source for centuries.

The need for the latter could be felt here in the Philippines, whose power infrastructure

capital exceeded those of its Southeast Asian neighbors, and yet household electrification still sits lower at 93% in 2019. With nearly 90% of close to 21 M households nationwide reliant on electricity, greenhouse gas emissions had only increased by 9.4% per year to 69.2 M tons from 2009–2019, mostly from coal-fueled plants churning out 67.7 M tons.

This isn't so surprising as the national population had swollen from 91 M to 108.3 M during the same period, which pushed the overall consumption by 4.3% annually to 36.3 M tons of oil equivalent (MTOE). Its electricity bill is expectedly ranked among the highest in the region at USD 0.20/kWh in 2017. What is alarming though is the import dependence for more than half of its total

The nuclear laboratory building being constructed at the DOST-PNRI, then known as the Philippine Atomic Energy Commission (photo from DOST-PNRI via Philippine History and Architecture).

supply, which itself had expanded by 4.2% yearly to 60.1 MTOE.

It's quite unthinkable now that over six decades ago, the nation had just hopped onto the post-war nuclear bandwagon with the passing of the Science Act of 1958, by which the Philippine Nuclear Research Institute (DOST-PNRI) was eventually founded. Sadly, from the year of its launch in 1963 until its shutdown in 1988, the Philippine Research Reactor-1 (PRR-1) made limited tangible headway other than on training and isotope production.

The Bataan Nuclear Power Plant (BNPP) too was supposed to radiate the beacon of hope that was expected for nuclear science and technology (S&T) in the country. Initiated in 1976, its construction was ordered by then-President Ferdinand E. Marcos in response to the 1973 global energy crisis driven by the Middle East petroleum embargo. A series of blunders, however, had transformed the auspicious solution into a wasteful problem.

Safety inspection of the BNPP prompted by the 1979 Three Mile Island facility disaster in the United States (US) revealed over 4,000 defects, among which was its proximity to the Lubao Fault and the Pinatubo Volcano. By 1984, only half (621 MW) of its original capacity was built for USD 2.3 B—way higher than the USD 500 M proposal of Westinghouse Electric, which secured the project over General Electric despite lacking specifications.

Following the overthrow of the Marcos regime and the 1986 Chernobyl facility disaster in the former Soviet Union, the BNPP was never fueled and operationalized by subsequent administrations. Other than the adamant opposition by anxious residents plus various national and international organizations, its launch was effectively hampered by the debt fallout that followed, the settlement of which in 2007 took over 30 years since its inception.

The gears must turn forward

Seeking to elucidate on the possible revival of the BNPP and the country's nuclear energy sector in general is Dr. Carlo A. Arcilla, Director of the DOST-PNRI and previously for the National Institute of Geological Sciences at the University of the Philippines Diliman. Dr. Arcilla obtained two degrees from the University of Illinois at Chicago— Master of Science in Geology and Doctor of Philosophy in Geotechnical Engineering and Geosciences.

 How does nuclear power compare with other systems, particularly non-renewable ones, in terms of cost and productivity?

Nuclear power is the most reliable energy source in terms of capacity factor (CF). In the US, the CF of nuclear plants is about 1.5–2 times higher than natural gas and coal plants.

In terms of cost, a fair comparison of energy sources is based on the levelized cost of electricity (LCOE), which accounts for

costs on the basis of investment, operation and maintenance, carbon emission, decommissioning, and dismantling. The LCOE of nuclear is relatively cheaper than the LCOEs for natural gas and coal in many countries and is significantly lower than the LCOE for solar photovoltaic (PV) and offshore wind energy sources.

 <u>Could nuclear power aid in effectively</u> reducing our country's dependence on imported fossil fuels and carbon footprint?

Nuclear plants emit carbon dioxide (CO²) that is lower by at least 180% compared to the CO² emissions of fossil-fuel-based plants like coal, oil, and natural gas. In fact, the lifecycle carbon emission of nuclear is even lower by nearly 100% than of solar PV. This is one of the main reasons why several countries that are committed to reducing their carbon emission have considered or are considering nuclear as an energy source. Hence, introducing nuclear in the Philippines' energy mix will indeed reduce our country's dependence on fossil fuels and will significantly reduce our carbon footprint.

To compare costs, if the BNPP were operated, its fuel would last 18 months and would cost approximately USD 20-25 M, and the fuel would literally fit inside a jeepney or a small truck. If a coal plant with the same 620-MW output as the BNPP was operated for 18 months, the coal required would be 50 PANAMAX ships (each with 50,000-ton capacity), and its importation cost would be about USD 600 M. This does not even consider the fact that the nuclear plant has zero emissions as compared to the huge CO² produced by the coal plant.

 With the support of the incumbent administration, is it high time to rally for the BNPP's revival as what had been attempted before?

The current administration demonstrated significant support to a potential nuclear power program in the country through the signing of Executive Order No. 116, which created the Nuclear Energy Program Inter-Agency Committee (NEP-IAC).

The NEP-IAC was tasked to conduct a study for the adoption of a national position on a nuclear energy program. However, the BNPP is just one of the options being considered in the study. Following a technology-neutral approach, the study is also considering the possibility of adopting other nuclear plant designs like small modular reactors, which are ideal for archipelagic countries like the Philippines.

The really overriding reason for considering nuclear is the very high cost of electricity in the Philippines, where the median Filipino family pays more than 10% of take-home pay for electricity; this is probably the reason why a 2019 survey by the Department of Energy showed that 89% of Filipinos are open to nuclear power.



Dr. Carlo A. Arcilla (photo from DOST-PNRI).



Another important reason is the impending depletion of the Malampaya natural gas source, which accounts for 40% of Luzon's energy—nuclear could help cover the gap.

The fully paid BNPP has three sister operating nuclear plants in South Korea, Brazil, and Slovenia that have run for more than three decades safely and profitably (see below). In fact, South Korea has offered to rehabilitate the nuclear plant based on its experience operating an exact copy that has been very safe. Nevertheless, its actual revival should be based on a comprehensive comparative study, which indicates the feasibility of reviving BNPP.

 Is there validity in the opposition to the <u>BNPP's revival concerning its structural</u> <u>integrity and system operability?</u>

BNPP was constructed following the international standards and codes at the time. It was designed, manufactured, and supplied by Westinghouse, a US company, which also supplied plants with a similar design in South Korea (Kori 2 facility), Brazil (Angra 1 facility), and Slovenia (Krsko facility). These three twin plants operated for more than three decades without encountering serious problems, which is a testament to the operability of the BNPP plant design. Nevertheless, as the twin units were operated, they have undergone regular maintenance and upgrades to ensure compliance with the most current nuclear and industrial standards.

Hence, should the Philippines consider the revival of BNPP, rehabilitation activities



have to be performed to ensure that it can operate according to current standards.

 How about the reservations toward the BNPP's proximity to tectonic and volcanic hazards? Do they remain pertinent to this day?

There are a number of operating nuclear power plants that share similar tectonic and volcanic hazards as the BNPP site and have safely operated for decades. In particular, Japan's 55 nuclear power plants also have volcanic and earthquake risks and the Fukushima accident has highlighted this concern. The magnitude 9 (M9.0) earthquake that hit the seafloor not far from Fukushima NPP did not destroy the nuclear power plants, which were Japan's oldest and had a seismic rating of 0.14 g; the BNPP, in contrast, was built with a 0.4-g design. It was, rather, the succeeding tsunami that flooded the diesel engines responsible for cooling the reactors that was the main cause of the nuclear accident. Proof of this is that four other nuclear plants in the same vicinity but whose cooling systems were built at a higher elevation and out of reach of the tsunami survived. Incidentally, this tsunami inundation risk was already pointed out to the nuclear operators, but they chose to ignore it.

For the Philippine BNPP situation, there has not been an M9.0 earthquake in its history, probably because of the segmented nature of the faults as compared to the continuous Japan trench. Furthermore, the BNPP is built at an 18-m elevation, and the Fukushima tsunami was at 15 m.

It deserves to mention that all the 450+ operating nuclear power plants in the world did a "Fukushima stress test" to make sure that this incident does not happen again. Among the steps taken in operating nuclear plants are additional and redundant power sources to operate the cooling systems, hydrogen absorbers, etc.

The BNPP itself has survived several tectonic events in its history: the M7.8 earthquake in 1990 and the 1991 Pinatubo eruption (the next neighboring volcano), which was one of the strongest eruptions in the past century.

In the past, the safety inquiry through the Puno commission in 1979 concluded that there is reasonable assurance that the occurrence of earthquakes, volcanic eruptions, and tsunamis will not cause significant damage to the BNPP. The seismic design of the plant (0.4-g safe-shutdown earthquake) has taken into account the strongest earthquake that was expected to occur at the plant site. Some experts even expressed the view that this design was over-conservative.

From a scientist's and civil servant's
 perspective, what better measures could
 have been done in the past to prevent
 the BNPP's shutdown?

Since the technical aspects of the BNPP have been duly considered, it can be said that the shutdown of the plant was mostly due to political reasons, probably arising from misinformation and the unfortunate Chernobyl accident in 1986, which was of a very different design safety-wise than western nuclear plants.

Hence, more proactive stakeholder engagement activities and an efficient and effective communication plan could have averted the mothballing of the facility.

• What would be the S&T roles to be assumed by the DOST-PNRI and the PRR-1 in the event that the BNPP is revived?

In case the BNPP is revived, or any other nuclear power plant is constructed in the Philippines, the DOST-PNRI will mainly perform a regulatory function. Nevertheless, since the Institute also has research, service, and technology diffusion mandates, the DOST-PNRI can also function as a technical support organization while maintaining internal separation and independence from its regulatory division.

As for the PRR-1, the DOST-PNRI is currently constructing the PRR-1 SATER (Subcritical Assembly for Training, Education, and Research), which can be utilized as a training facility for various stakeholders of the local nuclear industry.

DOST and LGU Del Carmen to establish first water testing lab in Siargao

By Aliana Gene E. Sarmiento, DOST-Caraga Photos from DOST-Caraga



Following the pilot implementation of the FEIGS (Food Establishment Inspection and Grading System) project, the Department of Science and Technology (DOST) Caraga and LGU (local government unit) del Carmen identified the need for a water testing center in the island to help establishments comply with the food safety requirements. The nearest one is in Surigao City, which roughly takes 3-4 hours of ferry and land transportation, thus affecting the integrity and preservation of the water samples. DOST-Caraga packaged a project for the establishment of a water testing facility in the island in partnership with LGU-del Carmen and Surigao State College of Technology (SSCT)–Del Carmen Campus.

The stakeholders have already signed the memorandum of agreement committing their support to the project. Procurement of equipment is ongoing with some are now ready for delivery to Del Carmen after the installation of water and electricity in the area. The LGU will help ensure the continuity of the laboratory operations after the project completion through the provision of necessary supplies and materials plus human resources in coordination with SSCT.

TECHNOLOGY & INNOVATION



Site visit to the ongoing construction of the water testing lab.



Other ongoing projects in Del Carmen include the field testing and commercialization of the Caraga Black Native Chicken—a breeding protocol being developed by Caraga State University with the funding support from DOST-PCAARRD. DOST-Caraga also packaged a proposal for the upgrading of the eco-friendly septic tank system facility in Del Carmen's famous Sugba Lagoon to ensure proper waste treatment with the use of the Vigormin powder. In support of the conservation of the country's largest mangrove forest, the National Research Council of the Philippines conducted the Del Carmen mangrove wetland research program, which assessed and consolidated hundreds of plant and animal species in the area. The data generated backs up the LGU's application for recognition to the Ramsar Convention on Wetlands of International Importance.

Through the leadership of Mayor Engr. Proserfina Coro, a chemical engineer and former president of the Philippine Institute of Chemical Engineers, LGU Del Carmen has been actively coordinating with agencies and institutions, especially the DOST, to package programs and integrate S&T interventions into the municipal development plans. All of the existing projects on the island are fairly concerned with the quality of water, may it be for drinking or preservation of the natural ecosystem, and to further develop the socio-economic activities on the island.



DOST, OWWA, and DTI join forces on tech-based businesses for OFWs

By Aliana Gene E. Sarmiento, *DOST-Caraga* Photos from DOST-Caraga



the memorandum of agreement (MOA), committing the agencies' efforts to the program to provide the best possible assistance to the OFWs.

DOST Secretary Fortunato T. de la Peña, during his keynote message, sighted OFWs-turn-technopreneur stories from different regions and hoped to witness more success in Caraga under the program.

Sec. Fortunato T. de la Peña as the Keynote Speaker

The Department of Science and Technology (DOST) Caraga, the Overseas Workers Welfare Administration-Caraga (OWWA), and the Department of Trade and Industry-Caraga (DTI) joined forces to assist overseas Filipino Workers (OFWs) during the pandemic and introduced the pilot beneficiaries of the program during the program launch via Zoom and Facebook 12 May 2021.

The Innovations for Filipinos Working Distantly from the Philippines or iFWD PH program aims to provide opportunities for repatriated OFWs and their families to establish technology-based enterprises. The program has two phases—capacity building and innovation funding—for the establishment of an enterprise.

Thirty-two (32) OFWs from the region, who came home in the country within the past three years, passed the pre-qualification requirements and are set to start the program Phase 1 virtual training on business concept and plan development from May to July this year.

The priority technology-based business sectors include food processing, furniture making, gifts, housewares and decors, agriculture and aquaculture, metals and engineering, and health and pharmaceuticals.

DOST-Caraga Officer-in-Charge (OIC) Engr. Noel M. Ajoc, OWWA-Caraga OIC Ma. Ireen C. Cambaling, and DTI-Caraga Assistant Regional Director Gay A. Tidalgo led the signing of



iFWD PH Caraga Phase 1 OFW-beneficiaries shared their work overseas stories and hopes for the program.



MOA signing with DOST, OWWA, and DTI regional offices' representatives.

DOST capacitates Caraga's future workforce through online learning

By Dionard Mendova, DOST-Caraga Photos from DOST-Caraga

Last April, a hundred-plus Caraganons from various agencies, institutions, and private sectors gathered in a Zoom meeting to gear up for workforce advancement through the Coursera learning program. DOST-Caraga's Project "Readiness of MSMEs for Industry 4.0" led this advocacy to prepare students, entrepreneurs, and leaders for a technology-centric industry.

Alongside local government units; higher education institutes; micro, small, and medium enterprises (MSMEs); and the business chamber, DOST-Caraga aims to launch opportunities for capacity building through massive open online courses or MOOCs. These courses, categorized into specializations, are offered in Coursera, an online learning platform allied with universities and companies around the world.

Engr. Noel Ajoc, DOST-Caraga-ORD Officerin-Charge, said Industry 4.0 revolves around automation, optimization, and technology. According to him, amid the pandemic, there should be some way to continue capacity building to prepare us for these opportunities.

As the government funds more research and development projects, Engr. Ajoc emphasized the importance of expertise in the fields of data science and analytics, machine learning, Artificial Intelligence, and more. Most recommended courses in the project are aligned with these fields of study.

The project also encourages grantees to take courses of their interest aside from the recommendations. Engr. Ajoc pointed out that this rare opportunity opens the door for Caraganons to venture into new platforms of education.



Engr. Ajoc presents the readiness of MSMEs and other sectors for Industry 4.0.



In his closing message, DOST-Caraga Assistant Regional Director Ricardo Varela encouraged the scholars to pursue the recommended courses since they will be experts in the said fields of science in the Caraga region. DOST-Caraga allocated funds under the Grants-in-Aid (GIA) for the project after the success of the first partnership with Coursera, which granted 75,000 slots to Filipinos worldwide. The project will grant 270 online learning accounts to DOST personnel and partner agencies, institutions, and private sectors in Caraga.



Featured Instrument

Gabbang

A gabbang is made of sixteen (16) bamboo bars separated by nails. It is played by direct striking on the bars using a pair of wooden beaters with a piece of tube rubber called "lilisagabang". The resonating case is decorated with floral and butterfly motives, and at the side ar...

Play Audio i More Info

The sound of science:

nurturing the Philippine indigenous music through research and development

UP Center for Ethnomusicology 133 indigenous instruments

By Hanah Lee B. Tabios, DOST-PCIEERD

Aiming to preserve the legacy of indigenous Filipino instruments and artists, a group of researchers from the University of the Philippines (UP) Diliman–Electrical and Electronics Engineering Institute and DOST–Advanced Science and Technology Institute created an open-source digital database that compiles audio recording of more than a hundred Philippine indigenous music instruments found in different parts of the country.

The Katunog Project is an answer to the seemingly declining interest of Filipinos in appreciating the local indigenous musical heritage.

"For the music industry, there is a resurgence of electronic music, driven by advances in technology and demands by consumers. However, it is observed that

the Philippine indigenous instruments are not being given considerable attention and leverage for commercial success," Dr. Franz de Leon, the project lead who has a background in digital signal processing for audio signals and has a doctorate degree related to music information retrieval said. De Leon is now the Director of the Department of Science and Technology Advanced Science and Technology Institute

"Having a database of Philippine indigenous instrument sounds allows for novel research-including understanding pitch scales, analyzing sound textures, and sound similarities," he added.

De Leon noted that the percentage of contribution of copyright-based industries (CBI) to the gross domestic product is remarkable, with the Philippine CBI's

contribution to the economy as one of the highest in the world. Core CBI's include literature, music, theater, film, the media, photography, software, visual arts, advertising services, and collective management societies, thus the need to create such in the Philippines.

With a total funding of PHP 16 million, the project ran from September 2018 to September 2020. It was a collaborative work with the UP College of Music, through its dean, Dr. La Verne de la Peña, who is also the director of the UP Center for Ethnomusicology (UPCE) that has a collection of indigenous instruments from around the country.

During the data collection phase, five students played more than 100 instruments from UPCE and have been recorded.

Development of a Philippine Indigenous Instrument Sounds Database

Franz Ade Leon, PhD Electrical and ElectronicsEngineering Institute University of the Philippines - Diliman

To further expand and add authenticity in the collection, on-site recordings using different indigenous instruments in different parts of the Philippines were also arranged. These include ethnolinguistic groups Isneg (Calanasan, Apayao); Bontok (Bontoc, Mountain Province); Sinadanga (Sadanga, Mountain Province); Applai (Sagada, Mountain Province); Applai/Igorot (Besao, Mountain Province); Ati (Panay); Ata (Panay); Panay Bukidnon (Panay); B'laan (Saranggani); Manobo (Agusan del Norte); Mansaka (Davao del Norte); Maranao (Lanao del Sur); Matigsalug (Bukidnon); Subanen (Zamboanga del Sur); and Tausug (Sulu).

The online portal Philippine indigenous instruments database (katunog.asti.dost. gov.ph), with desktop and mobile-friendly versions, was then successfully put up and was made available to the public.

The database included instruments that are played in different pitches, dynamics, and styles—including solo and ensemble performances.

To give the proper context and background to the instruments, rich data were also included for every instrument. These are historical and cultural data, images, field sound recordings, and links to performances. The platform is also dataprivacy compliant. In parallel with collecting music samples, he said audio signal processing techniques will be applied to extract the qualitative features that correlate with the acoustic properties of the recordings, as well as pattern recognition to discover possible relations between instruments. Consequently, the online portal will also provide a medium for educating and promoting Philippine indigenous instruments.

But de Leon said the journey toward achieving the final goal is not easy, primarily in bridging communication gaps with the indigenous peoples (IP).

"The project team needed to secure the IP's free and prior informed consent (FPIC). This is done in coordination with the National Commission on Indigenous Peoples. For every ethnolinguistic group, we had to arrange a disclosure and seek their consent to allow the researchers to conduct the recordings. It takes a great amount of patience and continuous communications for the disclosure meetings to happen," he said.

"The issue is compounded by differences in spoken language. Through the staff's valiant efforts, we successfully secured all the necessary permits, even if our work plan got delayed," he added. The pandemic also halted several developments for the project, especially with the government-imposed restrictions.

But once done, he said Filipino composers and artists can use the sound files for their compositions. This should help strengthen the local creative economy, an emerging concept that deals with creativity, culture, economics, and technology. Ethnolinguistic groups will also be able to transmit and maintain their music to reach a wider audience.

"The academe will also foster multidisciplinary work and publish new knowledge. I also see the project as a complement for our K-12 education. Music teachers will now have a new source of materials to reinforce the lectures. Students will have a better appreciation of the indigenous instruments as they will be able to see and hear them through the online portal," he added.

The public will also be able to expose themselves to the rich music culture of the country.

De Leon said researchers should always seek meaningful collaborations to ensure the success of the project, noting the importance of including a communication and dissemination plan to ensure that the outputs of the projects will reach the target beneficiaries.

The future is creative: the role of R&D in uplifting the Philippines' creative industries

By: Beatrice Marie S. Basi, DOST PCIEERD



It is a common belief that science and art are two different worlds. But when science meets art, breakthroughs happen.

This rings true for the Philippines' creative industry sector. It is considered as a high-value contributor to the Philippine economy. In 2019, it is 6.52% of the country's gross domestic product (GDP) that is an estimated PHP 1.27 trillion. With its steady growth over the years, the Philippines is envisioning to be the number one creative economy in the ASEAN region by 2030.

But when the COVID-19 pandemic struck the globe, it has rendered creative industries at a standstill. Rep. Christopher de Venecia, the chairman of the House of Representatives' Special Committee on Creative Industry and Performing Arts, expressed that this global health crisis has heavily impacted creative industries and have pushed them to pivot to the digital space.

"All these industries are in a state of flux. They're trying to come to terms with the situation of the pandemic and are trying to find ways now to serve. So, I think, state intervention is more important now than ever," de Venecia said.

This is where science comes into the picture. Since creative industries was added to their priority areas in 2017, the Department of Science and Technology (DOST)—through the Philippine Council for Industry, Energy, and Emerging Technology Research and Development (PCIEERD) has been scoping out the needs and struggles, as well as giving support for the development of technologies for the sector.

"The Philippines' creative industries sector has a special place in the heart of DOST-PCIEERD as we believe that science and technology (S&T), through research and development (R&D), can truly drive its growth forward and up," said DOST-PCIEERD Executive Director Dr. Enrico C. Paringit.

R&D for creative industries

In an interview with Rep. de Venecia, he pointed out that R&D is essential to adapt, keep up with the times, and take full advantage of Industry 4.0.

"R&D leads to the production of more creative output whether it's goods or services. It provides more value, more jobs, more livelihood, more contributions economically, to our GDP, more export, and more intellectual property," he explained.

In complement to this and as the leader and preferred partner in enabling innovations through R&D, DOST-PCIEERD has already been supporting the development of innovations to uplift the sector.

Creative innovations before the pandemic

Even before the COVID-19 pandemic, DOST-PCIEERD is already an active supporter of the country's creative industries. These are the R&D projects and capability building initiatives that it bolstered:

Industry Defined 2D Basic
 Animation Course

The Industry-defined 2D Basic Animation Course is a 12-week intensive basic animation workshop in partnership with Toon City Academy (TCA). Commenced in 2017, its first year produced 30 graduates from Iloilo City and 26 from Dagupan City.



Rep. Toff de Venecia



TECHNOLOGY & INNOVATION



DOST-PCIEERD Executive Director Enrico Paringit

Most of these graduates were hired in the TCA's production facilities in Iloilo and Dagupan. For the second year of the course, the training facility in Dagupan will be moved to Baguio. The program team is looking into including senior high students as well.

Original Content Development Project

The Original Content Development Project provided financial assistance to five Filipino animation groups to produce their content with the goal of showcasing the content in various animation festivals like Mipcom, Kidscreen, and Annecy.

This is to foster the Philippines' animation sector to develop original content for the global animation market. Two out of the three stories were translated into animation to showcase the Philippines' talent for producing original content for the global market. The third one is currently ongoing post-production activities. One of the stories titled "DOGGO" was an entry for Animahenasyon 2019 and was awarded as the Professional Division Grand Winner and also bagged the Jury's Award.

• Katunog, the Philippine Indigenous Instrument Sounds Database

Funded in 2018, the Katunog was birthed from the Development of a Philippine Indigenous Instrument Sounds Database Project, and it is available to the public at https://katunog.asti.dost.gov.ph/. The aim of this project is to bridge the gap between traditions and the current generation. Variation in the instruments' pitch, dynamics, and playing style were considered.

Katunog contains rich descriptions and related multimedia of the instruments. The project not only aims to preserve music traditions but to also promotes and educates the public. The research component of the project included the design, development, and usage of computer tools that have the potential to assist in ethnomusicological research. The database features 104 instruments from all over the country.

The art in software development

The booming industries nowadays under the creative industries sector are game development for education and augmented reality (AR) and virtual reality (VR) development for tourism. This shows that there is art in software development.

Gaming for education may be viewed as an interference to learning in the past, but its role in education is continuously being explored as educational game are seen to increase students' motivation and engagement, enhances visual skills, improves students' interaction and collaboration abilities with their peers, and enables them to practice and apply gaming values in a real-world situation

With travel restrictions in place because of the pandemic, AR and VR technologies are emerging in the tourism industry to encourage tourists to travel and visit scenic places virtually. These offer endless ways for tourists to engage with vacation spots and far-away locations. Leveraging this technology can give the tourism industry new ways to market to and connect with guests.

DOST-PCIEERD funded the development of games for education and AR/VR techs for tourism to also usher the growth of the Philippines' information and communication technology, education, and tourism industries.

To date, these are the projects that Filipinos will soon enjoy:

- Stunt Science, a physics simulator mobile game;
- Handum, a digital game-based learning tool for primary and secondary education;
- A game-based mobile learning platform for Social Studies
- Haynayan AR, an AR-based lesson for the improvement of learning achievement in cell Biology for the STEM (science, technology, engineering, and mathematics) Curriculum
- Imahe Labs, an educational game for Chemistry in the senior high school and junior high school sectors of Baguio City;
- IJuanderer, an augmented reality-based gamified local tourism and cultural heritage promotion and preservation; and
- MR. TOURGUIDE, a cultural adaptive mapping platform using mixed reality.

What's next for the creative industries

To ensure the continuous growth and bright future of the creative industries sector, DOST-PCIEERD organized LIKHAINnovate, an S&T consultation meeting last 18 December 2020 to gather key stakeholders from the sector to discuss its current status and issues to come up with strategies for improvement for the coming years, which included forging areas for collaboration and development of innovations. DOST-PCIEERD saw the need and pledges to spur these technologies and initiatives for the creative industries sector:

- Game, animation, and film development
 - Serious game applications with AR, artificial intelligence, or machine learning
 - Software development kits
 - Human-computer interface
 - Animation tools
 - Manual for standard or baseline processes
 - Game research laboratory
 - Multimedia facility or incubation center
 - 5G ecosystem innovation center
 - Industry-defined workshops
 - Policy for protection of trade secrets and company pipelines
 - Platform for networking and linkages
 - Data analytics
- Cultural heritage (fashion and design, indigenous textiles, and musical instruments)
 - Historical building recoveries
 - Preservation of cultural heritage and structures
 - Process/product development and improvement
 - Mechanization and upscaling technologies
 - Innovation in raw materials and further development of technologies
 - Mobile and VR/AR technology
 - Manual and digital capacity and capability building of technologies, systems, and processes in the context of the region
 - Technological solution to address the effects of the pandemic
- Cultural Sites and Tourism
 - Maximizing opportunities in the virtual world, engagement to the younger generation such as Gamification of tourism experience
 - Transforming/enhancing exhibits into digital and virtual forms
 - Improving public access
 - Technology demo and assessment for digitization and preservation
- Functional and aesthetic creations
 - Facilities and laboratories

- Ergonomic technologies for craft and artisan production
- Integrating indigenous technologies in R&D
- Mechanize traditional processes
- Scale-up the manufacturing process of various sectors
- Innovation of locally- available products as raw materials
- Research on blockchain technology and tokenizing commodities
- Supply chain digitization
- Technology upgrade advancement for digital transformation
- Develop a specific loom for a certain community and establish handloom weaver training regulations for the handloom sector
- Contactless product development

It also conducted a call for proposals 2023 that opened on 03 May where Filipinos can soon expect innovations on following priority areas:

- Functional and aesthetic creations
 R&D in material innovation
- Addressesing the challenge in the availability of quality and affordable raw materials in the sector specifically for the footwear, jewelry, and furniture industries
- Design and product innovation
- Developing design and product innovation that can be utilized by creative industries' production/ manufacturing and delivery of services.
 - Innovative solutions for craft and artisanal production
 - Addresses the need to ensure and maintain the quality standard of

"Filipino" products by developing innovative solutions for crafts and artisanal production

- Animation, game, and film
 - Serious game applications for education
 - Design and development of game-based learning to effectively promote the acquisition of knowledge and skills in an exciting medium
 - Local development of software and engines
- Developing affordable, quality software for game, animation, and film

Innovate, change, and grow

It is apparent that R&D is a strong driving force to achieve breakthroughs in the Philippines' creative industries. These breakthroughs are innovations that push the sector to improve and become more resilient.

"It is our goal to provide innovative solutions and rally Filipinos to always create and innovate, because through innovations, the country changes and grows," emphasized Paringit.

This is echoed by Rep. de Venecia as he said that "there's a saying that if you don't change anything, nothing changes. So, we need to be able to constantly innovate. But on top of innovation, the greatest value of the Filipino workforce is our creativity. Creativity is inherent to each and every Filipino," said Rep. de Venecia.



Color the world naturally and safely through this **DOST**-funded colorant

By Dannieline Solis, DOST-PCIEERD



Monascus Red[™] Natural Colorant

THE PROBLEM Existing colorants in the market are mostly synthetic which lead to various safety concerns such as cancer, allergic reactions, and worsening of hyperactivity in children. Many of these colorants are not safe for human consumption, thus alternative sources are being studied and explored. Ret being the most widdly used color for food-related applications. However, there is no existing local company that produces these alternative natural colors.

Monascus Red", a natural bio-based colorant that is safe for use and has additional functional properties. It contains Monacolin K, a cholester lowering compound, as well as higher antioxidan content than commercially available Vitamin E.

THE MARKET Monascus Red" is an alternative colorant suitable for branded consumer goods (snacks, candies, chocolates, beverages, coffee, biscuits, noodles, cosmetics), swell as agro-industrial commodities such as flour, meat products, eggs, and animal

The colorant is produced using a patent-pending process using locally-available materials and is more sustainable compared to other natural colorants available in the market. It comes in powder form, with a fruity, fermented scent, and le both in water and in alcohol. Monacus



CURRENT STATUS We currently have two (2) filed production patents, one (1) approved trademark with Freedom-to-Operate, technical and material safety data sheets, as well as USFDA-based toxicity test results. Market validation studies are being done for further refinement and user-acceptability of the c

e currently looking for companies who are ted to license and commercialize Monasc



IDES MARCIANA Z. TAMBALO BIOTECH - UPLB E-mail: fztambalo@up.edu.ph

DR. RONILO P. VIOLANTA UPPLB



The color red exudes energy, passion, strength, and determination that may have fueled researchers from the University of the Philippines Los Baños (UPLB) to paint the world in a different hue with natural colorants.

Composed of a very fine and loose particles, this natural colorant has a fruity and fermented scent and is soluble both in water and alcohol. Monascus Red™ will not only satisfy your eyes but it will also keep you safe and healthy. It is non-toxic, non-mutagenic, and safe-to-use and can be stored for up to two years.

Microbiology specialist Ms. Fides Marciana Z. Tambalo said that most colorants available in the market are synthetic and may lead to cancer, allergic reactions, and even trigger hyperactivity among children.

"We came up with Monascus Red™, a natural colorant to help our dear fellow Filipinos lower their risk of many serious and chronic health conditions," Tambalo continued.

Helping you start off with healthy living, this bio-based colorant can be used for consumer goods like snacks, candies, chocolates, beverages, coffee, biscuits, noodles, and cosmetics as well as agro-industrial commodities such as flour, meat products, eggs, and animal feed.

Tambalo and her team developed three product forms—including a liquid concentrate, a meat additive tenderizer (in collaboration with one of their market validation partners), and a powdered colorant—engaged with 21 companies for testing and evaluation, secured two patents and one trademark, and many more.

There is no doubt that even big multinational food and beverage companies are developing the application of Monascus on their products. The project team has worked closely with the Food and Drug Administration for the inclusion of Monascus to the approved list of food additives in the country. Currently, Monascus already has a product code and may be registered under the novel ingredient category.

The safe and biobased Monascus Red[™] colorant was supported by the Department of Science and Technology (DOST) through the Philippine Council for Industry, Energy, and Emerging Technology Research and Development (PCIEERD) with a total grant of over PHP 17.5 million for its initial development and subsequent market validation projects.

"We are grateful for this partnership with BIOTECH-UPLB (National Institute of Molecular Biology and Biotechnology) particularly on their efforts to commercialize this alternative natural colorant that is safe for public consumption," says PCIEERD Executive Director Dr. Enrico C. Paringit. "We are optimistic that this technology will create a vibrant hue to give light during these darkest times," he continued.

Avail this bio-based colorant by contacting the project leader Ms. Fides Marciana Z. Tambalo at fztambalo@up.edu.ph and/or call (049) 536-1612.









Sample Applications

Science-based farming: the future of Caraga's coffee industry

By Dionard N. Mendova, *DOST-Caraga* Photos from DOST-Caraga

"AGRICULTURE IS a science; hence, the science-based approach is the way for us to compete," Mr. Mark Balahay, CAPE consultant to the Brgy. Durian coffee community.

In 2016, the Department of Agriculture identified the lack of quality materials among the weak points of Caraga's coffee industry. To help address the increasing demand and limited supply of quality coffee beans in the region, the Department of Science and Technology (DOST) through its Agusan del Norte and Consultancy for Agricultural Productivity Enhancement (CAPE) program identified Brgy. Durian in the municipality of Las Nieves as one of the program beneficiaries.

On 08 April 2021, Mr. Mark Balahay, CAPE Consultant and Coffee Quality Institute Q Grader at Philippine Coffee Council, trained the 15 members of the Durian Farmers' Association on Coffee Plantation Maintenance.

The consultant explained proven agricultural practices in planting density, fertilization, pest control, and rejuvenation cycle. He urged farmers to rejuvenate old coffee trees by regularly pruning or cutting secondary and tertiary branches to give more space for primary ones to grow.

In contrast to the traditional farming belief of "more branches, more fruits," rejuvenation including regular pruning and de-suckering decreases competition for nutrients resulting in more fruits and increase in yield up to 30% per season.

Although new technology results in viable coffee beans, Mr. Balahay pointed out that they don't want to exclude traditional practices in the community and encouraged the integration of practices.

He also explained that the flavor and aroma of beans reflect how farmers take care of the plantation. They give back their absorbed nutrients into organic acids transformed into flavor profiles.

Mr. Sindo, Durian Farmers' representative, said achieving this will be a joint effort between the farmers and DOST-Caraga to produce quality beans. Despite challenges, he said farmers are willing to commit and adopt new technology for increased farm yield.

DOST - Agusan del Norte Provincial Science and Technology Director Meriam Bouquia committed to providing more technology interventions and equipment to increase quality and production.



PHIVOLCS-Rapid Earthquake Damage Assessment System (REDAS) Software: Atin 'To!

By Maria Leonila Bautista, Associate Scientist, DOST-PHIVOLCS Photos from DOST-PHIVOLCS

IN 2002-2004, the Philippine Institute of Volcanology and Seismology of the Department of Science and Technology (DOST-PHIVOLCS) developed through a DOST-Grants-in-Aid project, a software called REDAS (Rapid Earthquake Damage Assessment System). The core REDAS software can simulate earthquake hazards such as ground shaking, liquefaction, landslides, and tsunami. Through the years. REDAS developed new capabilities including multi-hazard impact calculations and monitoring as well as database development in REDAS. To do this, the REDAS software developer, Dr. Bartolome C. Bautista, former Director of DOST-PHIVOLCS, put together existing database, algorithms, and freeware to create a software system. Back in 2004, the original and initial modules of REDAS were a) simply plotting lines, points, and polygons; b) viewing and sorting the Philippine earthquake catalog; and the c) seismic hazard assessment

(SHA) module. In the SHA module, the user can simulate the earthquake intensity of a given earthquake scenario and plot them as peak ground acceleration and intensity maps. Through the years, other modules were developed.

To address the need of the local government units (LGUs) to acquire immediate earthquake and tsunami information, in 2008-2009, a module on earthquake and tsunami alerting module (ETAM) was developed and added in REDAS. In this module, using internet connection, LGU operation centers can monitor automatically earthquake occurrences in near real time. Users may opt to get their information from three sources such as DOST-PHIVOLCS, the Regional Integrated Multi-Hazard Early Warning System (RIMES), and the USGS-NEIC (United States Geological Survey-National Earthquake Information Center). Users can also choose magnitude values that they want to be alerted on. Warning is issued via a speech synthesizer, which can alert Watchstanders to the occurrence of earthquake and tsunami. By 2010, another module, the REDAS exposure database module (EDM) where LGUs can develop their own exposure database using a set of questionnaire and plot them on map was developed. The REDAS EDM later on was placed in android smartphones as a collecting platform. Also by this time, to make the REDAS software multi-hazard, hazard maps of



The opening pages of the REDAS impact assessment modules: 1.SHAke (for earthquake), 2. SWIFT (for severe wind), 3. TsuSIM (for tsunami), 4) FLOAT (for flood), and 5) CropDAT (for agricultural crops)



The opening page of the REDAS hazard monitoring modules ETAM and SRM.

hydrometeorological hazards such as floods, rain-induced landslides, and storm surges are also incorporated into the software package when distributed.

Around 2014, through various partnerships, DOST-PHIVOLCS was able to develop the impact assessment capabilities of REDAS. Quantifying possible impacts will enable LGUs to prepare properly by having science-based estimate so potential losses in terms of lives and properties. To do this, PHIVOLCS initially tapped the University of the Philippines Diliman's Institute of Civil Engineering (UPD-ICE) to develop engineering fragility curves for earthquakes. The UPD- ICE later developed curves for other hazards such as floods and severe wind hazards, which are also incorporated in REDAS. Following this development—through partnerships with state universities and colleges (SUCs) in Regions II, III and XI—the REDAS SHAke module (which can compute for impacts due to earthquakes) was developed. In the SHAke module, the user can compute possible earthquake impacts such as physical damage, fatalities, and economic loss. This is possible by combining earthquake hazard simulation, exposure data, and fragility and vulnerability curves.

Then, in 2016, in partnership with the Philippine Atmospheric, Geophysical, and Astronomical Services Administration (DOST-PAGASA) and the Mines and Geosciences Bureau, DOST-PHIVOLCS added two other impact calculation-modules namely SWIFT (Severe Wind Impact Forecasting Tool) and FLoAT (Flood Loss Assessment Tool). These additional impact assessment tools allow impact calculations for severe wind and flood hazards. Post-disaster surveys especially for earthquakes are done to gather data to further improve the engineering fragility curves in REDAS. In 2017, DOST-PHIVOLCS codeveloped the Crop Damage Assessment Tool (CropDAT), in cooperation with Region I SUCs. In this module, impacts due to severe wind and floods can be computed for areas planted to agricultural crops like rice and corn. The results are in terms of losses in yield and peso values.

The module was accompanied by a mobile application on data collection that can be used by LGUs for databasing their agricultural areas. In 2019, the tsunami impact calculation module called TsuSIM (Tsunami Simulation and Impact Calculation Module) was developed. TsuSIM results are expressed in terms of the number of structures and persons affected. Damages are categorized from "none" to "severe damage" and computed based on their building types. In TsuSIM, users can plot tsunami hazard maps and, from these, will be able to define their own tsunami evacuation routes and location of signages. The TsuSIM is the module used by the REDAS Team to teach LGUs how to develop community-based tsunami early warning systems. During the same year, the 2009 REDAS ETAM was refurbished to a new ETAM. In this new ETAM, users can use Google Earth images to plot earthquakes aside from the usual earthquake monitoring. The REDAS earthquake intensity reporting module called ToSIR (Tool for Seismic Intensity Reporting) is also incorporated in this module. In ToSIR, REDAS users are able to report felt intensities whose results can help improve ground shaking simulation results. Also in 2019, the REDAS EDM was merged with the GeoMapperPH platform of DOST-PHIVOLCS' GeoRiskPH Project.

In this REDAS EDM using GeoMapperPH module, the original EDM questionnaire was retained, with some additions on building attributes related to severe wind. At the same time, the building location is collected as building polygon instead of data. Data collection is also transmitted in real time via internet to a server. In 2020, the latest REDAS module was developed, which is the Satellite Rainfall Monitor (SRM). In SRM, the users may be able to tap international organizations like NOAA (National Oceanic and Atmospheric Administration) and JAXA (Japan Aerospace Exploration Agency) to infer rainfall values in near real time. SRM was developed because raingauges are expensive and maintain and inherently difficult to install. In SRM, users may be able to install virtual rain gauges in any site of their choice. They can use this to monitor rain values, and from these, develop local early warning systems for lahars, landslides, and floods. Photo 1 shows the opening pages of the five impact assessment modules in REDAS while Photo 2 shows the two REDAS, hazard monitoring tools ETAM and SRM.

How is REDAS disseminated?

Due to high computer requirements to run simulations, running REDAS is done using individual computers. Running it via web application is difficult, considering the computer capabilities of users coupled with poor internet connectivity. At the same time, the data required such as exposure database are not readily available and has to be developed by local communities. With this situation, REDAS is shared through trainings where the software is installed in each participant's laptops. The software distribution comes with a weeklong training and post training support. This training and accompanying software provides savings for the country as software of similar kind and capabilities are expensive, hard to acquire, and needs in-depth data preparation. Since the onset of the COVID-19 pandemic, the six-day training was segregated into modular online courses, with Modules 1 and 2 being the stepping stone to higher modules—specifically impact calculations modules such as SHAke, SWIFT, FLOAT, TSuSIM, and CropDAT.

REDAS was developed by DOST-PHIVOLCS and is now being shared to LGUs as a tool for emergency preparedness, contingency planning and, more importantly, for mainstreaming disaster risk reduction into the local development planning process. The software and training are free. Interested parties need to enter into a memorandum of agreement with DOST-PHIVOLCS in order to avail of the free software and training. Despite the pandemic, for 2020, DOST-PHIVOLCS has trained 380 participants from Zamboanga Sibugay, Lanao del Norte, Iligan City, OCD (Office of Civil Defense), JICA (Japan International Cooperation Agency), Makati City, San Roque Power Corp.-including Catholic Relief Services, which supports the LGUs of Pasig, Caloocan, Manila, Pateros, and San Jose del Monte City (Bulacan), etc. For 2021, the target stakeholders are DSWD (Department of Social Welfare and Development), Light Rail Management Corp., Nueva Vizcava, Bulacan, Lanao del Norte, Iligan, and various state universities and colleges. To date, DOST-PHIVOLCS has trained 51 provinces, 29 cities/municipalities, 38 SUCs, 78 private companies, 10 non-government organizations, and five government institutions on the use of the REDAS software. Figure 1 shows the distribution of provinces trained on use of **REDAS** software.



Figure 1 show provinces trained on use f the REDAS software as of May 2021.

Effective communication vital in relaying hazard information, says geologist

By Geraldine Bulaon-Ducusin, DOST-ST//

"YOU HAVE to be very, very convincing about the urgency of the situation. You have to be an educator for the educators who will be your partners in disseminating this information."

This was according to Dr. Karlo L. Queaño, a geologist and Assistant Professor at the Ateneo de Manila University, who believes that information, education, and communication (IEC) is the most vital component when doing geohazard assessment. Further, the most difficult part of the IEC is that one really has to be a very good communicator in relaying hazard-related recommendations.

Queaño, a 2019 Achievement Awardee of the Department of Science and Technology– National Research Council of the Philippines (DOST-NRCP), shared his life as a researcher during the second webisode of iShare, entitled, "On Becoming a Researcher: Looking Back and Giving Back."

iShare is a digital storytelling platform of the DOST-NRCP which aims to inspire young people through the lives of Filipinos whose careers are in the areas of science, technology, engineering, mathematics, arts, social sciences, and the humanities.

Queaño used to be one of the team leaders in the conduct of geohazards assessment and mapping throughout the country, particularly in the aspect of rain-induced landslide and flood hazards. He expressed his sentiments when he was a geologist working in government when there were occasions that their recommendations for hazard mitigation were not heeded. In some occasions that, despite their efforts, government geologists were also criticized for the model or forecast that they have presented.

To address this mindset, he emphasized the need for people to understand the concept of model. He said that when one talks about model, it is based on assumptions and some limitations. Similarly, when one talks about forecast, it is based on a set of data at the time the forecast was formulated.

"So, it's not really a question of whether your model is right or wrong model. It's more of a question of whether or not your model really makes sense," Queaño pointed out.

Being in the field of geoscience, Queaño obtained a lot of exposure, not only with the various rock formations abroad but also with the living conditions of people from other cultures as well. He learned a lot about life of



Photo lifted from zoom presentation: Queaño initially took up AB English at the University of the Philippines Diliman, until his mother convinced him to shift to the B.Sc. Geology program in his second year. He holds an M.Sc. in Petroleum Geoscience from the Universiti Brunei Darussalam and Ph.D. in the Earth Sciences. With the inspirations that he obtained in his studies and fieldworks, both local and abroad, his motto is to work and apply his learnings that could help improve the lives of the less fortunate sectors of society.

Filipino domestic helpers, whom he shared stories with while he was on a four-year doctorate study in Hong Kong.

The stories of the domestic helpers gave him the inspiration to think of how to translate his learnings that would impact the lives of the Filipinos-the concept of giving back. Queaño imparted that giving back is what really is expected from being an *Iskolar ng Bayan*.

After some years of being a public servant at the Mines and Geosciences Bureau, Queaño joined the mining industry in 2013 because he wanted to experience first-hand what the sector is really all about and what are the social, political, and environmental issues that are confronting the mining industry. His industry experience also exposed him to the life's realities, especially poverty conditions in other countries, making him realize that many Filipinos are still fortunate despite the hardships they encounter. Because of these experiences, he knows that geologists have much to contribute to the betterment of society.

Queano expressed his gratitude to the DOST-NRCP for recognizing his contribution in the sciences and for making him a regular member. To date, he has produced at least 38 Scopus-indexed international publications. His advice to those who want to become future researchers:

"Keep your curiosity alive; find motivation in people and in your surroundings to keep you going in your research; take advantage of opportunities that can be translated into research; and-more importantly-I guess, relax, enjoy, and share your blessings particularly to the most vulnerable sectors in our society."

Who is Natalia Araña? Get to know this young Filipina student who won The New York Times STEM writing contest

By Jasmin Joyce P. Sevilla, DOST-ST// Photos from PSHS-Main Campus

ge is just a number, as they say. This was proven true by this young Filipina student who, in the young age of 16, has already made the Philippines proud. Meet Natalia Araña, a student from the Philippine Science High School-Main Campus, who was one of the 11 winners of this year's The New York Times STEM Writing Contest."

The annual writing competition, hosted by The New York Times, encouraged students, specifically teenagers across the globe to identify any subject within the field of science, technology, engineering and math (STEM), and to write about it in a way that is appealing and easily understandable to the readers. In other words, they have to make science more relatable by turning complex concepts into digestible explanations using only 500 words or less.

As a violinist herself, Natalia personally chose to write about Stradivarius, the famous and rare violin, and how they were able to replicate its sound through science.

In her essay, she explains that the Stradivarius violin remains superior for violinists and that for years, it is hard to replicate the majestic sound it makes. The culprit? Global warming. "Today, as the global temperature increases, spruce trees grow wood with greater density," Natalia mentioned in her essay. The change, as she further explains in her winning piece, has a huge effect on the sound that the wood produces, therefore affecting the quality of the violins they make.

Let's dive in more and get to know the young student who wowed the world with her passion for writing, music, and science.

1. What made you join The New York Times 'Essay Writing Contest? Can you share with us the chain of events that led you to choose your topic and write about your winning piece?

I first chanced upon a post about biotech violins on Facebook, and it immediately piqued my interest as a violinist and a student intending to pursue a career in biotechnology. Back then, I didn't know about this contest, so



Natalia Araña

I just read about the topic because I was highly intrigued by it. I found out about the contest later on when a member of our school's English publication sent a link to the New York Times Learning Network contest website.

When the time for writing my contest entry came about, I realized that the biotech violin was the perfect thing to talk about. Aside from having a STEM background thanks to Pisay, I've also been playing the violin since I was 6 years old, and it has influenced my life so much. There was also one recent memorable experience that contributed to my writing piece: during the early days of guarantine, my orchestra would have documentary viewing sessions that featured different composers. I can vividly recall one of the films that featured the Stradivarius, and how absolutely enthralled I was by its beautiful sound as it was being played in a church. That was the basis of the imagery at the start of my essay.

Overall, my experience as a violinist and performer, interest in biotechnology, and passion for science writing and communication helped me both appreciate the musical relevance of the topic and also gave me enough of a background to understand what I wrote about. Through writing about this topic, I hoped I would be able to communicate to people the wonderful connection between science, music, and the world.

2. Is it challenging to write about science and make it creative? How was your writing process on this?

It is challenging, but definitely fulfilling and even enjoyable! Personally, what helped me the most was to write about something that I really was interested in. I also enjoyed incorporating creative devices in my writing that would somehow turn my piece into a mini story. Science often already tells its own story, but it's up to us how we can retell it in our own unique way to cater to different audiences.

For the New York Times STEM Writing contest, I focused on communicating my ideas to a general audience, which meant I had to break down the more technical parts of the research and explain them in a simpler way. But first, I had to catch the attention of the readers by starting with a vivid description of a scene that would hopefully pique their interest. I also tried to keep the readers hooked throughout the entire essay by adding a little suspense here and there! For the more scientific chunk of the essay, I first took down the key points of the experiment and other technical information I felt was essential to explaining my topic. Then, I tried to make use of familiar ideas and metaphors that would help readers easily understand and visualize the concepts described.

3. What do you think makes a good, compelling science story?

Growing up, I read a lot of science books that weren't necessarily complicated. In fact, they were simple and fun to read, and I devoured them the way I devoured my beloved fiction books! I really enjoyed learning new things, but I got especially excited when I read about something that I could somehow connect or relate to. In my essay, one very prominent topic that I connected to science was music. But on top of that, I also tried to integrate a more universal kind of connection in the "global impact" part of my essay, where I talked about global warming. Global warming and climate change were ever-present topics in the books I read as a child and I think that was why they really stuck to me. That was how I realized that what we read and consume as children really affects how we think today.

It really is difficult to understand the extent of a lot of global issues, and possibly discouraging to wonder how much we can really make a difference. But every time a

young person is inspired to make their own change, that already makes an impact! This is what I aimed to do with my article-to hopefully let people think about the bigger picture. Music and the environment may seem like very distant topics at first, but in reality, everything has a connection. For me, finding this connection between science and one's personal interests or experiences is what can make a science story compelling.

4. What does winning an international essay writing contest mean to you as a young science W student? Do you have plans to pursue a career in science, in writing, or both? set on pursuing a career in the sciences since my elementary days, I had also dreamed of becoming a writer.

Now, my goal is to be able to integrate both writing and scientific work in my future career to expand the reach of science education and advance the field of STEM in the country.

5. As a 16-year old Pisay student, what are your other interests outside of school? Feel free to share your hobbies, favorite food, music, TV/Internet idols, etc.

Interestingly, Pisay actually opened me

6. What can you tell your fellow Filipino students who also have a heart for science and in writing?

Science and writing are really wonderful things to be passionate about! Personally, I believe that these two things can definitely go hand in hand to help improve science communication and education in the country, so if this is something you think you can do, go for it!

If you're like me, there may be many times that you will doubt your abilities. Honestly, I've had several moments wherein I was thinking, "Do I really have a future doing research or

> becoming a scientist in my country? Will I ever be able to publish any work as a writer?" But I'm glad that although some worries may resurface from time to time, my mindset has changed. Your future is what you make it to be! Of course, there are a lot of outside circumstances that can affect you, but if you think of where you are now, where you want to be, and make a plan from there, I believe that things can work out! Turn your doubts into actions towards growth, not hindrances! The worst thing you can do is to discourage yourself and block off any possibilities for yourself.

7. Any words of advice for kids your age studying in this challenging time?

Hang in there! I am proud of you for being able to get through this every day. It definitely isn't easy to put the effort into studying when everything in the world right now is so overwhelming. There may be days when you need to stop and take a break, and that's okay! Don't forget to look after yourself too. You can also check up on your friends and classmates, and don't be afraid to ask for help yourself! Despite the physical distance between me and my friends, I am so grateful that I still felt like I had them by my side all throughout this crazy school year. Sometimes, all we need is a reassurance that we're not alone, and that we have people there for us. That includes ourselves! So give yourself a pat on the back for doing well and a helpful push to keep going if you need it.

Read about Natalia Araña's winning piece, "Mycowood Violins: A Different Kind of Time Machine" on the next page.



When she's not burning the midnight oil, Natalia Araña keeps herself busy by playing the violin.

I think the best part about winning this contest is to be able to encourage other young Filipinos to shoot their shot as well! This was a great chance for my voice to be heard among thousands of others, and alongside it, I feel like I also brought along the voices of the people who have helped, taught, and inspired me until today. From my teachers to friends and of course my family, a lot of people have shaped my knowledge and interests. I think the best part about the topic I wrote about is that I feel like I was able to share various tiny pieces of my life or at least get inspiration from them, from my learnings at a science high school to my experience as a violinist. I am really happy that I had this opportunity to use my skills in science writing and show the world what I'm capable of, even just as a young student.

My love for both science and writing bloomed at an early age. While I have been

up to more opportunities and experiences outside the field of STEM. I met a lot of people with various interests in sports, music, art, and beyond, and was even able to dabble in these different fields myself. I became more active in sports, although I mainly swam competitively before the pandemic. I started trying out art and design. I even got to be part of a band, which expanded my violin experience beyond the classical sphere! Back in elementary, my music pretty much consisted of classical songs I was learning in my violin lessons. Now, I enjoy listening to a wide range of genres, and the songs I love the most are often tied to my favorite memories with friends, family, and even myself. Last but not the least—of course, I've always loved reading and writing! Although I mostly do article writing now, I like to get back into creative writing, poetry, and even simple journaling from time to time.

"This essay, by Natalia Araña, 16, from Philippine Science High School in Quezon City, Philippines, is one of the top 11 winners of The Learning Network's second annual STEM Writing Contest, for which we received 3,741 entries." – The New York Times

Mycowood Violins: a different kind of time machine

By Natalia Araña, PSHS-Main Campus

THE TOWERING walls of the concert hall are filled with anticipation as the audience holds its breath. Suddenly, a warm, colorful melody begins to play, filling the whole building with its majestic sound.

This is the magic of the world's most famous violin — the Stradivarius, made over 250 years ago by Italian luthier Antonio Stradivari. Today, only a few hundred of these million-dollar violins are still in existence; even fewer are being used for performance. But what if we could travel back in time and find a way to remake its unique sound?

For years, many have tried to identify and recreate what makes the instrument so special. Yet for violinists, the Stradivarius remained superior. Recently, however, scientists were able to discover one of the culprits behind the mystery of why the Stradivarius was so hard to replicate — global warming.

"Nowadays, trees grow more rapidly and unevenly than during a very particular cold spell in the 17th century, when the wood for Stradivari's instruments was felled," explained scientist Francis W.M.R. Schwarze from the Empa Applied Wood Materials Lab.

During that cold climate, wood from European spruces was homogeneous: perfect for creating an instrument with a uniform structure. Today, as the global temperature increases, spruce trees grow wood with greater density. This negatively affects the properties of an instrument's vibrations, which are also known as sound waves.

Sound waves, like tiny ocean waves, have crests and troughs with varying amplitudes. When the amplitude of sound waves traveling through a violin's plate is large compared to the force on its strings, the instrument's sound emission increases. To achieve this high plate amplitude, the wood used for the instrument must have a high radiation ratio: the ratio between sound velocity and density.

In order to let modern-day wood acquire this characteristic, Dr. Schwarze designed a different kind of time machine — an invention that could take us back to an era when wood growth and density were still untouched by global warming. How? By recreating the effects of the cold temperature on wood using a notso-secret living weapon: white rot fungi.

For three months, Dr. Schwarze let these decomposers feast on the wood until its cells shrunk, letting the timber reach its optimal density without largely affecting the speed of sound travel through the material. The result? A higher radiation ratio that made the newly created "mycowood" one step closer to the resonance wood used by Stradivari — close enough, in fact, that most listeners in a blind test mistook a fungi-treated violin for the original Stradivarius!

With these positive results, this technology could provide musicians with accessible instruments made from high quality wood, even when the original material is lost to the past.

We have tried to replicate many things taken away by climate change, from the exquisite wood of the Stradivarius to the beautiful landscapes of nature. Although we can't recover everything, researchers like Dr. Schwarze are continuing to find ways to restore the past as we carry on our battle for a more sustainable future.

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Celebrating Filipino scientists' ingenuity— Briones among the 2021 Asian Scientist Magazine 100

By Rosemarie C. Señora, DOST-STII

IT IS no question that heroes from the medical field all around the world are at the forefront of the battle against the COVID-19 pandemic. They are the reason why we are still hopeful that somehow, we can still go back to the way we live pre-pandemic.

But we must not forget the men and women of science who, amid a global pandemic, continue to make breakthroughs in their respective fields.

It is for this reason that Singapore-based Asian Science Magazine has decided to honor them and celebrate the meaningful science taking place in Asia in the sixth edition of the magazine's Asian Scientist 100.

"It is now clearer than ever that science—and scientists—are what will help us overcome challenges like COVID-19 and longer term issues like climate change," said Dr. Rebecca Tan, Editor-in-Chief of Asian Scientist Magazine.

The Asian Scientist 100 is an annual list of Asia's most outstanding scientists and researchers from China, India, Malaysia, Singapore, Japan, South Korea, the Philippines, Bangladesh, Hong Kong, Sri Lanka, Indonesia, Thailand, and Vietnam in fields ranging from biotechnology to hydrogeology.

"We are committed to shining a spotlight on the scientists who often work behind-thescenes to bring much needed innovations like new vaccines to the world," she added.

To be acknowledged on this list, the honoree must have received a national or international prize in the preceding year for his or her research. Alternatively, he or she must have made a significant scientific discovery or provided leadership in academia or industry.

DOST's pride

For 2021, eight scientists and researchers from this list are Filipino and, among them, an outstanding woman from the Department of Science and Technology (DOST).

Meet Dr. Annabelle V. Briones, Director of the DOST–Industrial Technology Development Institute (DOST-ITDI), who are recognized for her work in the development of the mosquito ovicidal/larvicidal (OL) Trap system, which was originally launched in 2011.



Dr. Annabelle V. Briones, DOST-ITDI director, during the inauguration of the AMCen facility.

Briones was awarded the 2020 Gregorio Y. Zara Award for Applied Science Research for her development of the said system to address the burgeoning problem of dengue infection by detecting, monitoring, and controlling the population of the dengue-carrying mosquitoes.

The recognition is even sweeter as Dr. Briones is also among the list of selected scientists from the 2021 edition of the Asian Scientist List.



What exactly is OL Trap?

The OL Trap technology aimed at reducing the incidence of dengue fever in the country. It makes use of simple and readily-available materials–black tumbler, lawanit strip, and larvicide pellets made up of black pepper (*Piper nigrum L.*) extracts, that attracts female *Aedes aegypti* to lay eggs on the strip soaked in larvicide solution. The solution, when absorbed by the lawanit strip, eventually kills the egg and larvae preventing the mosquito from reaching adulthood.

The solution is potent against mosquitoes but safe for humans and animals, as it is composed of ingredients commonly used in the kitchen for food preparation.

OL Trap kits are already commerciallyavailable and may be purchased in selected supermarkets nationwide.

According to the research team, the laboratory and field studies of the OL Trap system has been published in the Acta Medica Philippina Volumes 46 and 47, a peer-reviewed scientific journal published by the University of the Philippines Manila and the Philippine Council for Health Research and Development.

Together with Dr. Briones who worked for the OL Trap are team leader Dr. Nuna E. Almanzor, and team members Hermelina H. Bion, Maricar B. Carandang, Alicia G. Garbo, and Josie L. Pondevida.

The technology is even recognized nationally when in December 2014, the women power team from DOST-ITDI bagged the highly-respected *Dangal ng Bayan* Presidential Award, which was conferred during the 114th Philippine Civil Service Anniversary in Malacañang Palace, Manila.



Other Filipinos in the 2021 Asian Scientist 100 List



Dr. Kathleen B. Aviso of De La Salle University, Philippines

Aviso was awarded the 2020 Dr. Michael Purvis Award for Sustainability Research for her important contributions to environmental systems engineering, as well as developing novel optimization models to guide national and global environmental decision-making.



Dr. Salvacion Gatchalian of Research Institute for Tropical Medicine, Philippines

Gatchalian was posthumously honored with the Dr. Lourdes Espiritu Campos Award for Public Health for her advocacy for tobacco control and the immunization of children.



Dr. Desiree M. Hautea of University of the Philippines Los Baños

Hautea was conferred the 2020 Leads Agriculture Award by the Philippine Association for the Advancement of Science and Technology for her research into the adoption of the genetically modified Bt eggplant in the Philippines.



Prof. Sandra Teresa V. Navarra, MD of University of Santo Tomas Hospital, Philippines

Navarra was awarded the Dr. Paulo C. Campos Award for Health Research by the Philippine Association for the Advancement of Science and Technology for her research on lupus.

> Mr. Edgardo G. Vazquez of Vazbuilt Technology Philippines

Vazquez, known for inventing sturdy, prefabricated modular housing, won the 2020 Ceferino Follosco Award for Product and Process Innovation.



Dir. Jonel Saludes of University of San Agustin, Philippines

Saludes was awarded the 2020 Gregorio Y. Zara Award for Basic Science Research for his research into the chemical biology of natural products from organisms.



Dr. Francis Aldrine Uy of Mapua University, Philippines

Uy is the recipient of the 2020 David M. Consunji Award for Engineering Research for his engineering and innovation projects, including a sensor that monitors the structural integrity of buildings.



DOST's COARE supercomputing facility continues to support COVID-19-centric initiatives

By Dyan de los Reyes-Lamando, DOST-AST/



It has been more than a year since the COVID-19 pandemic devastated the world, affecting the global economy and altering lives. The Philippines was not spared, and the nation has been hit hard. With the virus claiming more than 20,000 lives and the total number of cases is still climbing past the one million mark, there is a need to intensify our efforts in battling this highly infectious disease.

Since March 2020, the Computing and Archiving Research Environment (COARE), the supercomputing facility housed at the Advanced Science and Technology Institute of the Department of Science and Technology (DOST-ASTI), has been instrumental in expanding our knowledge about the virus. Through the continuous allocation of its supercomputing resources, the facility did not only aid a plethora of research institutions in their highcomputing and data storage needs, but it also helped propel the nation's collective efforts to shed light on COVID-19.

Here is a look at how COARE's supercomputing facility contributed to the efforts of the government and research institutions regarding their COVID-19-centric research initiatives from the dawn of the pandemic up to the present.

FASSSTER for LGU epidemiology surveillance units

FASSSTER was officially turned over to the DOH (Department of Health) in September 2020. It is a pandemic intelligence monitoring platform that aids national government agencies, local government units (LGUs), and the Inter-Agency Task Force on Emerging Infectious Diseases (IATF) in their real-time decision-making processes, making interventions and implementing programs to address COVID-19 cases in the country. FASSSTER has a fast and secure data warehouse that features multiple modules used for collating, storing, and filtering real-time information sourced from various health records, reports, and parameters. Since March 2020, the COARE facility has been of crucial help to FASSSTER, providing access to its virtual cloud services to help them in their mathematical models and data warehouse needs.



The COVID-19 dashboard of FASSSTER.

S-PaSS (Safe, Swift & Smart Passage)

COARE has provided large storage and compute resources to the Safe, Swift & Smart Passage application or S-PaSS, a web-based system developed by the DOST Regional Office VI to manage the travels of LSIs (locally stranded individuals), ROFs (returning overseas Filipinos), APORs (authorized persons outside of residence), and ETs (emergency travelers). To manage travel and mobility in and out of the country and across provinces and regions, the IATF, LGUs, and the Philippine National Police adopted the said travel management system. With the expected scale-up of the application, COARE is ready to provide additional compute and storage resources to support its nationwide adoption.

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The interface of the web-based S-PaSS system.

COVID-19 Operations Center Monitoring Dashboard & Data Platform: DOST-ASTI and SGV & Co.

DOST-ASTI, in cooperation with SyCip Gorres Velayo & Company (SGV & Co.), developed the COVID-19 Operations Center Monitoring Dashboard and Data Platform to help LGUs in managing, tracking, and monitoring COVID-19 cases. The system consolidates COVID-19 data that LGUs can view through an easy-access dashboard. It includes visualization features like heat maps and charts for monitoring, designed for municipality up to the *barangay* level. It also includes modules for encoding patient information and assigning patient records for contact tracing. COARE has assisted the COVID-19 Operations Center Monitoring System in storing and analyzing their data through the provision of virtual servers.



The COVID-19 operations center monitoring dashboard & data platform.

SafeTravelPH

This collaborative research between the University of the Philippines (UP) Diliman and the Department of Transportation (DOTr)– Land Transportation Franchising and Regulatory Board aims to enhance the quality and safety in public transport through the deployment of SafeTravelPH, a crowdsourcing app and dashboard that provides an integrated system for real-time fleet monitoring and evaluation of public transport services. Through the establishment of an information exchange platform, this app aims to set up parameters and performance indicators for fuelefficient public transport operations through the promotion of eco-driving practices and safe commuting through real-time data feeds and commuter-contributed alerts. COARE assisted in the SafeTravelPH research through the provision of science cloud services.



The crowdsourcing application of SafeTravelPH

CovCheck Application

The Department of Computer Science and the FireCheck team of the UP Cebu has developed the web application called CovCheck. It enables LGUs in Cebu to manage and respond to the transmission of COVID-19 through the collection of data from people who have self-assessed and self-reported for COVID-19 symptoms. CovCheck also features Quarantine Buddy, an application that allows the LGU to monitor residents who are admitted to their quarantine facilities. At present, COARE has helped UP Cebu's CovCheck by hosting their web application in its virtual servers.



The COVID-19 web application of UP Cebu's CovCheck.

COVID-19 analysis; COVID-19 assembly; evolutionary analysis of SARS-CoV-2

The Philippine Genome Center (PGC) of the UP Diliman is a genome-focused institution that currently prioritizes research pursuits on COVID-19. The PGC's current activities center on phylogenetic analysis, computational studies, evolutionary analysis, molecular biology, and in *silico* detection of COVID-19. From the onset of the pandemic, COARE has given support to the PGC by providing its researchers an access to the facility's supercomputing services.



Screenshot from the PGC's virtual conference, "OnePGC," held on 10 December 2020.

Advancing Antivirals thru Combined Computational Design and Emerging Omics to Leverage Repurposed and Natural Drugs for SARS-CoV-2 Therapeutics (ACCELER8)

Faculty members and scientists from the UP Manila, PGC Mindanao, and the De La Salle University Manila are working on the ACCELER8 research project to be able to identify antiviral inhibitors of SARSCoV-2 from repurposed, commercially available drugs and Philippine natural product compounds. COARE has given ACCELER8 researchers an access to its supercomputing services to help them conduct simulations and data analysis on computational drug design and omics, supported by in silico and in vitro screening.



The research and resource portal of De La Salle University that lists the research works, activities, and initiatives related to COVID-19.

Telemedicine Network of the Philippines (TNP)

Aside from the resources provided by COARE, DOST-ASTI's high-speed network, PREGINET, has been a crucial tool for COVID-19-related activities, especially in advancing telemedicine initiatives. The only national research and education network of the country, PREGINET has been working closely with the Telemedicine Network of the Philippines to facilitate and support online events and educational webinars significant to healthcare practitioners in the local and international scenes. Since the pandemic started, the activities conducted related to telemedicine focused more in expanding useful knowledge about COVID-19.

Amid the availability of COVID-19 vaccines worldwide and the ceaseless plight of the medical community in giving assistance to COVID-19 patients, the end is still far from sight for this virulent disease. However, through the support of supercomputing facilities such as COARE, researchers are empowered to create data-driven systems, platforms, and applications, and work on research initiatives that allows us to get closer to uncovering the facets of this virus.



A telemedicine initiative during the Philippine Association of Laparoscopic and Endoscopic Surgeons Virtual Congress 2020.

About COARE

COARE (The Computing and Archiving Research Environment) is one of the services offered by the DOST-ASTI (Department of Science and Technology's Advanced Science and Technology Institute). It fosters collaboration among institutions by enabling multiple data integration between DOST-ASTIinitiated programs and other collaborative projects with other agencies that have considerable requirements for data storage and high-performance computing. The COARE facility provides a platform for easy storage, analysis, and sharing of scientific data by providing the following services: high-performance computing, science cloud, and data archiving.

About PREGINET

PREGINET is the only research and educational network (REN) in the Philippines that interconnects and catalyzes research among academic, government, and research institutions. PREGINET has links to several overseas RENs-including the Asia-Pacific Advanced Network, Asian Internet Interconnection Initiatives, and Trans-Eurasia Information Network 3.

Do you have questions about the supercomputing facility? You may send inquiries through e-mail at gridops@asti.dost.gov. ph. For more information about the COARE, interested parties may visit our wiki and Facebook.

The forgotten epidemic: mental adversities amid COVID-19

By Allyster A. Endozo, DOST-ST//



The latest data have shown that the ongoing COVID-19 pandemic has been inflicting a severe impact on the mental health of Filipinos nationwide (image from medscape.com).

It was around 1550 BC. The ancient Egyptians – despite being embroiled in bitter conflicts among warring factions – managed to write one of the world's oldest medical texts. Known as the Ebers Papyrus, the 20-m-long scroll described various illnesses that are still known today. In its aptly named Book of Hearts, depression was said to have rooted in the heart being "eaten away" by deepseated anger. Anger, perhaps likely, but towards which?

Three and a half millennia had already passed and conditions of such nature are far from being effectively managed. As much as 970 M people suffer from any mental or substance use disorder worldwide in 2017, with nearly 11 M in the Philippines. In 2015, about 3.3 M Filipinos or 3.3% of our population reportedly experienced depressive symptoms. In 2016, suicide accounted for 3.2 deaths out of 100,000 people, even more so among males (4.3).

Apart from low household income, access to mental health care has been hindered by our strong cultural stigma of being perceived as "abnormal." Those opting to seek help would have to endure systemic issues at the national level. As little as 3% of our health budget had been reserved for mental care. Among its few recipients were two tertiary-level plus 12 satellite psychiatric hospitals manned by only 2–3 health workers per 100,000 people.

It was because of these perennial challenges that our policymakers strived for many years to craft long-term solutions – both of which were finally signed into law in 2018. Section 6a of the Universal Health Care Law includes mental health among other eligible services for Filipino citizens. As its anchor, the Mental Health Act would launch a policy for medical and educational interventions in addressing both mental illnesses and prejudices thereon.

Little did anyone realize that these legal mechanisms would be denied headway to carry out their purpose, as the COVID-19 pandemic began engulfing more towns and cities. As the extent of infections and fatalities exploded, so too did the people's worries about their education, livelihood, and well-being. Crisis- and suicide-related hotline calls of 400 daily from May 2019 to February 2020 surged locally, in fact, to 953 in March–May 2020 alone.

Since then, social media posts plus news reports on relationship breakdowns, marital and child abuse, alcohol

and substance misuse, self-harm, or suicide cases have only grown more common. Yet by feeding the mind with beneficial information, rather than tragic ones constantly, the body can have much strength to overcome its daily tolls and ordeals. After all, "learning seeks not to fill empty minds but to liberate suffering ones," or so they say.

Measuring the impact

In a recent webinar, Academician Allan Benedict I. Bernardo of the National Academy of Science and Technology's (DOST-NAST) Social Sciences Division reinforced the earlier statistics. A survey in September 2020 found out that 86% of Filipinos felt stress amid the pandemic – 58% of which deemed so as "great." Even more troubling is the percentage of those who felt hungry, which grew from 20.9% in July to 30.7% or close to 7.6 M people.

However, some of these "stressed" individuals may not even be subject to the complexity by which superficial conditions are often medically diagnosed. The absence of a universal system – mainly for sectors like teenagers, young adults, high-risk and migrant laborers, plus displaced communities – makes accurate screening quite problematic. Both factors may have hindered the planning for and allocation of services and resources in the past.

Unlike typical surveys, clinical screening protocols follow a scale known as the DASS-21 tripartite model that measures the level of <u>depression</u>, <u>anxiety</u>, or <u>stress</u> among a set of respondents. Among its 21 items, symptoms of stress can manifest as mood shifts and tendencies to overreact. Anxiety can be marked by irrational fear, trembling, and panic. Most seriously, depression can be noticed in one's loss of passion and self-esteem.

From late March until mid-April 2020, the scale was applied in a study by medical and statistics experts from the University of the Philippines in Manila and Diliman, National University of Singapore, and South East Asia One Health University Network. Among the 1,879 highly-educated Filipino adult respondents, symptoms of anxiety and depression were tallied as follows: Tagalog-based Filipino (33.3 and 23.8%), Cebuano (23.1 and 20.3%), Ilokano (10.3 and 5.5%), Kapampangan (11.0 and 18.2%), and Hiligaynon (14.9 and 11.1%).

Although the sample set was regarded as not fully reflective of the population, the experts have made a few remarkable observations. Severe to extremely severe symptoms were better detected in the locally-translated DASS-21 than in the English version. Moreover, better diversity in geographical representation was attained. Lastly, the symptoms tended to be more severe in areas with high infection rates and stricter quarantine controls.

As clinical psychologists nationwide noted highly specific yet atypical symptoms of anxiety in the months during the lockdown, the team developed a novel scale to account for these developments. The 11-item Coronavirus Pandemic Anxiety Scale thus proved to be more effective as per screening capability for severe anxiety, which was registered at 29.19% compared to only 11.07% for English and 19.05% for the Philippine iteration of DASS-21.

Success, therefore, appears to have been achieved by our experts in devising new scales that can accurately detect underlying symptoms of mental distress. Perhaps in the future, both methods can be co-integrated to serve as a stronger datadriven basis in the targeted procurement of resources for mentally afflicted citizens nationwide. Now, more than ever, agility in measuring the extent of this pressing issue would be crucial for millions of lives.

Beyond measuring the severity of this pandemic's impact as it drags on this decade, the importance of a "working" system for mental health care and education — built on modern science and legal sensibilities — cannot be overstated. The socio-economic welfare of the "body" that is our republic hinges on the acumen of the "mind" that is our government. "A sound mind in a healthy body," the Romans did hint over 1,800 years ago. Lest we forget.

severe to extremely severe symptoms were identified for stress (13.4%), anxiety (28.8%), and depression (16.9%).

Seeking to test the study's accuracy, Acd. Bernardo and other researchers from De La Salle University, College of Saint Benilde, Holy Angel University, Saint Louis University, Education University of Hong Kong, Life Risks Inc., and the Cohen Clinic in Canada went to translate the DASS-21 into five Philippine languages. All 21 items were communicated in Tagalog-based Filipino, Cebuano, Ilokano, Kapampangan, or Hiligaynon, as preferred.

Among the 1,462 adults screened using Philippine languages, severe to extremely severe symptoms were noted for anxiety (19.0%) and depression (15.7%). And yet for each one, severe to extremely severe



Acd. Allan Benedict I. Bernardo (right inset) discussing the level of stress that the COVID-19 pandemic brings to Filipinos nationwide (screenshot from the DOST-NAST webinar).

Balik Scientist eyes a more accessible nuclear medicine for the Philippines

By Hans Joshua V. Dantes, DOST-PNRI

Balik Scientist Dr. Thomas Neil Pascual works on making radiopharmaceuticals more affordable and more accessible to Filipinos, especially in fighting the "fatal four" diseases.

Beyond the COVID-19 pandemic, cancer will remain dreaded by millions-both by the victims as well as their loved ones who have to keep the struggle, as cancer breaks not only the body but also the spirit. In a developing country such as the Philippines, cancer breaks your bank account as well. From getting a timely diagnosis to sustaining the grueling treatment and recovery process, the expenses alone can frame cancer as an economic bane on Filipinos battling the disease-most of whom can afford neither.

Enter Dr. Thomas Neil Pascual, one of the country's most recent *Balik* Scientists under the Department of Science and Technology (DOST). An international expert in nuclear medicine, Dr. Pascual devotes his efforts towards expanding the role of radiopharmaceuticals in the Philippine medical setting – and more importantly – making these advanced applications more affordable and available to the average Filipino.

But first, how does one go nuclear on cancer and other diseases,

amounts of these special isotopes as drugs — that's why we call them radiopharmaceuticals – which a patient takes in to help doctors get a clearer picture of the body's insides.

Radiopharmaceuticals emit low doses of radiation that are not at all harmful. Think of X-rays, but more than just the bones, you get images of vital organs such as the brain, lungs, kidneys, liver, and thyroid, among others. To produce these images, radiation technologists use specialized equipment such as gamma cameras and scanners for positron emission tomography-computed tomography (PET-CT) procedures.

While early diagnosis is key to getting better and timely treatment, many would rather hope it was nothing at all until it's too late, because spending tens or hundreds of thousands of pesos on a hunch supposedly hurts the wallet more.

This cavalier attitude towards diagnosis holds true, not just for cancer but also for other common ailments. Cancer, diabetes, and cardiovascular and chronic respiratory diseases make up the "fatal four," which account for around half of all the annual deaths in the Philippines.

"Mortality for Filipinos is still high on non-communicable



Dr. Thomas Neil Pascual, DOST Balik Scientist.

anyway? And how did such homegrown Filipino talent go on to become one of the world's leading experts in the field of nuclear medicine?

Atoms for medicine

If bombs, green glowing waste and power plants are all that you know about nuclear, think again. A large chuck of the modern world's use of radioactive materials are found in your average fullscale hospitals and medical centers.

In a nutshell, nuclear medicine refers to the use of small



DOST-PNRI Director Dr. Carlo A. Arcilla (left photo) signs a memorandum of agreement for the Balik Scientist Program with Dr. Pascual in 2019.

diseases," observes Dr. Pascual.

"Nuclear medicine is useful in appropriate medical management of certain cardiovascular diseases and cancer, among others. If these technologies are used in the proper timing and context of diseases management, mortality can be decreased, and it can also offer economic benefits in disease control."

Radiopharmaceuticals are also being used to treat diseases. A common example is the use of iodine-131 to treat thyroid cancer and hyperthyroidism caused by Grave's disease, since iodine is

HEALTH & NUTRITION



The first medical cyclotron in the country was set up in 2001 at St. Luke's Medical Center as an in-house facility.

naturally attracted to the thyroid. Radiation from it would then kill the cancer cells or reduce the overproduction of hormones that affect the metabolism, heartbeat, and weight of a patient.

Nuclear medicine in the Philippines

For Dr. Pascual, the applications of nuclear medicine in the Philippines are still on the rise, with a very progressive trend in hybrid imaging and the emerging use of theragnostics – a portmanteau of therapy and diagnostics wherein nuclear imaging is integrated in treating the patient by targeting and killing the cancer cells as precisely as possible without harming the healthy tissue around it.

However, there's still a huge room not only for expanding the plethora of radiopharmaceuticals being used, but also to make these emerging technologies more available and affordable.

There are presently 61 nuclear medicine facilities across the country, and while the numbers are good and increasing, much of these are concentrated in the NCR and other regions in Luzon. Metro Manila alone accounts for 28 of these facilities.

"There is room for improvement in the introduction of emerging radiopharmaceuticals, both for diagnostic and therapeutic intentions," says Dr. Pascual.

"We need to utilize streamlined and emerging cyclotron-derived radiopharmaceuticals into hybrid imaging practices in the country. We have limited operational medical cyclotrons, making access limited to costs and technology."

Cyclotrons produce important radioisotopes such as fluorine-18, which is used for PET-CT scans. The Philippines reached a milestone in 2001 when it had its first medical cyclotron established at St. Luke's Medical Center in Quezon City as an in-house facility.

Almost two decades later, however, there are still only a grand total of 11 units of PET-CT scanners spread among four licensed cyclotron facilities in the country; three of these are in Metro Manila and one in Cebu, with the construction of two more underway.

Unfortunately, PET-CT scans cost an average of PHP 40,000– 60,000, which is already an improvement from the early years. The said amount is also beyond the coverage of PhilHealth benefits.

Meanwhile, the Philippine Nuclear Research Institute DOST-PNRI was able to establish a technetium-99m generator facility in 2012, which aims to start the local production of the workhorse radiopharmaceutical and reduce its costs.

World-class expert and award-winning pioneer

Thankfully, the Philippines retains a strong partnership with the

International Atomic Energy Agency (IAEA), which has regularly offered its technical expertise to bolster the country's nuclear and radiation-based projects.

The IAEA's assistance was invaluable in establishment of the country's second cyclotron facility at the National Kidney and Transplant Institute, which allowed PET-CT imaging to be more accessible to several hospitals and at a reduced cost.

Dr. Pascual himself served as a Technical Officer for the IAEA, starting his stint in 2012 as a nuclear medicine physician for the international organization. He worked in several capacity building projects promoting the peaceful use of nuclear techniques in human health in member states across Africa, Asia, and the Pacific regions. Among his most notable pioneering work is his assistance in the establishment of the first nuclear medicine facility in Cambodia.

"IAEA has opened opportunities and challenges on how nuclear medicine technologies can be promoted, especially in a developing country," says Dr. Pascual.

"The experience led me to contribute to the IAEA as it works with its member states and multiple partners worldwide to promote the safe, secure, and peaceful use of nuclear technologies."

He also served as Executive Director of the Asian School of Nuclear Medicine, the educational arm of the Asian Regional Cooperative Council for Nuclear Medicine since 2007, and became the Vice-dean in 2018.

His accomplishments and exemplary contributions here and abroad earned him the IAEA Merit Award twice in 2014 and 2017, as well as the Distinguished Filipino Nuclear Medicine Award for International Leadership on the 50th anniversary of the Philippine Society of Nuclear Medicine (PSNM).

With these accolades under his belt, he would later take on the gargantuan task of expanding nuclear medicine in the Philippines as a Balik Scientist under the DOST in 2019.

Homegrown talent

 $Like\ most\ Filipinos,\ Doc\ Tom,\ as\ some\ of\ his\ colleagues\ know\ him,\ started\ out\ small\ but\ with\ a\ noble\ ambition\ to\ become\ a\ doctor.$

Fortunately for him, medicine runs in the family; his father was an alumnus of the University of Santo Tomas (UST), while her mother graduated from the University of the Philippines (UP)College of Dentistry.

"Ever since I was a child, I only wanted to be a physician as it's the only career that I was exposed to," reveals Doc Tom. $^{\prime\prime}I$ remember after classes in elementary and high school, my siblings and I would wait in the clinic until all patients are seen, then we go home altogether."

Following his father's alma mater, he took up biochemistry for his bachelor's degree before finishing his medicine at UST, earning his license as a physician at the turn of the millennium. His interest in taking up a unique practice made him specialize in nuclear medicine — which was quite a challenge since it was a fresh frontier in the Philippines at that time.

"After my medical internship at Makati Medical Center, I always wanted to get into a medical specialty which is relatively new. I finally decided to take nuclear medicine studies as there are only few specialists at that time," he says.

He pursued nuclear medicine and health professions education for his graduate studies at UST, where he was mentored by some of the best Filipino experts in the field, and graduating with honors in 2006.

Spreading his wings a bit further, he undertook a fellowship at The Children's Hospital in Westmead, Sydney, Australia. It was during his early international practice in Australia where he started to engage in pediatric nuclear medicine with specialty rotation in adult hybrid imaging (PET/CT).

From there, he would go on to hone his expertise in nuclear medicine for several more years until his official involvement with the IAEA in 2012.

Giving back as a Balik Scientist

During his stint as a Balik Scientist, Dr. Pascual closely collaborated with PNRI, particularly its Isotope Techniques Section, to help develop the national health research and development (R&D) agenda in the field of nuclear and radiation applications in medicine.

Out of this collaboration, DOST-PNRI engaged in one of its ongoing flagship projects: the establishment of the Center for Nuclear Medicine Research and Development, a massive cancerstaging center with its own cyclotron and multiple PET-CT facilities.

"Every year, 70,000 people die from cancer, and the best way to diagnose them early is through PET-CT scans," informs DOST-PNRI Director Dr. Carlo Arcilla, who is one of the project's staunchest proponents.

Intended to push down the cost of PET-CT diagnostic procedures to around a third of the current cost, the facility will also serve as a training hub for radiochemistry and hybrid imaging, among others.

Dr. Pascual also spearheaded potential R&D to widen nuclear medicine applications in the country. Among these fertile grounds are the diagnosis of neurological disorders such as dementia and related problems such as seizures, movement disorders, and even drug abuse. He also pushed for expanding the use of PET-CT imaging in heart-related diseases and its use alongside radiation therapy procedures. His rich experience working for the IAEA also proved valuable in helping to improve quality management and regulations applicable in the field. Another key accomplishment during his term as *Balik* Scientist is the initiative to improve the current nuclear medicine curriculum, particularly for graduate studies. Leading educational institutions such as the UP Manila and De La Salle University have already expressed their interest to integrate these developments in their existing courses.

Sustaining the gains

With the COVID-19 pandemic casting a slight pall on what was otherwise a truly productive year, Dr. Pascual remains hopeful that the government will sustain these initiatives despite the shifting priorities and challenges in 2020.

The virus took its toll not only on the health of more than 500,000 Filipinos, but also on the country's healthcare capacity as the sudden surge of patients and the quarantine regulations left hospitals filled to the brim.

This seriously challenged the medical sector's ability to meet the needs of patients with cancer, cardiovascular, and neurological diseases -a different epidemic of sorts, as Dr. Pascual sees it.

"Hopefully, we will stay on track," says the *Balik* Scientist, "and we'll have these problems solved through different instruments such as policy dialogue and research initiatives which would benefit the Filipino people in the long run."

Indeed, Dr. Pascual will continue to soldier on as he enters his second year of service as a Balik-Scientist, allowing him to ensure that these gains are sustained.

More than that, he is very hopeful that others will follow in his footsteps to keep the nuclear fire alive, especially in the medical field.

"Stick with science and everything else will follow. Always share the best technical knowledge in your expertise so that appropriate action can be decided upon."

The Balik Scientist Program is an initiative of the DOST since 1975 that aims to encourage Filipino, experts, scientists, and researchers based in foreign countries to return to the Philippines and contribute their expertise to the improvement of various fields and sectors.



An artist's rendition of the DOST-PNRI Center for Nuclear Medicine Research and Development soon to rise in Quezon City

Remembering two DOST champions of regional development

By Rosemarie C. Señora, DOST-ST//

THIS COVID-19 pandemic is really a thief—stealing our time, peace, and most regretfully, the lives of many people dear to us.

Among these people are two Department of Science and Technology (DOST) champions of regional development, who both served as DOST Undersecretaries for Regional Operations and will surely be missed by everyone their lives touch in their years of service for the people.

A transformational leader

A transformational leader, Usec. Brenda believed that in this fast-changing world, growth, and change are inevitable—that if we want to catch up with the rest of the world, we have to improve our ways, no matter how drastic the changes may be.

It was her transformational leadership that led to the attainment by DOST Regional Office IX–the organization she handled for more than two decades–of having the distinction as the first DOST Regional Office to have been conferred the Philippine Quality Award (PQA) Level 1: Recognition for Commitment to Quality Management (in 2012) and PQA Level 2 – Recognition for



Proficiency in Quality Management (in 2017). She also inspired four other DOST Regional Offices to embark on the quality excellence journey. With her guidance and leadership, there are now five DOST Regional Offices that have been conferred with PQA – three Regional Offices with PQA Level 2 (DOST II, DOST IX, and DOST XI), and two Regional Offices with PQA Level 1 (DOST CALABARZON and DOST VIII).

As a scholar of the former National Science and Development Board, she graduated with a degree of Bachelor of Science in Chemistry from the Western Mindanao State University, *magna cum laude*. She earned her academic units in Master of Science in Management Engineering from Adamson University and academic units in Master of Science in Chemistry from the University of Sto. Tomas. She obtained the degree of Master of Science in Environmental Engineering from the Asian Institute of Technology in Bangkok, Thailand.

DOST has been a home to Usec. Brenda. After graduating from college in 1983, she started working for the National Science and Technology Authority (now DOST), then as a Science Research Specialist 1. She rose from the ranks to become the Officer-in-Charge, Office of the Regional Director of DOST-IX in March 1991, when she was just around 29 years old. She then took her oath as the full-fledged DOST-IX Regional Director in January 1992. Twenty-five (25) years after, she became the DOST's Undersecretary for Regional Operations in January 2017.

A model leader and a recognized public manager that she was, Usec. Brenda received several awards such as the 2012 GAWAD Career Executive Service Presidential Award, the 2005 Distinguished Alumni Award conferred by the Asian Institute of Technology Alumni Association's Mother and Philippine Chapters, the Regional Outstanding Lady Executive, and the Golden Heart Medallion Award for Excellence in Science Promotion, Research and Development, and Technology Transfer, among many others. She is also a Career Executive Service Officer I.

Usec. Brenda passed away on 04 February 2021 after a long battle with cancer.

A technology transfer champion

A selfless and hardworking leader, Dr. Maripaz L. Perez devoted her life in championing technology transfer and commercialization in the country through the implementation of programs and activities to promote local technologies and inventions.

Dr. Perez joined the Socio-Economics Research Division of the Philippine Council for Agriculture, Forestry, and Natural Resources Research and Development of the Department of Science and Technology (DOST-PCARRD) right after graduating from the University of the Philippines Los Baños in 1977.

After completing her doctorate degree in Economics specializing in Resource Economics and Marketing, she pursued post-doctoral studies on research priority setting and resource allocation at the Virginia Polytechnic Institute and State University in Virginia, United States of America.

Upon returning to the country, she was appointed as Chief Science Research Specialist of the Technology Development and Regional Coordination Division of DOST-PCARRD in 1991.

In 1992, she became the Director of the Technology Application and Promotion Institute (DOST-TAPI).

During her time in the Institute, she has spearheaded the creation and operationalization of strategic programs particularly on investors' forum, display and exhibit center, production of technology packages, municipal science and technology advisory, consultancy for agricultural productivity enhancement, and global technology search.

She also developed programs on venture financing, prototype development assistance, and student enterprise development, which are still being implemented today through the Venture Financing Program, Invention-Based Enterprise Development (IBED) Program, and DOST-Academe Technology-Based Enterprise Development (DATBED) Program, respectively.

In 1998, she brought Filipino innovation in Melbourne, Australia by participating in a Filipino Show, "A Centennial Celebration of the Pilipino Community in Melbourne." The exhibition featured unique local products to stir nationalism among Filipinos in Australia and inspire them to join the national efforts to be a fullyindustrialized nation by the turn of the century.

The event aimed to draw the interest of foreign investors to these products, as well as the ideal investment climate in the Philippines and encourage them to come to the country to do business.

A year before leaving DOST-TAPI in 1999, she led the conduct of the 10th National Science and Technology Week, where it recognized the need to enhance technology transfer and accelerate technological cooperation.



Dr. Maripaz L. Perez was the DOST-TAPI Director from 1992-1999.

During the event, the Department introduced the technological exposition

and technology market as a major component of the annual fair where buyers and sellers of technologies are given a venue to conduct immediate transactions.

Dr. Perez was appointed as the DOST Assistant Secretary for Research and Development, and Technology Transfer.

She assisted the Department in implementing strategic programs to enhance the transfer and commercialization of technologies and inventions from the scientific community.

In 2001, she created the Municipal Science and Technology Advisory Program where it facilitated technology transfer delivery in 197 municipalities of 25 provinces and conducted 54 technology-based training, benefitting 6,653 individuals.

Moreover, she developed the Science and Technology Experts Volunteer Pool Program, which deployed 207 science and technology experts in 41 cities and provinces, benefitting 6,682 recipients.

The Production of Technology Packages Program and Prototype Development and Testing Program under her wing has completed nine feasibility and two industry studies, and evaluated 42 project proposals from 28 investors and 14 academies, respectively.

Finally, the Networking of DOST Standards and Testing Centers Program provided financial assistance of up to PHP 3 million pesos to six DOST Regional Science and Technology Centers for the improvement of their standards and testing services.

In 2004, she became the DOST Undersecretary for Regional Operations and spearheaded the implementation of the SETUP (Small Enterprise Technology Upgrading Program) aimed at increasing the productivity and the competitiveness of small and medium entrepreneurs all over the country.

Until her passing on 31 Mar 2021, Dr. Perez has been active in participating and contributing to DOST programs and activities by providing consultancy services and partnerships.

Maraming salamat po sa inyong tapat na serbisyo para sa bayan!

(with information from Rodolfo P. de Guzman and Jund Rian A. Doringo)

Limang chichs ni Lolo

Zampen native chicken Story

By Karl Raven Ramon, *DOST-STII* Photos by DOSTv

NEW LIFE. Tatay Bernard was earlier released in May 2019 and was given five chickens to start anew.

INMATES OR also known as "persons deprived of liberty" (PDL) in San Ramon Prison and Penal Farm (SRPPF) will received five (four hens plus one rooster) zampen native chickens once they are released to start anew.

In SRPPF, many soon to be released inmates were encouraged to join the research and development project of Western Mindanao State University (WMSU), funded by the Department of Science and Technology–Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development.

Headed by Dr. Teresita Narvaez of WMSU, their study aims to purify the disease-prone mongrel chicken (mongrel pertains to mixed races).

Jail Warden Wilfredo Castillo of SRPPF reiterates the importance of this project to their inmates, "Kadalasan po kasi ang mga PDL kapag lumalaya sila, nahihirapan silang humanap ng magandang trabaho so [ngayon] puwede silang magsimula ng pagmamanukan sa kanilang probinsya para kahit papaano makatulong sa kanilang pamilya lalunglalo na sa kanilang araw-araw na pamumuhay."



In an interview with DOSTv, Dr. Narvaez recalled how her father who used to be an inmate inspired her to integrate this project to the inmates of SRPPF to offer additional leverage in changing their ways of life.



Jail Warden Wilfredo Castillo.



DOSTv's Sinesiyensya QR code.

"Ang pure native chicken ay hindi madaling magkasakit, resistant siya sa sakit, so far noong nagsimula kami noong 2013, hindi pa kami nakaranas ng sakit tulad ng Newcastle Disease (ND),"proudly shared Dr. Narvaez. In 2016 alone, ND has killed 109,255 chickens in the country.

Aside from being resistant, Dr. Narvaez ascertained that purebred native chicken could produce 16% more eggs compared to the mongrel chicken. In their record, each of the purebred produces an average of 105 eggs per year.

You can watch the full story of the inmates of SRPPF in DOSTv's Sinesiyensya by scanning this QR code.

To date, we could only hope *Tatay* Gaudencio and Georgino are also now with their families as they were supposed to have been released in 2020.







On 14 Nov 2020, Tatay Edward was also released.

Likhang Maragondon, weaving science and art

By Joy M. Lazcano, DOST-ST//

SOME 54 kilometers south of Manila, Maragondon is a small agricultural town in the province of Cavite with an area of 16,549 hectares. It is an upland municipality with mountain ranges including Mt. Pico de Loro, Mt. Palay Palay, Mt. Hulog, Mt. Mataas na Gulong, Nagpatong, and Mt. Buntis that surround this historic town. The latter is known in history as the site where Philippine revolutionary Andres Bonifacio and his brother Procopio were executed in 1897.

When touring the town, you may see one of the 26 oldest churches in the Philippines, the 384-year-old Nuestra Señora dela Asuncion Parish standing the test of time with its wellpreserved baroque altar and pulpit. Aside from this, you will see the house where the Bonifacio brothers were court-martialed, still standing although it has undergone a facelift in recent years.

But for a town haunted by the grim events of the past, a genial endeavor is out to relive the rich heritage of artistry and creativity that weaves a tapestry of beauty and new beginnings. Making it true, the past does not make for the future, as local artisan weavers, with skills learned and passed on for generations of weavers, create ensembles of ingenious decorative and functional products. Similarly, local masters meticulously fashion unique crafts out of bamboo tubes that are incidentally abundant in the town.

Artistic social enterprise

To preserve the tradition and harness the skills and artistry of local weavers, a social entrepreneur by the name of Catherine Diquit came up with the simple venture in 2019 when she started *Likhang* Maragondon.

Likhang Maragondon is a social enterprise that taps into the traditional craftsmanship of weaving and bamboo product-making. Born out of a simple need to promote local and sustainable goods, Likhang Maragondon soon found and embraced its deeper purpose of empowering Maragondon-based artisans to preserve the art and support their livelihood at the same time.

And yes, *Likhang* Maragondon is proud of what it has created since then. According to its owner and founder Catherine Diquit, "the opportunity it has created to imagine a community of dreamers and doers. It isn't just the fabrics nor the crafts we produce; more importantly, it is the purpose and pride the work instills in every artisan we support that keeps the team moving forward."



Habing Maragondon face mask with habsak (double thread) bandana (photo courtesy of Likhang Maragondon Facebook page).

Among their famous products are the *Habing* Maragondon face masks (as appropriate during the pandemic), bamboo touch-free foot press stand, and *Habing* Maragondon kitchen towels.

The former is made from local textile woven by the last three weavers of Maragaondon "using the antique wooden looms," Diquit explains. "We want to promote *Habing* Maragondon and save our dying tradition of weaving." She added that when they started the business two years ago, there were only two weavers left; thus, they decided to put up the business to promote the town's handwoven fabrics and preserve a living heritage.

Science behind the art

Seeing the opportunity amid adversity, Diquit did not waste time to pivoting her business and buckled down to create a product that will be in great demand because of the COVID-19 pandemic—the face mask, made with science, designed with art.

Using four layers of cloth protection, the face mask they produce has an outermost layer woven with 52.3% polyester and 47.7% cotton

for aesthetics. The second outermost layer is made of hydrophobic material to protect the wearer from large droplets or splashes of bodily and hazardous fluids. It is knitted with 100% polyester fabric. The third and innermost layer is made from hydrophilic material that is knitted using 100% polyester and the other is a combination of 78.7% polyester and 21.3% rayon woven together to make a breathable and fluid resistant face mask.

For functionality, the face mask has ultrasoft and adjustable elastic ear loops that are ergonomically designed to provide ease when speaking.

What is unique of the products is that it is made up of 40% upcycled threads for sustainable production. Upcycling is the process of reusing fabrics in a way that it creates a product of higher value than its original purpose.

According to the Environmental Protection Agency in the United States (US), some 14.4 million tons of textiles were sent to the landfill in 2012 or 5.7% of the total municipal solid waste in the US. Therefore, upcycling makes a lot of sense in creating more value for otherwise waste materials that will just be thrown away.

The face mask also underwent chemical



Celebrities and news personalities seen using the Habing Maragondon face mask (clockwise): TV and movie director Cathy Garcia- Molina, ABS-CBN news reporters Jeck Batallones, Jacque Manabat, and PBA legend Jojo Lastimosa. (photo courtesy of Catherine Diquit)

and physical testing at the Department of Science and Technology's Philippine Textile Research Institute (DOST-PTRI) to meet the standards prescribed for non-medical face masks.

Following several chemical and physical tests conducted by the textile research institute on the mask's water repellency, air permeability, water absorbency, fiber composition, fabric type, and mask shape, the brand *Habing* Maragondon became the first local handwoven face mask that conformed to what the DOST-PTRI, Department of Health's Public Health Service Team, and World Health Organization prescribed as the recommended minimum specifications for non-medical face masks for community use.

According to Diquit, their sales went up when people learned that their face masks are DOST tested. She believes science and technology add value to a product as it "gives quality assurance and improves product efficiency." "Through the help of DOST-PTRI, we were able to save our small social enterprise and provide livelihood to our *kababayans* in Maragondon," added Diquit.

Currently, *Habing* Maragondon has sold 7,000 face masks as of this writing and shipped to 13 regions in the Philippines and are available in 16 cities in Metro Manila.

Opportunities beckon

As proof of their novelty and market potential, these products that are sewn and assembled by mothers at the comfort of their homes while taking care of their children have already found their way to 21 countries—including the US, Canada, France, England, Libya, Australia, Japan, and Hong Kong, among others.

From just three employees when the company started, the venture has now grown to 23 employees and is currently doing business with nine suppliers, all during the time of pandemic.

"Because I am from Maragondon," Diquit maintained. "And our main goal is to empower our locals, provide them livelihood, and everything that we sell is made by the people of Maragondon."

The popularity of her face masks spreads like wildfire as celebrities and social media personalities got hold of the hand-woven face masks, including ABS-CBN news reporters Jacque Manabat and Jeck Batallones and even the blockbuster TV and movie director Cathy Garcia-Molina and Philippine Basketball Association legend Jojo Lastimosa.

On his Facebook page Kyle "Kulas" Jennermann, the Canadian traveler turned social media influencer, encouraged Diquit to sell her face masks to the public. "You should get your masks out on the market! They are so beautiful and I am sure people will purchase."

Carpe diem

Inspired by these positive feedbacks, Diquit turns to seize the day as her enterprise continues to thrive. She plans to further strengthen her partnership with DOST to pursue the development of bamboo as textile fabric. This lady social entrepreneur said that she already presented her proposal to the Cavite Provincial Science and Technology Center for possible collaboration on fiber development using bamboo. Incidentally, Maragondon boasts of its abundant supply of bamboo in the whole province of Cavite.

Recently, DOST-PTRI has included bamboo in its efforts at nurturing the natural textile materials that will produce naturally blended yarns and woven fabrics. Based on research, bamboo possesses the highest textile yield among the local natural textile fibers such as pineapple, banana, and *abaca*.

Furthermore, the technology introduced by DOST-PTRI has optimized bamboo processing by using a combination of mechanical and chemical processes that significantly increase the value of the bamboo poles from PHP 5 per kilogram to PHP 910 per kilogram once transformed into bamboo textile fibers in a spinnable form to spun yarns.

Just like any other business venture, the journey of *Likhang* Maragondon was not easy, but it is one of the many local enterprises that found success through a combination of perseverance, a noble mission, and the use of science and technology to breathe new life to the art of community weaving.

SETUP & LIVELIHOOD



Mr.& Mrs.Efren Rapallo (right), owner of Jea Natural Coffee in Sinacaban, Misamis Occidental, pose inside the coffee processing area with DOST–Misamis Occidental staff, Provincial Director Eufresnie Ann Simbajon (2nd from left, and Rogelyn Calago (left).



Source: Jea Natural Cofee FB page

Jea Natural Coffee: brewing success thru science and technology

By Rogelyn C. Calago, DOST-X

THE WILLINGNESS to comply and the flexibility to accept change are the winning gauges of Jea Natural Coffee.

A homegrown enterprise from Sinacaban, Misamis Occidental, Jea Natural Coffee has been producing roasted ground corn beverages for more than five years now. It has been manufacturing its product using improvised roasting and grinding machines.

However, in 2020, it was as if a steaming, brewed cup of corn beverage was poured unto them when news came in that the Food and Drug Administration (FDA) tagged their product as "unregistered" at the FDA website. Hence, an advisory to the public prohibiting purchase was published.

For Jea Natural Coffee, it was not a point of turning back but a call to press on and step up. Their goal is to upgrade its production equipment, establish a good manufacturing practice (GMP)compliant production facility, and acquire a license to operate (LTO) from the FDA. In the same year, to fully realize their aspiration, Jea Natural Coffee applied for the Department of Science and Technology's (DOST) Small Enterprise Technology Upgrading Program (SETUP). By the second quarter, the firm received the DOST-SETUP assistance to upgrade its production equipment. The program also includes enhancement of product label design, GMP-compliant production building layout, and technical support on the online application for LTO.

At the start of the year 2021, the firm's application for LTO got approved. This time, they also started their production using the upgraded equipment in an enhanced and GMP-compliant facility.

With the assistance from the DOST, Jea Natural Coffee's production capacity increased from 40 to 80 kg per production schedule with 6-27% increased average productivity improvement. Even with the pandemic, the firm was able to employ four production workers and additional two sale agents.

"Dako kayo ang natabang ug kabag-ohan ang nahatag sa DOST. Sauna maulaw mi if na'ay muanha sa buhatan kay mopalit. Karon proud na mi nga mupakita sa building ug mga materials (DOST helped a lot in improving our production operations. Before, we were hesitant whenever customers visit our facility. Now we are proud to showcase our production building)," said Jill Rapallo, owner of Jea Coffee.

"For Jea Natural Coffee, success did not happen overnight. It needs determination and partnership to brew one's goal successfully. For us, we are fortunate to partner with DOST," Rapallo added.

With the willingness to accept technological innovation combined with partnership, a brew of success will surely be within the reach of Jea Natural Coffee.

For more information on the various assistance available from DOST-X, please contact Julie Anne H. Baculio, Science Research Specialist I at stpromotions@region10.dost.gov. ph or through mobile number 0917-709-3706.

Pitch perfect: innovating the local bamboo musical instruments

By Joy M. Lazcano, DOST-STII

WHEN PEOPLE say that music is food for the soul, there is truth to this saying because music, universal as it is, provides an avenue for creative expression where different emotions are expressed in lyrics and melodies.

Dr. Earl Jimenez is the Dean of Philippine Women's University School of Music. He teaches music to students including Filipino traditional music. Dr. Jimenez also owns several bamboo musical instruments in his collection. From different types of bamboo flutes, xylophones, and mouth harps, he can play most of them with ease. His collection of musical instruments varies from bamboo to gongs.

He is fond of these bamboo musical instruments (BMI) as these are very portable. "They are also relatively easy to make," he described as the material used (bamboo) in the instrument is readily available. He further explained that bamboo instruments are now being innovated using technologies to enhance its traditional sounds with the contemporary music.

And as traditional music evolves to suit the younger listeners, the Department of Science and Technology–Forest Products Research and Development Institute (DOST-FPRDI) will soon roll-out its Bamboo Musical Instruments Innovation Research & Development (BMIIRD) program to develop the BMI industry into a formidable and profitable sector to contribute

in the economy and improve the quality of BMI sold in the local and international markets.

Currently, the industry is experiencing some surge in demands for these musical instruments in the local market as modules on Philippine traditional music and instruments are part of the K-12 program. However, there still remains some challenges to fully compose an *obra maetsra*!

Barriers to creating beautiful music

The program that will be implemented by the DOST-FPRDI hopes to address the many challenges facing the production and growth of bamboo musical instruments in the country.

One of the challenges facing the growing industry is the poorly made instruments that are susceptible to insects and fungi attacks, which not only mar its appearances but also decreases the sound quality of the bamboo instruments therefore resulting to low public appreciation.

According to Dr. Jimenez, his BMI collections must be treated against insect infestation and store them in areas that are not too hot nor too cold as these instruments can easily crack. Cracks and fungi infestations may reduce the quality of its sound and playability.

He added that instrument makers need government support to improve the products so local makers can expand to a larger market.

On hitting the perfect pitch

Like any other musical instrument, every musician aims for the perfect pitch to create memorable music that will transcend generations. According to Aralyn Quintos, the BMIIRD program will provide for the establishment of a BMI Processing Center that is scheduled to be inaugurated in July 2021. The Center primarily aims to cater to the needs of producers and start-ups who wish to adopt FPRDI-developed technologies on BMI making. The Center will, likewise, host several trainings for teachers, students, and other interested individuals on BMI making and tuning. "At least 10 teaching modules/lessons have already been completed for printing and distribution to select Department of Education offices soon," confirmed Quintos.

The modules are intended to be used by K-12 teachers as guide in teaching the musical instruments to better explain the musical characteristics of the instruments to students.

Similarly, a database on BMI will be launched in August 2021 that contains photos, videos, and information on the bamboo species used in instrument making including its ethnographic reports of documented BMI makers and players, among others.

Last year, DOST-FPRDI held a virtual concert to showcase the various bamboo instruments that are used by local performers to entertain the public and preserve the Philippine musical heritage.

And for a musicologist like Dr. Jimenez, this is a welcome development for the industry as he longs to see more vibrant and innovative bamboo instrument products in the future. He hopes to see instrument makers and musicians continue to thrive in the next 10 years and local musical instruments like bamboo flutes, xylophones, and mouth harps will be more available to the public.



Former OFW turned white shrimp producer benefits from DOST-MIMAROPA's assistance

By Charlotte Pizarras, DOST-MIMAROPA



Workers at WTL Enterprises in Mansalay sort out newly harvested white shrimps ready for the market.

IN A bid to pave the way to infuse innovation in the aquaculture industry in the MIMAROPA region, the Department of Science and Technology—MIMAROPA (DOST-MIMAROPA) assisted a local white shrimp grower in Oriental Mindoro through the Small Enterprise Technology Upgrading Program (SETUP).

Located in Mansalay, Oriental Mindoro, WTL Enterprise, which is owned by a former OFW (overseas Filipino worker) and visionary entrepreneur Wilfredo T. de Lara, started off with rice milling and trading. Later on, seeing the potential of aquaculture, de Lara then ventured into *bangus* (milkfish) farming. Inspired by the world's largest shrimp producer and agriculture and aquaculture conglomerate, Charoen Pokphand Foods Philippines Corporation, de Lara converted its 10-hectare bangus farm to four earthen ponds for pacific white shrimp farming in 2017.

Pacific white shrimp, scientifically known as *Litopenaeus vannamei*, is among the world's most widely cultivated shrimp due to its ease of cultivation and rapid growth rate. However, shrimps grown in earthen ponds or ponds constructed in soil are highly vulnerable to diseases, which lead to increased mortality.

"Earthen ponds tend to have low pH, salinity, temperature as well as low dissolved oxygen during unfavorable climatic conditions, and thus creating an unfriendly environment for the cultured shrimp," said Jesse Pine, the DOST–Provincial Science and Technology Director in Oriental Mindoro.



The newly harvested white shrimps from WTL Enterprises' farm were relatively bigger than the previous harvests without technological interventions.

According to Pine, stressed shrimps are also more likely to grow in smaller sizes. He said that 30% of the enterprise's produce before consisted of small-sized shrimps that subsequently command a lower price or value.

The earthen ponds currently being used by WTL Enterprise also limits productivity to only two harvesting seasons a year since it requires at least two months of preparation before restocking.

Confronted by these problems and limitations, de Lara decided to seek the help of the DOST through SETUP last 2019 to acquire appropriate technologies to boost the productivity of his pacific white shrimp farm. Through the program, WTL Enterprise was provided with 30 sets of paddle wheel aerator and 25,480 square meters of high-density polyethylene pond lining material.



Left and right photos show the current setup of ponds with the High-Density Polyethylene (HDPE) pond liner and paddle wheel aerators.

Catch to cash: fisherfolks of Misamis Oriental generate more income through CEST

By Rain Shower R. Dalugdug, DOST-Misamis Oriental Photos from DOST-Misamis Oriental



THE DAMPIAS Fisherfolks Association (DAFIAS) of Binuangan Misamis Oriental gained more income through the science and technology (S&T) interventions from the Department of Science and Technology (DOST) Region X.

"Sa wala pay nets, tagagmay ra [ang kita] kay dili man mi makapanagat kung walay net. Karon naay gabii, muhalin mi ug tag 1,500 pesos. 1,200-1,300 pesos ang hinlo. Sa isa ka bulan, mga 12,000 to 15,000 pesos ang income.

Dako-dako gyud natabang. (Before, we can only earn a little since we have no nets, and we cannot go fishing without them. Now, we can reach PHP 1,500 sales a night with a net income of PHP 1,200–1,300. Overall, we earn PHP 12,000–15,000 a month. The project is a big help.)," said Cesar Excelise, member of DAFIAS, as he expressed his gratitude to DOST

for the livelihood support granted to their association.

Before the DOST intervention, Excelise's monthly income from squid catch ranged from PHP 6,000–7,000. The money was barely for food and other basic needs. Now, with a net of various seafood such as *kutob* and *pidlayan*, he provides not just the family's daily needs but also clothes, housewares, and two cellular phones for his children's online classes.

Excelise also thanked the local government unit of Binuangan for all the help and efforts they exert for the association. He further solidified his gratefulness to the LGU and became a volunteer of the *Bantay Dagat* or the Fish Wardens of Binuangan.

"Volunteer ko sa Bantay Dagat agi nalang tabang sa ila ba [LGU] aron makatabang sad ko sa ila sa ilang gitabang sa ako (I am now a volunteer at Bantay Dagat as my way of helping and giving back to the government)," Excelise added.

The DOST-X S&T interventions include fishing gears and training for 25 fisherfolks in Dampias, Binuangan, Misamis Oriental through a project under the CEST (Community Empowerment through Science and Technology) program. The project fund amounted to PHP 299,000.

The fishing gears were composed of multifilament nets, lead sinkers, hanging line ropes, sack floaters, and round buoys. The series of training tackled the assembly and mending of nets and the re-orientation of the Binuangan Comprehensive Fishery Ordinance in support of Republic Act No. 10654 known as the Philippine Fisheries Code of 1998.

Japanese organization lauds silkworm rearing houses in Misamis Oriental

By Danielle Jeane Quilit, DOST-Misamis Oriental Photos from DOST-Misamis Oriental



Project monitoring visit to the sericulture rearing house with DOST-MOR, PTRI-TCMO, and PAGRO (Provincial Agriculturist Office) in Sitio Saguing, Brgy. Patag, Opol in Misamis Oriental.

JAPANESE NATIONAL Yukihiro Ishibashi— Resident Representative of the Organization for Industrial, Spiritual, and Cultural Advancement (OISCA) International—gladly expressed his satisfaction with the silkworm or sericulture rearing houses in Misamis Oriental. He recently visited two sericulture project sites in Sitio Saguing, Barangay Patag in the Municipality of Opol and Barangay Balubal in Cagayan de Oro City, both in Misamis Oriental.

OISCA is an international organization based in Japan committed and dedicated to promoting international cooperation. One of its programs is on sericulture industry development in the Philippines. In fact, the organization funded the construction of a silkworm rearing house in Barangay Patag.

Misamis Oriental is one of the seven beneficiary provinces for skills training and other assistance for sericulture operations. The other provinces include Benguet, Nueva Vizcaya, Aklan, Iloilo, Antique, and Negros Occidental. The aim is to develop model sericulture farmers with abilities to produce high-quality cocoons at a faster pace. To further support the initiative, the Department of Science and Technology– Misamis Oriental (DOST-MOR) sourced funds from OISCA worth PHP 145,000 for the silkworm rearing house. The agency then linked the farmers to the Philippine Textile Research Institute–Technology Center in Misamis Oriental (PTRI-TCMO) for training and technical assistance in silk cocoon production.

Four members of the Sitio Saguing Community Farmers Association (SSCFA) in CNQ Farms have just completed a three-day hands-on training on sericulture at the PTRI-TCMO, Villanueva, Misamis Oriental last 05-07 May 2021. Evaluators of the rearing house in Barangay Patag considered the facility to be suitable for silkworm rearing and functional for silk cocoon production.

Meanwhile, the sericulture project in Barangay Balubal was made possible by the DOST Local Grants-In-Aid program in cooperation with the local government unit of Cagayan de Oro City through the City Housing and Urban Development Department. As a result, the project's beneficiaries were

successful in their first and second silk cocoon harvest last 14 February and 28 April of this year, respectively.

Ishibashi expressed his great appreciation for the building of the rearing houses. He further said that the setup was very ideal considering the distance between the rearing house and the mulberry field of the sericulture site in Barangay Balubal.

"They are very cooperative with our activities in OISCA so I'm very happy and satisfied with the performance of the staff of the government, at the same time [the] cooperation of the community beneficiaries in Misamis Oriental," Ishibashi said as he expressed his gratitude and appreciation to the government agencies involved in the implementation of the sericulture projects.

Ishibashi vouched that OISCA will continue to support the development of the silk industry in the province and help communities in their livelihood. To know more about the project, please contact Julie Anne H. Baculio, Science Research Specialist I at stpromotions@region10. dost.gov.ph or mobile number 0917-709-3706.



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