Philippine Council for Industry, Energy and Emerging Technology Research and Development (PCIEERD)











Annual Report 2013

Philippine Council for Industry, Energy and Emerging Technology Research and Development

PROFILE

The Philippine Council for Industry, Energy and Emerging Technology Research and Development (PCIEERD) is one of the three sectoral planning councils of the Department of Science and Technology (DOST).

It is mandated to serve as the central agency in the formulation of policies, plans and programs as well as in the implementation of strategies in the industry, energy and emerging technology sectors through the following S&T programs:

- Policy Development and Advocacy
- Support for Research and Development
- Human Resource and Institution Development
- S&T Information Dissemination and Promotion
- Support for Technology Transfer and Commercialization

VISION

The PCIEERD envisions to be recognized for the quality of its people, leadership and performance and contribute to the nation's productivity and competitiveness.

Towards this end, the PCIEERD commits to pursue and make available S&T solutions and innovations to help create and sustain competitive industries, attain energy self-sufficiency, and ensure the efficient and effective use of emerging technologies for the inclusive growth and development of the country, through:

- a well-defined Research and Development (R&D) thrust from innovative idea to technology development and knowledge generation to technology transfer and utilization
- active engagement of scientists, researchers and engineers in R&D activities
- strengthened partnerships and significant collaborations with industry, academe and government agencies to complement resources and expertise.

MISSION

To lead and partner with the public and private institutions in generating S&T policies, strategies and technologies that will contribute significantly to national economic development.

PRIORITY AREAS

Industry

- Electronics and Semiconductor Industries
- Food Processing
- Metals and Engineering
- Mining and Minerals

Energy

- Alternative Energy
- Energy Efficiency
- Transportation

Emerging Technologies

- Biotechnology/ Genomics
- Information and Communications Technology
- Materials Science/ Nanotechnology
- Photonics
- Space Technology Applications

Special Concerns

- Climate Change Adaptation and Mitigation
- Disaster Risk Reduction and Management
- Environmental Issues

DOST SECRETARY
M E S S A G E

Two of the most destructive disasters happened just last year -- an earthquake and a super typhoon which occurred one after the other. They threw a fit of destruction that swept away several communities in the Visayas region, testing their resiliency.

As a nation, we are diminished by the toll that left the communities emotionally scarred. And we could only imagine the inconsolable grief of those who lost their loved ones.

These national tragedies dominated our collective consciousness, driving researchers in Climate Change Adaptation and Disaster Risk Reduction (CCA-DRR) Programs and Projects under PCIEERD's monitoring, to double their efforts and respond to post-disaster needs.

Research outputs have been mustered to help provide rapid post-disaster assessment and relief and are being refined for future events.

I am confident that with PCIEERD's portfolio of R&D projects spanning energy, strategic industries, and emerging technologies, we have made the right investments to meet our peculiar needs as a nation.

I am hopeful that we can make meaningful contributions to shaping self-reliant and disaster-resilient communities across the country.

Mabuhay!

MARIO G. MONTEJO
Secretary

PCIEERD EXECUTIVE DIRECTOR
M E S S A G E

PCIEERD is steadfast in its commitment to the development, execution and transfer of technologies that are world-class, cost-effective, and most importantly, fulfill a felt need by Filipinos. In the process we build institutions and develop human resource.

In 2013 DOST formulated the National R&D Agenda under the direction of Secretary Mario G. Montejo and Undersecretary Amelia P. Guevara. PCIEERD's participation in the formulation brought to fore the need to not only focus R&D programs and see them through either commercialization or deployment of technologies, but to synergize with the various agencies of DOST, the academe, other National Government Agencies (NGAs) and Local Government Units (LGUs), in planning and executing R&D programs and transferring R&D outputs. One example is the software program Learning English Application for Pinoys (LEAP), led by Dr. Susan P. Festin, which started development in 2011, launched in 2013 and will be released to the public in the first quarter of 2014. It was a need that was identified by the industry, designed and executed by the academe, and will be deployed by CHED, DepEd, TESDA, DOLE and BPAP. A second example is the Nation-wide Disaster Risk and Exposure Assessment for Mitigation (DREAM) Program that introduced the use of LiDAR technology for hazard assessment and flood modeling, but is now being used by LGUs for infrastructure planning, resource assessment and post-disaster rehabilitation. With the help of UK scientists, the DREAM team, led by Dr. Enrico C. Paringit, learned LiDAR technology, executed data acquisition, processing and validation in the last two years, and now transferring the results for use of LGUs and NGAs. For 2014, DREAM will expand data acquisition from 12 major river systems to the entire country and will involve 15 other universities and institutions. A third example is the Strengthening of DOST Regional Metrology Laboratory Services (STARLabs) Program that is being undertaken by the DOST Regional Offices under the leadership of Dir. Brenda L. Nazareth-Manzano. STARLabs offer accredited test services in the regions to pave the way for standards compliance in preparation for the ASEAN Economic Community in 2015.

In 2013, PCIEERD instituted its call for proposals for 2014, resulting in 237 submissions and 43 funded projects* that were approved by the PCIEERD Governing Council before the end of the year. We initiated two competitions for electronics and rain forecasting to encourage more researchers and developers in these areas, and to maximize the outcome of the government's investment in the Electronics Product Development Center (EPDC) and the NOAH Program, respectively. The rest of our 2013 activities are detailed in this annual report.

2013 has been a very productive year for PCIEERD and this can be attributed to the strong cooperation among PCIEERD employees, the open collaboration with our clients and the solid support of the DOST family.

ROWENA CRISTINA L. GUEVARA, Ph.D.

FOREWORD

Managing public funded R&D projects is a complex process. The inventive route is often strewn with both hopeful and unsettling probabilities. But the creative mind is invariably expectant. Some people call it passion. Others breathe and preach inspired ideas like religion.

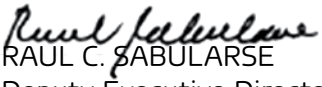
Over the years we never ran out of intrepid scientists, researchers, engineers, and technologists wanting to lift people and society out of lingering and emerging miseries. All these make for a curious tutorial in human temperament. But imagine a world without them.

Audacious women and men largely shape our world today. Long hours spent in understanding the forces hidden in nature gave us better food choices, lifestyle options, safer environment, and purposeful living.

In PCIEERD, we are more than witnesses to such human drama. We try to help unwrap intellectual gifts. Truth be told, we also experience discomfort trying to keep egos and pride and sensibilities on even keel. This can be a touchy balancing act especially when smart ideas and public accountability seem in collision.

Surely managing public funded R&D is serious work. But we never want to miss the fun. We suppose these are not mutually exclusive. Laughter can be a child of surprise. Work and the workplace can be a part of the larger home. After all, what we do—from the administrative offices, and lab-to-the-public—is to build a strong family welfare system.

Mabuhay!



RAUL C. SABULARSE
Deputy Executive Director

EXECUTIVE SUMMARY

PCIEERD has the mandate and position to take on development initiatives almost unique in the public funded R&D system. The portfolio of R&D projects that it manages weaves the short and long term, tactical and strategic development imperatives of the nation. It has wrought a nearly instinctive rigorous selection process calculated to produce optimum benefits to the country, the science community, and the creative force in each R&D work.

In 2013, internal growth prospects along with rising external pressure raised the urgent mission to build and enhance national capability in materials science, biotechnology, nanotechnology, microelectronics, alternative and renewable energy, space technology, earth science, intellectual capital, and information and communication technology.

Meanwhile, climate change induced events and a devastating quake in central Philippines more than underscored the need to understand nature and adapt to a changing environment. A business-as–usual posture is not an option.
Urban sprawl also demands prudence in urban planning. This includes smarter modes of transporting people and goods especially in highly populated urban centers. An efficient mass transport system saves energy, reduces carbon footprint, and accelerates socioeconomic productivity.

PCIEERD invested in purpose-driven R&D during the year as it strives to keep in step with development challenges that transcend intellectual and social curiosity. In all the R&D initiatives, it remains committed to a nation-first path.

S&T Policy and Program Formulation

The development and sustainability of Philippine science and technology capability can enhance the country's competitiveness especially in the face of imminent cross-border regional, and expanding borderless global trade environment. Deepening the nation's knowledge resources reciprocally raises its intellectual capital's potential to embrace innovation as a valuable competitive aptitude.

In this light, PCIEERD maintains the S&T roadmaps of 16 sectors that define specific R&D directions including strategies and interventions to achieve desired short-to-long-term outputs. These roadmaps cover detailed technology developments, interventions, and solutions designed to complement the government's inclusive development and growth policy.

In 2013, PCIEERD set out to sustain the aggressive implementation of R&D programs on energy, improve industry competitiveness, and enhance capacity for emerging technologies. To keep things in step, it focused on the following programs:

Industry

- Provision of R&D and testing facilities to enhance industry competitiveness
- Resolving the mining and mineral sectors' environmental concerns straddling extraction, processing, and recovery
- Development of innovative products and processes

Energy

- Development of renewable energy
- Energy efficiency system
- Development of biofuel feedstock
- Efficient transport system

Emerging Technology

- Sustain the aggressive implementation of R&D programs to enhance capacity for emerging technologies:
- Nanotechnology/ Advanced Materials Science
- Genomics
- Biotechnology
- Space Technology Applications
- Photonics, Information Communication Technology (ICT) and Electronics
- Other emerging technologies

Meanwhile, PCIEERD also ensures to align its programs and R&D agenda to the Department of Science and Technology's priority outcomes particularly:

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

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

- Highly skilled and globally competitive S&T human resources in support of the national S&T programs (PSHS to be the leading science high school in ASEAN by 2015 & every town to have at least one DOST scholar by 2016)

- Science-based weather information and climate change scenarios with associated impact assessments that shall enable concerned agencies to develop appropriate mitigation strategies for a disaster and climate change resilient Philippines.

These programs are responsive to the Aquino administration's Key Result Areas (KRA) specifically on:

- KRA 2. Poverty Reduction and Empowerment of the Poor and Vulnerable

- KRA 3. Rapid, Inclusive, and Sustained Economic Growth and

- KRA 5. Integrity of the Environment and Climate Change Adaptation and Mitigation.

PCIEERD Executive Director, Dr. Rowena Cristina L. Guevara opens the Call for Proposals for 2014

Call for Proposals

In 2013, PCIEERD instituted its Call for Proposals via PCIEERD's e-Proposals submission in pushing for directed research in towards specific sectors that have immediate impact to the economy or which directly address a pressing national concern. R&D proposals should be directed towards harnessing the potential of emerging technologies, expand technology development and innovation for the industry and energy sectors, and develop S&T interventions and solutions for climate change adaptation and mitigation and disaster risk reduction. In keeping with its directed research, funding opportunity will be prioritized for R&D proposals that fall under the following areas: 1) Appropriate Technologies for Industry Competitiveness; 2) Sustainable Energy; 3) Sustainable Mass Transport; and 4) Environment, Climate Change and Disaster Risk Reduction.

R&D proposals for funding opportunity in CY 2015 are expected to come from public and private universities, research and development institutes (RDIs), R&D consortia, non-profit S&T networks and organizations, and other proponents seeking funding for their R&D initiatives. This funding opportunity intends to encourage S&T collaboration and applied research among these agencies and institutions.

Support for Research and Development

Research and development (R&D) are core businesses of the Council. It ensures that its R&D agenda is directed towards the Key Result Areas (KRAs) identified in the social contract of President Aquino with the Filipino people. These KRAs are:

1) transparent, accountable, and participatory governance;
2) poverty reduction and empowerment of the poor and vulnerable;
3) rapid, inclusive, and sustained economic growth;
4) just and lasting peace and the rule of law; and
5) integrity of the environment and climate change adaptation and mitigation.

PCIEERD's R&D focused particularly on KRA 3 and 5 and ensured that these are also anchored on the DOST's priority programs.

KRA 3: Responding to Rapid, Inclusive, and Sustained Economic Growth

In recent years, the Philippines has been considered as a bright spot amid a lingering global economic slowdown. But the challenge is to spread the nation's resources and respond to the KRAs. Creating new opportunities, enhancing gains, and adding value to strategic resources could usher the country to a path of sustainable, if not equitable, wealth distribution in country which challenged by climate change-induced scenarios that have encompassing consequences to individual, community, and national life.

In 2013, PCIEERD invested its R&D resources in energy, food and feed, genomics, human resource development, microelectronics, mining and minerals, nanotechnology, process technology, space technology, transportation, biotechnology, electronics, information and communication technology, nuclear technology, materials science, and packaging technology.

Electronics Sector

On-Going Projects

Establishment and Operation of Philippine Electronics Product Development Hub (EPDC)

DOST-Advanced Science and Technology Institute (ASTI)

The electronics and semiconductor sector remains to be one of the leading industries in the Philippines. In the past two decades, the industry's share to the total export of the country has been steadily increasing and in 2010, the industry generated revenues of about $31B.

(from left) DOST Undersecretary for R&D, Dr. Amelia P. Guevara, Engr. Alexander S. E. Sy, President, Alexan Commercial Inc., Engr. Denis F. illorente, Director, DOST-ASTI, PCIEERD Executive Director, Dr. Rowena Cristina L. Guevara, and DOST Asst. Secretary Robert O. Dizon during the ground breaking ceremonies of the EPDC.

The project aims to establish and operate a product development center for the electronics industry. Specifically, it seeks to [1] set-up infrastructure, tools and equipment for the electronics product development center, [2] conduct human resource development for the staff that will operate and manage the electronics product development center through training and exposure to electronics product design flow, and [3] support future R&D projects that will utilize the tools and equipment in the product development center.

The center's three operational facilities include the [1] Electromagnetic Compatibility (EMC) and safety test facility, [2] PCB prototyping and fabrication facility, and [3] product prototyping laboratory. The EPDC will be constructed at the DOST-MIRDC Compound.

Versatile Instrument System for Science Education and Research (VISSER)

National Institute of Physics, UP-Diliman

The VISSER addresses the need for science laboratories in the Philippines. Activities are focused on putting modern science laboratories in every school. The goal is to design and develop home-grown experimental modules based on a handheld microcontroller-based universal platform that can replace existing experiments as well as new and sophisticated laboratories which can be done using the latest developments in technology. About 100 ready-to-commercialize experimental modules in Physics, Chemistry, Biology, Environmental Science and engineering will be developed. VISSER modules will be inexpensive yet sophisticated learning.

There are now 10 prototypes of the multichannel data acquisition system and several plug and play analog and digital sensors (light, temperature, humidity, distance, etc) have been produced to test the laboratory experiments and refine the laboratory manuals. A VISSER software library for interfacing and data analysis and an initial web graphical user interface have been developed. This web interface can download software to the VISSER handheld through RFID. 31 Laboratory manuals and 31 experiments in Physics and Engineering (12), Chemistry (9), Environmental Science and Biology (10) are ready for pilot testing. Also, a teachers training was held in UPLB with 48 teacher participants from schools in Laguna. Also, there are 1 MA Education, 1 MSEP, 2 MA Physics students who are already doing VISSER related work.

Visser handheld module device

RxBox2: Integrating Medical Devices in the National Tele-Health Service Program - Project 3 - Field Deployment of Telemedicine Devices

National Tele-Health Center, University of the Philippines - Manila

The RxBox2 Program will develop locally manufactured medical-grade telemedicine devices, and demonstrate their usefulness in target Rural Health Units (RHUs) / Local Health Centers in GIDA (Geographically Isolated and Disadvantaged Areas).

This multidisciplinary program consists of three component projects:

Project 1:	Integration of Commercial Biomedical Device Units with CHITS and eTriage
Project 2:	Development of a Portable Industrial Grade Biomedical Diagnostic Device for Remote Maternal and Fetal Health Care Monitoring

Projects 1 and 2 are monitored by the Philippine Council for Health Research and Development (PCHRD).

Project 3:	Field Deployment of Telemedicine Devices

Project 3 is monitored by PCIEERD for two years. It is expected to achieve the following: [1] subject RxBox2 to DOH-BHDT ethical review and clearance to ensure adherence to ethical practices and medical device regulations, [2] provide feedback to the engineers on RxBox2's usability and functionality in its several versions – alpha, beta, and production units, [3] define the most appropriate ICT to be incorporated into the telemedicine devices relevant to the country's geographic and network/ ICT infrastructure conditions, [4] define behavioural, social, and operational parameters to support adoption of RxBox2 among target health workers based in RHUs, and clinical specialists in urban medical centers, [5] enhance the Training Program for the use

The RxBox Device

of biomedical devices in telemedicine (NTSP), and [6] develop or enhance the skills of health professionals in the use of telemedicine devices.

SmartWire Program

University of the Philippines – Diliman

The program intends to create, refine and develop the necessary technologies needed to make the SmartWire vision a reality. One specific objective of the Smart Wire program is to develop the necessary technologies to implement a fully integrated sensor node with (1) power-line and RF energy harvesting, (2) data acquisition and signal conditioning for AC current and line temperature measurements, (3) power line and RF communications capability, and (4) computation and control for node management, communication protocol implementation as well as data processing. Specific projects are undertaken as follows:

Project 1 - Energy Efficient Data Acquisition and Conditioning for SmartWire Sensor Node project

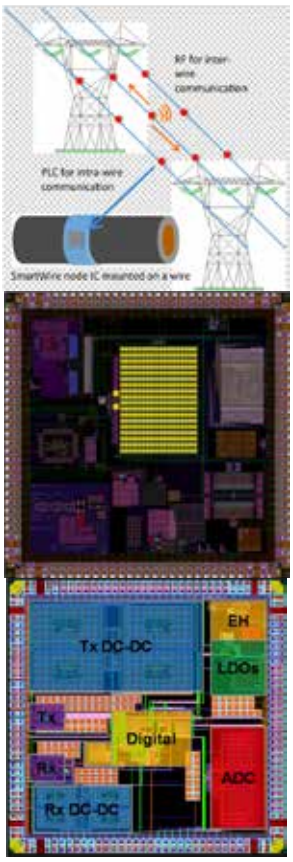
The 2-channel data acquisition (DAQ) subsystem for the SmartWire sensor node is in the final design stages and is already being integrated into the SmartWire subsystem. The system includes the Successive Approximation Register (SAR)-based algorithmic ADC for current measurements and a counter-based ADC for temperature measurements. The 2-channel DAQ will be powered by the on-chip energy harvesting and regulation subsystem (Project 2), and will be controlled by the on-chip processing unit (Project 3), and will be ready for fabrication on the last ST 65nm run date for 2013.

Project 2 - Integrated Energy Harvesting, Storage, and Regulation for Smartwire Sensor Node Project

The SmartWire system with the energy harvesting and power delivery subsystem powering the 2-channel DAQ (Project 1), node management and the communication subsystem (Project 3) was scheduled for fabrication on the last ST 65nm run date for 2013 (October 14, 2013).

An initial harvester and voltage regulators (LDO and DC-DC converters) powering the minimal SmartWire system has already been fabricated last April 2013, and these circuits are expected to arrive for testing late October 2013.

Project 3 - Energy Ultra-Low Power Computation And Communication for the Smartwire Sensor Node Project



The node management subsystem for the SmartWire sensor node performs the following tasks: (1) synchronization, (2) packet assembly and disassembly, (3) power cycling, and (4) parameter measurements. The system has already been designed and verified.

The communication subsystem has been designed with the following major components: (1) low-noise amplifier (LNA), (2) power amplifier (PA), (3) saturating amplifier, and (4) power-line couplers.

The node management and communications subsystems are currently

being integrated with the energy harvester and power delivery subsystem (Project 2), as well as with the DAQ subsystem (Project 1). The SmartWire system with the node management and communications subsystem, together with the energy harvesting and power delivery subsystem, as well as the DAQ subsystem will also scheduled for fabrication on the last ST 65nm run date for 2013 (October 14, 2013).

Development of Hybrid Weather Monitoring System and Production of Weather Monitoring System and Rain Automated Weather Stations (AWSs)

The project has accomplished its targets having installed 81 AWSs and 100 automated rain gauges (ARGs) in key areas across the Philippines to complement PAGASA's weather forecasting facilities. These serve as alternative to GSM/GPRS communication for timely and continuous weather information access and ensure reliable and continuous operation of AWSs and rain monitoring stations. The deployed servers are consistently monitored with

satellite module and upgraded firmware version of 73 AWSs and 90 ARGs. Further, the project acquired visualization software and developed visualization application as well as developed AWS and ARG manuals.

Energy Sector

New Projects

Experimental Studies on Thermophysical and Transport Properties Characterization of Industrially Important Solvent System, and Process Simulation Studies of Post-Combustion Capture of CO2 And H2S Using Aqueous Single and Blended Alkanolamine Solutions

Mapua Institute of Technology

Carbon capture, transport, and storage is a huge technological challenge to domestic industries heavily dependent on fossil fuel like power plants. In consideration of these challenges, the project is being undertaken. It will characterize the thermophysical and transport properties of different solvents that could be used as absorbent for carbon capture from flue gases. This study on property measurements and correlation development could add to the increasing number of data needed for process and equipment designs on carbon capture. The results will be important inputs to process simulation studies to identify the best alkanolamine solutions for H2S and CO2 capture. This could be useful to industries that incorporate absorption of these two acid gases.

Smart Grid Technology for Filipino Households

University of the Philippines - Diliman

In keeping up with the DOST's smarter way of doing things through S&T, the PCIEERD is conducting a project that will help consumers, particularly Filipino households, to effectively monitor and manage their energy consumption using a smart home platform that will be locally designed. This will also promote efficient use of energy and energy conservation in the long run.

Project 1 - Design and Development of a Smart Home Platform

The traditional method of providing consumer energy services is to supply the required electricity regardless of magnitude and location. Due to climate change and

dwindling fossil fuel resources, a better method to provide energy services should be established.

Smart Home System Diagram

To address this, the project will design a smart home platform that would inform consumers of their energy consumption patterns. The smart home platform will be deployed in several households to assess its contribution to achieving energy conservation. The recommendation that will be gathered in surveys will be incorporated in the design of the platform to maximize its effectiveness.

The smart home prototype will consist of 20 units of smart meters that can measure and transmit an attached appliance's real-time power consumption to IHD: real power consumption voltage, current and reactive power, 100 smart plugs that can transmit an attached appliance's real-time power consumption to the display, and disconnect the appliance from socket upon instruction by the display. Also, 20 units of in home display that can display relevant information to user, store measurement data, and act as control center that issues commands such as turning on and off of appliances will be designed and deployed.

Project 2 - Design and Development of an Advanced Metering Infrastructure (AMI) Emulator Platform

A smart meter records consumption of electric energy in intervals of an hour or less and communicates that information at least daily back to the utility for monitoring and billing purposes.
Setting up advanced metering infrastructure (AMI) entails significant capital. The potential benefits and impacts of AMI has not been fully realized and understood even in countries with AMI. An AMI differs from traditional automatic meter reading (AMR) in that it enables two-way communications with the meter

The project aims to design an emulator that can implement AMI features which will be deployed in several households to stimulate small-scale metering infrastructure. The emulator will be used to conduct consumer studies on demand response such as prepaid metering, afterwhich, the recommendations will be incorporated in the AMI design to maximize its effectiveness.

Project 3 - Prepaid Metering and Smart Home System: Technology Acceptance and Technology Features Studies

Prepaid metering and smart home system are technologies expected to enable households to manage electricity consumption with minimal effect in their quality of life. This promise of significant reduction in total energy consumed and peak demand is hooked on positive user experience.

These studies will look into the preferences of consumers as regards their electricity consumption. Specifically, they will be conducted to: [1] develop a model that describes the factors that determine consumers' decision to switch to prepaid metering, [2] describe consumers' preferences on prepaid metering system and incorporate these in the development of prepaid metering system, [3] investigate consumers' initial benefit in using prepaid metering system, [4] understand the utilities' perceptions in providing prepaid metering service to customers, [5] understand consumers' perception on smart home technologies, [6] investigate consumers' intention to adopt smart home technologies, [7] describe users' preference for various components of smart home technology and incorporate these in the development of smart home technologies, and [8] investigate consumers' initial benefits in using smart home technologies.

Design and Implementation of a Power Distribution System for Data Centers

Electrical and Electronics Engineering Institute (EEEI-UP Diliman)

The project aims to develop a low-cost energy monitoring system called power distribution units (PDUs) for data centers. The PDU measures data such as power consumption, voltage, current, etc. and send these to a central computer.

Moreover, the project aims to design and implement a centralized power distribution system for data centers that will consist of a PDUs that can measure energy consumption of several electric sockets and send this information together with temperature and humidity measurements to a central computer, and a central computer that would receive, organize and archive the data sent by PDUs, and can also issue commands to remotely turn on or off individual socket in a PDU.

Pilot Testing of Wind Turbine Generator

Electrical and Electronics Engineering Institute (EEEI-UP Diliman)

Data center servers with multiple PDUs installed

The Department of Energy (DOE) places the Philippines' wind energy potential at 75,000 MW. But technical and non-technical barriers blow against wind power. Technical challenges are inherent in wind power systems. Low wind speed cannot produce enough electricity. Strong winds can destroy the wind turbine and tower. This is a unique challenge in the country, which is whipped by at least 20 typhoons annually. Meanwhile, non-technical issues include: 1) the need to develop local manufacturing capability for wind turbine components which are currently sourced overseas although fabrication of most parts can be done locally, an 2) the void of local technical expertise in this field.

The DOST's "Wind Turbine Generator System" program addressed these two issues by developing a local wind generator system designed to operate in local conditions including wind speed, temperature, and other environmental conditions. The project proposes to pilot test the developed wind turbine generator developed by the UP-Electrical and Electronics Engineering Institute (UP-EEIE) for water pumping application in Looc, Occidental Mindoro through a partnership with non-government organization Sibol ng Agham at Teknolohiya. The developed wind turbine generator will be used to put up a small wind turbine (SWT) to power up a water pump that can supply water to at least one barangay. The system's electrical performance and weather durability will be monitored continuously for at least 6 months of deployment. It will also evaluate the whole system's efficiency to deliver the target water volume on demand. The community will be oriented on the SWT system including its operation and maintenance.

Wind resource Assessment for Wind Power Systems

Electrical and Electronics Engineering Institute (EEEI-UP Diliman)

The project aims to support the government's efforts to promote the development and utilization of the country's renewable energy resources, and assess wind resources in selected sites. Specifically, it seeks to [1] identify potential operational sites of wind measuring equipment, [2] install and operate wind monitoring equipment in five project sites, [3] obtain actual measurements of wind speed and direction for 14 months, [4] compile, analyze, and evaluate wind energy potentials in terms of power densities, [5] provide information on returned period of extremes, and [6] evaluate techno-economic viability of wind power systems in selected sites.

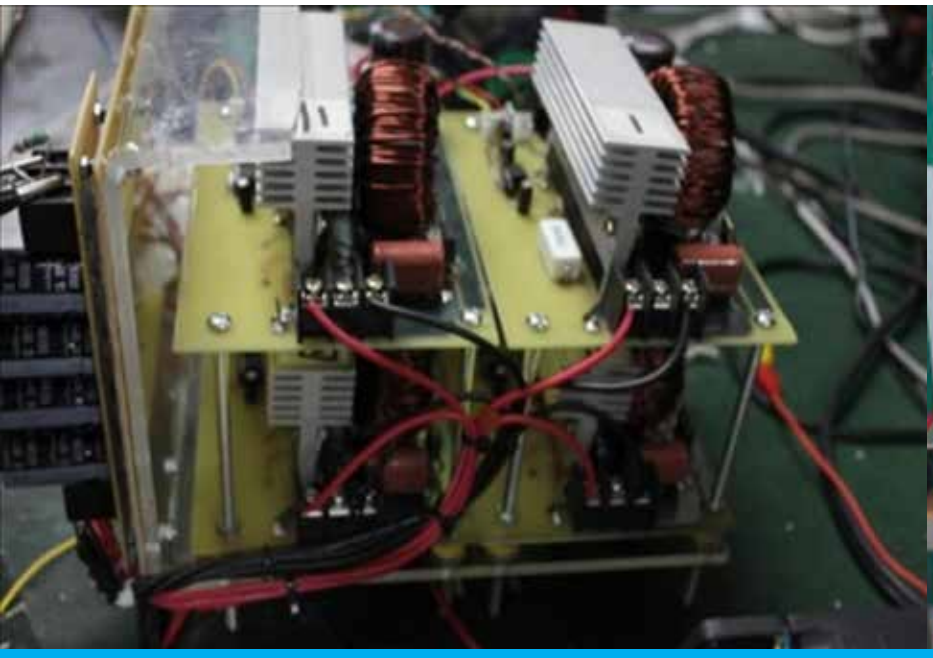
The five sites considered in the study are [1] Siargao, Surigao del Norte, [2] General Santos, [3] Mati, Davao Oriental, [4] Canavid, Eastern Samar, and [5] San Vicente, Palawan. These areas are either ecotowns identified by the Climate Change Commission or areas serviced by the National Power Corporation's Strategic Power Utilities Group. Most are located in Mindanao to attract renewable energy investments in the area.

On-going Projects

Rapid Electric Vehicle Charging (CharM)

University of the Philippines - Diliman

The key developmental objective of the project is to support the government's e-trike (electric tricycle) program which accelerates the use of electric vehicles to replace tricycles. Electric vehicles are energy efficient as they are supposed to use up 75% of their



Power electronics for wind turbine

Permanent magnet generator with emulator system

energy to power the vehicle versus only 20% used in most internal combustion engines. The e-trike produces no noise and zero tailpipe emissions and can be charged at night during off-peak electricity hours. A conventional tricycle needs between 5 and 7 liters of gasoline to travel approximately 100 kilometers at a cost of P250 to P350. To travel the same 100 kilometers, an e-trike will use between 3 and 5 kilowatt-hours (kWh) of electricity at a cost of only P30 to P50.

The project proposes the development and demonstration of a fast charging facility which can charge an e-trike in less than 30 minutes. The CharM project is similar to the behavior of a conventional gasoline station such that the user would like to replenish the energy in the storage tank as quickly as possible. A user interface to facilitate the payment scheme and for the user to control the length or amount of charge to fill up his/her vehicle will also be developed. A GSM – based payment scheme where the user can use his/her cellular phone to transfer payment for the charging expenses will be adopted.

Study for the Implementation of Smart and Green Buildings within the DOST Compound DOST-ASTI

Smart green building strategies deliver program instruments for measurement from baseline to comparative analysis so that empirical benefits are quantified and evaluated. These can also be scaled to other applicable institutions. This is an architectural initiative that encompasses design, structure, utilities, social, culture, economics, and technologies that are key components for the project and in reconstituting a department for national identity in science and technology development. It is important to conduct architectural research study in green building and technologies to ensure that the value from implementation of the project exceeds or is commensurate to the investment it will use. This study focuses on DOST main building and the Science Heritage building.

In applying smart green building strategies, the project will develop architectural design programming and planning geared to achieve identified project values in using smart technologies with highest standards in green building practices. It is also expected to come up with baseline study of subject buildings, a conceptual physical design and structural coordination, architectural programming, space management process and needs analysis, renewable energy options and cost benefits, security systems recommendation, and systems energy and environmental design evaluation.

Biotechnology Sector

On-going Projects

Abaca Functional Genomics: High Throughput Discovery of Genes and Molecular Markers Institute of Plant Breeding,

University of the Philippines – Los Banos

There is no existing genomic information on endemic abaca in the Philippines. This project addresses this need by building the abaca genomic resources, and will use various molecular biology and bioinformatics tools particularly the construction of expressed sequence tags libraries from various tissue types and during virus infection for abaca functional genomics.

Specifically, its objectives are to [1] prepare various tissue types at different developmental stages with and without virus infection by lyophilization for expressed sequence tags library construction, [2] sequence the expressed sequence tags from all constructed libraries, [3] evaluate and characterize different expressed sequence tags libraries derived from at least 16 tissue types-developmental stages- with or without virus infection using in silico bioinformatics tools, [4] construct expressed sequence tags database, and [5] identify genes involved in fiber quality and virus resistance (abaca bunchy top virus).

Fuel Ethanol Production From Lignocellulosic Feedstock Program

National Institute of Molecular Biology and Biotechnology (BIOTECH)

The program aims to provide R&D back up for large-scale ethanol production in the Philippines using lignocellulosic materials as feedstock. It will assess potential feedstock for ethanol production, develop isolates capable of degrading and utilizing lignocellulosic substrates and possessing desirable fermentation properties, improve process efficiency, reduce production costs, and assess and mitigate production's potential environment impacts. The program also aims to upgrade the BIOTECH laboratory facilities at the University of the Philippines in Los Baños to make it a leading center for research and services on cellulose ethanol technology in the Philippines. The specific projects under the program are:

Project 1- Assessment of selected lignocellulosic residues and non-food crops as feed stocks for fuel ethanol production

Project 2 - Evaluation and optimization of pre-treatment methods for locally available and promising lignocellulosic feed stocks for fuel ethanol production

Project 3 - Development of microorganism capable of utilizing lignocellulosichydrolysates for fuel ethanol production

Project 4 - Optimization of saccharification, fermentation and purification processes for pilot scale ethanol production from lignocellulosic materials

Extraction of lignocellulosic subtrates using steam explosion device.

Utilization/Conversion of Sago Starch Into Value-Added Products: Ethanol and Lactic Acid – Sago Program I

University of the Philippines – Mindanao

Project 1.1 - Cloning and Expansion of Raw Starch Digesting Amylase Genes from Saccharomycopsis fibuligera and Saccharomycopsis bubodii for Direct Ethanol Fermentation

This project will generate bioinformatics data by cloning the raw starch-digestiong amylase (RSDA) genes from Saccharomycopsis fibuligera and Saccharomycopsis bubodii 2066, the isolates possessing the highest amylolytic activities from biochemical tests conducted in previous projects. Expected outputs are cloned and expressed RSDA in E. coli, which is proof of function of the RSDA gene. Transformed Saccharomyces cerevisiae containing RSDA may also be produced.

Sago plantation

Sago shoot used for tissue culture

Project 1.3 - Direct Lactic Acid Fermentation of Sago Starch without the Costly Starch Pretreatment using Enterococcus faecium DMF78: Pilot Scale of the Costing Process

The study aims to verify in the larger-scale, 30L and later in the 300L fermentator the capability of the microorganism to retain its productivity, efficiency and optical purity which had been reported in the lab scale. In the pilot scale, with the above parameters proven and data for recovery taken, a fair costing can be done.

Completed Projects

Project I.2 - Ethanol Fermentation of Sago Starch using Starch Digesting Amylases: Strategies for Ethanol Production Without the Costly Starch Pretreatment

This study has been completed and made use of the RSDA produced in Project II.1 (Yr 1). Lab-scale process designs were tested to ferment sago starch to ethanol without the high energy-consuming step of starch gelatinization prior to ethanolic fermentation.

Clonal Propagation of Sago Palm

The project aims is to continue research efforts on sago palm micropropagation that started during the first phase of Sago Biotech Program. This will also include traditional clonal propagation by improving sucker survival in situ through mycorrhiza application. This would lead to the optimization of tissue culture protocol for sago sucker production and tissue cultures suckers. Further, the project seeks to [1] improve direct shoot formation efficiency, [2] investigate the NA effect on callus initiation from leaf tissues of sago palm, [3] evaluate the influence of silver nitrate on somatic embryo formation from sago palm calli, [4] generate plantales from somatic embryos, and [5] evaluate the ability of Mycovam in enhancing sucker growth in situ.

Food Sector

New Projects

Roll-out of DOST-Developed Food Processing Equipment to the Regions

DOST- Food and Nutrition Research Institute (DOST-FNRI)

The Food Processing Firms (FPFs) are considered prime movers of economic growth. In many successful and newly industrialized countries, FPFs provide reliable and balanced economic development.

In the Philippines, technology-based food processors struggle with barriers such as access to relevant information and capital, and high cost of equipment. The inability to acquire appropriate equipment deprives local manufacturers of the opportunity to expand. In 2011, the project "Design and Development of Process Equipment for Food Processing Firms" was approved and funded under the DOST-GIA program. ITDI implemented the import-substitution project in cooperation with DOST-MIRDC and PMEDSO. This led to the development of five (5) prototype equipment such as water retort, vacuum packaging machine, vacuum fryer, spray dryer, and freeze dryer.

The project promotes and demonstrates the functionality of locally fabricated food processing equipment developed in partnership with state colleges and universities (SUCs) and LGUs. These will be based initially in 9 DOST Regional Food Innovation Centers (FICs) located in NCR, Regions 2, 5, 6, 7, 8, 9, 10 and 11 to be managed as business enterprises by partner institutions.

Roll-out of Complementary Food Production in the Regions

DOST-FNRI

Alleviating malnutrition by decreasing the prevalence of underweight children under five (5) is covered under the National Priority Plans and Programs. The DOST-FNRI responded to this through its project "S&T-Based Intervention to Address Malnutrition" to reduce the prevalence of under nutrition among children 6 to 35 months. This was done through the production and technology transfer of complementary food blends, snack foods, and DOST PINOY (Package for the Improvement of Nutrition of Young Children). This intervention complements various government

Food processing equipment

programs on hunger mitigation such as conditional food for school, food fortification, salt iodinization, deworming, and feeding, among others.

The technology for the development of affordable and nutritious complementary foods could be transferred to local adoptors for commercialization, and enhance the partnership of DOST, LGUs, private sector, and other institutions in five regions under the project.

In the project, three (3) FNRI-developed complementary food technologies in the regions, namely, rice-mongo curls, rice-mongo baby food blend, and rice-mongo-sesame blend will be introduced to adoptors.

Process Improvement and Waste Minimization in Chichacorn Manufacturing

Mariano Marcos State University (MMSU) and Northwestern University (NWU)

Chichacorn is a popular corn snack from the Ilocos region prepared through a series of processes that include soaking, boiling, de-skinning, drying, and deep-frying. Through the One Town One Product (OTOP) program of the Department of Trade and Industry (DTI), eight (8) manufacturers of the Paoay Chichacorn Producers Association were already able to tap markets in Cyprus, Australia and Saudi Arabia. The increase in demand for the product led to the growth of the industry and the emergence of several small scale chichacorn manufacturers in the region. However, most chichacorn products are not able to meet the minimum requirements specified in the Philippine National Standard for chichacorn. Realizing the need to improve the safety and quality of chichacorn, the project will help the dynamic industry by developing an optimized process to produce chichacorn which is compliant with the specifications in the Philippine National Standard for chichacorn. To date, the project was able to gather different methods and practices of chichacorn processors in the Ilocal region. These processes are now being standardized for chichacorn to be able to meet the standard.

On-going Projects

Production of Multi-nutrient Extruded Rice Kernel (MNERK) to Address Malnutrition

DOST-FNRI

Micronutrient malnutrition remains to be a significant public health concern in the Philippines. Macronutrients (carbohydrate, protein, and fat) are essential for health, growth, healing, and immune function. The 2008 DOST-FNRI National Nutrition Survey shows that only a small percentage of Filipino households meet the Recommended Energy and Nutrient Intake (RENI) for most essential nutrients such as iron (13%), calcium (11.5%), vitamin A (21.5%), vitamin B1 (34.5%), vitamin B2 (19.7%), and vitamin C (30.2%). These nutrient deficiencies lead to prevalence of diseases and health risks such as low birth weights among infants and mental and growth retardation.

Food fortification is one strategy to address malnutrition. Rice is the most commonly consumed food item by Filipinos, hence, it is a good vehicle for fortification of nutrients. This project aims to fortify rice by producing multi-nutrient extruded rice kernel to address micronutrient malnutrition using either hot extrusion and/or cold extrusion technology.
Three target prototype products have been developed and produced with the following micronutrients:

Product 1: Double fortification with iron and zinc
Product 2: Multi-fortification with vitamin A, iron, zinc, vitamin B9 (folic acid) and vitamin B12
Product 3: Multi-fortification with vitamin A, iron, zinc, vitamin B9 (folic acid), iodine, vitamin B12, vitamin B1, vitamin C, calcium and, vitamin D.

Production of Secondary Certified Reference Materials (CRMs) Conforming to ISO/IEC 17025 Specifications for DOST Laboratories and Provision of Proficiency Tests for Metals in Water [Elemental water solutions]

DOST- Industrial Technology Development Institute (DOST - ITDI)

The project aims to develop local capability in producing secondary CRMs for DOST analytical laboratories. To achieve this, there is a need to strengthen the capability of DOST-ITDI's Standard Testing Division in laboratory scale production of secondary CRMs as well as conduct characterization of the secondary CRMs. Proficiency testing through inter-laboratory comparison among participating DOST laboratories will be also be conducted. The economic viability of producing secondary CRMs will be assessed.

Technological Support for the Industrialization of Makapuno

The production of mutant coconut or "makapuno" in local dialect, is fast becoming a big industry due to its high economic value not only in making Filipino delicacies but also in pharmaceutical and personal care products, including biodegradable edible film that can be used as wrapper for candies and other food products). Makapuno is obtained from the coconut tree and presently, embryo culture technology (ECM) is the only way to mass produce pure bearing macapuno palms. Studies show that farmers harvest 1.67 million macapuno nuts a year, but the demand from small buko pie bakeries and multinational food companies is up to 8.42 million nuts, or 4.2 million kilograms of macapuno meat a year. For this, the DOST Region IVA has drafted the Macapuno Road Map that puts in place the S&T interventions to nurture macapuno development.

Project 1 – Evaluation of Quality Profile and Functional Properties of Makapuno (Embryo-Culture Makapuno or ECM and Kabuwig) (DOST – ITDI)

For food processors and product developers to come up with Makapuno products that conform to standards, safety, quality, and interests of the consumers must have information on proximate and functional properties, quality profiles (aroma and flavor) of Makapuno components at different maturity. Since these are not yet established the project will determine and evaluate the nutritional content (proximate), quality profile, and functional properties of Makapuno (ECM and Kabuwig). The quality profiles of Makapuno will be determined using Electronic-Nose, Electronic-Tongue, Gas Chromatography–Mass Spectrometry (GC-MS) and Sensory Evaluation.

Project 2 – Development of Frozen ECM as Intermediate Raw material for Food Processing
Batangas State University (BSU)

Makapuno meat spoils easily even with the shell thus, hence, there is a need to stabilize by processing it into an intermediate food product that can be readily used by processors. The current practice in the industry is to use a frozen preserved Makapuno strings or a combination of coconut and Makapuno in syrup. If Makapuno will be processed or blast frozen, its shelf life can be lengthened without compromising its natural flavor and texture. This project has tried to process Makapuno as intermediate raw material for food processing by subjecting fresh Makapuno to blanching and blast freezing. Preliminary results showed that blanching at 100°C for 10 minutes decreased the microbial load up to 97% which can result to a longer shelf life. This technology is seen to create an opportunity for food processors to address the growing needs of Makapuno in the industry.

Establishment of Centralized Facility for Ultra High Temperature (UHT)/High Temperature Short Time (HTST) Pasteurizer for Milk, Coconut water, and Other Juices

Batangas State University (BSU)

UHT and HTST are the most common techniques for thermal stabilization of beverages. This is process of subjecting the liquid to a high temperature for an extremely short period of time to kill any pathogenic bacteria that may be present. Currently, these technologies are availed by local manufacturers from fabricators of other countries which are commonly too costly and the features are limited to one function, either UHT or HTST.

The project aims to establish a facility equipped with UHT/HTST pasteurizer for milk, coconut water and other juices. This will open opportunities for local SMEs since they can now invest on locally fabricated equipment that may be cheaper compared to commercially available ones. The facility will also be made available to the community through rental of the facility for research and toll packing purposes by students, researchers, and food processors.

Continuing the STARLabs (Strengthening the Testing and Analytical Capabilities of the Regional Laboratories to Support the Competitiveness of Local Industries)

DOST Regional Office No. IX

The DOST Regional Standards and Testing Laboratories (RSTLs) have established a leverage in the regions becoming the laboratory of choice of local industries for testing and calibration services. To maintain this reputation, the STARLabs project is being continued to further strengthen the capacity and capability of the RSTLs in delivering relevant, timely, cost-effective and accurate analytical and

testing service to address the testing needs of the MSMEs. The RSTLs also now offer other services such as trainings on food and water microbiological analyses, provision of technical assistance to academe and the industry, among others. Aside from the food sector, the construction, manufacturing, accommodation and food services, sewerage, other service facilities such as gasoline stations, medical/hospital, and agriculture sectors are being serviced by the RSTLs.

Completed Projects

Flour Production from Sago for Food and Non-food Use

UP -Mindanao

The research on sago as alternative food due to the unstable price of wheat flour in the world market and the prevalence of glucose-intolerance has become very relevant and timely. Sago flour is an untapped resource endemic to Mindanao, ready for harvest and yields higher starch per hectare than any other source like cereals and rootcrops. Through the efforts of UP Mindanao Sago Biotech Program, the mechanization of sago flour was undertaken to produce a world class gluten-free flour for export. Several bakery goods and flour-based products are being consumer tested to promote sago flour as flour substitute to wheat for such items as noodles, bread and ice cream cones. It addresses two needs at once - as source of gluten-free product for the gluten-intolerant and a source of livelihood for people who have access to these wild sago stands.

Better Alternative Drying Process for the Production of Stabilized Brown Rice

DOST – FNRI

The DOST-FNRI conducted a study in 2011 which improved the shelf-life of brown rice through a combination of steaming and force-draft drying. From the usual shelf-life of 1-4 months, the treated brown rice was able to retain sensory acceptability and quality from 4-9 months, depending on the variety. However, the entire process required drying for more than one hour, hence, for large scale production, this may not be attractive for adoptors. The project addressed this by combining saturated steaming with fluidized bed drying to reduce processing time and make the technology commercially and technically feasible.

Brown Rice for the Production of Potential Functional Food Products and Recipes

DOST – FNRI

Brown rice is a prime commodity that can enhance the nutritional status of vulnerable groups (young children, pregnant and lactating mothers and elderly) because of its nutritional advantage over white rice. Its regular consumption can also prevent diet-related diseases. Food products and recipes utilizing brown rice may provide beneficial options to the public in general and to the health-conscious consumers. The project has developed brown rice power bar, rice cereal for babies as well as delicious recipes which could tickle the appetite of even picky young children, discriminating adolescents and health-conscious adults.

Development of Okara Powder as Fiber and Protein Ingredient

UP – Diliman

The study utilized conventional process of dehydration to extend the shelf life of okara, locally known as sapal, a by-product of taho, tofu, and soymilk processing. Traditionally, okara in the country is commonly used as an animal feed if kept unprocessed since it deteriorates immediately. Okara is a good fiber and protein ingredient for snack food products. The project was able to stabilize okara and add value by incorporating it as an ingredient to extruded snack foods such as cheese curls. This project can therefore help the local soybean-based manufacturers market okara as a value-adding ingredient in the industry.

S&T Based Solution Towards Sustainable Strategy for Child Malnutrition: The First 1000 Days Window of Opportunity

DOST-FNRI

The Operation Timbang Study conducted by FNRI in 2011 showed that 1 out of 4 pregnant women are nutritionally at risk and 2 out of 10 children from 0-3 years old have low birth weight. The project evaluated and sustained a nutrition strategy to improve the nutritional status of young children and pregnant/ lactating mother. It includes complementary feeding of 6-35 month old children for 120 days with Multi-Nutrient Growth Mix (MGM) and supplementary feeding for pregnant mothers with iron-rich food recipes and iron-fortified rice (IFR) developed by FNRI. Endline data showed that all children participants increased their weight from 0.3 to 2.5 kgs. For the pregnant mothers, 69% improved their nutritional status and were no longer anemic.

Shelf-life Extension of Fortified Ready-to-Drink Tropical Fruit and Vegetable Juice Blends Prepared by Aseptic Processing and Packaging

UP – Diliman

This project developed safe, nutritious and high-quality beverage products from indigenous fruits and vegetables in the Philippines. It optimized the parameters for pilot scale aseptic processing of five (5) formulated ready-to-drink (RTD) tropical fruit and vegetable juice blends fortified with vitamins A and C. This project used an aseptic processing and packaging technology to ensure maximum retention of quality and nutrients. Five juice blends namely, mango-guapple, pineapple-dalandan, carrot-calamansi, papaya-calamansi and strawberry-banana, developed in an earlier study were considered in this project. These blends were fortified to meet at least 33% of the Recommended Energy and Nutrient Intake (RENI) for vitamin A and 100% RENI for vitamin C, produced at pilot-scale production.

Improved Mango Fruit Bagger and Picker

Pangasinan State University (PSU)

In harvesting mangoes, farmers are exposed to hazards because they need to climb the trees or ladders to reach and bag mango blossoms and pick ripe fruits. To address this, the project designed a mango bagger that has an adjustable light-hand pole with three (3) connected cylinders which serves as holders of the bag (plastic bag with tiny holes for ventilation) with a sling to be pulled manually. A scissor-type picker was likewise designed with curved blade and spring to return the blade to cutting position and a 1-inch allowance from the stem to prevent dripping of the sap which stains the fruit. The picker also has a net attached below the cutter to prevent falling of the fruit directly to the ground. The bagger and picker will be field-tested to evaluate efficiency, physical quality and quantity of the bagged/picked fruits.

Field Testing of the Heat Pump Dryer and Cooler for Mangoes

Mariano Marcos State University (MMSU)

The project aims to evaluate the existing Heat Pump Dryer-Cooler of the Mariano Marcos State University (MMSU) under field conditions to cater to the drying and cooling of products being harvested in the university, the locality and the region. The heat pump dryer and cooler was refurbished and improved, specifically the dehumidifier to suit the requirements of the industry.

Field trials conducted at MMSU established the following parameters: Average Energy Input, Average Drying Time, Average Drying Temperature, Drying Relative Humidity, Percent Recovery of Dried Mango, Average Energy Efficiency. The machine is simple and can be operated by semi-skilled workers because it is not highly computerized and the quality of dried mangoes is similar to those dried by the dryers that use LPG as energy source. The technology thus provides a cheaper alternative in the drying of commodities. This creates an opportunity wherein bulk of produce during the season can be hygienically dried and stored. More exhaustive field trials to further validate the data gathered will still be conducted.

ISO/IEC 17043:2010 Accreditation as Proficiency Test (PT) Provider for Credibility Improvement and International Recognition of DOST-FNRI Proficiency Test Program

DOST-FNRI

Testing laboratories subscribe to proficiency testing (PT) program to ensure that their capabilities are at par with other competent testing laboratories in the world. In the absence of a PT program provider locally, the laboratories are forced to subscribe abroad despite its high cost and difference in the type of materials being analyzed. This project therefore established a PT laboratory to organize PT programs and develop reference materials (RM) on proximate, minerals, and other nutrition labeling analyses for commonly analyzed food products (e.g. milk formula) in the country. Also, the laboratory is now ISO/IEC 17043 accredited which means that it is a competent provider (including development and operation) of PT programs.

Fabrication of Biomass-fired Steam Kettle for the Production of Concentrated Coconut Water Generated by Copra Makers as Intermediate Material for Coconut Beverage

DOST – ITDI

The coconut farmers still remain as suppliers of raw materials and only earn an average monthly income of P10,000.00. Coconut water, which is just being thrown away by copra processors, could be converted or integrated as value added products to maximize profit and increase income of the farmers. Coconut water can be made into an intermediate product for coconut water

beverage. Appropriate method for processing into an intermediate product such as concentrated coconut water is therefore needed. The ITDI has previously developed technologies such as open pan evaporator or biomass-fired steam kettle for concentration of juices. This project utilized this kettle for coconut water concentration by employing some improvements to suit the needs of the farmers. The kettle which is simple to operate was scaled up in terms of capacity to cope with the available volume of coconut water from copra processors. Field testing of the equipment and demonstration of the processing of concentrated coconut water were conducted in copra processing areas in Quezon and Laguna provinces.

Identification and Selection of Equipment Fabricators in Support of the Various DOST Programs

DOST

One of DOST's intervention to its firm beneficiaries, particularly through Small Enterprise Technology Upgrading Program (SETUP), is the provision of equipment and machineries which at times need to be custom-made to fit the specific requirement of the firm beneficiaries. This project provided the beneficiaries of DOST and its attached agencies with a pool of reliable equipment fabricators that can produce equipment according to the desired specifications and efficiency. The readily available database of local equipment fabricators can help provide timely delivery of high quality custom-made equipment/machineries which will help fast-track the acquisition of these equipment/machineries for the firm beneficiaries.

Support to the Establishment and Implementation of the Quality Management System for the Metals and Engineering (M&E) Sector's Beneficiary Firms

DOST- Metals Industry Research and Development Institute (DOST- MIRDC)

The DOST-MIRDC supports the industry in its quest to improve its productivity and be globally competitive by implementing a quality management system (QMS). This will ensure consistent production of quality and internally recognized products and services. It will also provide opportunity for SMEs in the metals and engineering sector to widen its market horizon, thus, enhancing customer satisfaction by reliably meeting their requirements as well as those of the regulatory bodies. Through the project, eight (8) beneficiary firms were guided by MIRDC in the establishment and implementation of a QMS to obtain ISO 9001:2008 certification. Seven of these firms are already ISO certified.

The following are the selected beneficiary firms for the QMS project:

NCR
- Supercast Foundry and Machinery Corp. Region IV-A
- K.E.A. Industrial Corp.
- Optitech Machine Tools
- SWIS Co.

Region VII
- Pertian Industries Corporation
- Proline Industries Metal Works & Engineering

Region XI
- Davao Beta Spring, Inc.
- Deco Machine Shop, Inc.

Upgrading of the FPRDI Furniture Testing Center (FFTC) into "One-Stop-Shop" National Furniture Testing Center (NFTC), and Establishment of Satellite Furniture Testing Center (SFTC) in Cebu

DOST – Forest Products Research and Development Institute (DOST-FPRDI)

The FPRDI Furniture Testing Laboratory (FFTC) is the only existing furniture testing laboratory in the Philippines. To best serve the growing needs of the furniture industry particularly on furniture testing, the testing capabilities and competence of FFTC should be upgraded into a "One-Stop-Shop National Furniture Testing Center". This involves the expansion of the services, establish accreditation/affiliation to local and foreign laboratory accrediting bodies, and provision of relevant trainings to laboratory personnel. The new tests to be developed include lead content analysis, corrosion testing, UV testing for garden and outdoor furniture, and flammability testing. This is to ensure high product quality and safety and to sustain growth and global competitiveness of the furniture industry.

On the other hand, the establishment of Satellite Furniture Testing Center (SFTC) in major furniture producing areas like Cebu will provide the necessary furniture testing services for Visayas as well as

Mindanao. The SFTC will be a testing facility for structural evaluation of furniture (performance testing). This is very cost effective to the furniture companies in Vis-Min since their furniture is being shipped to Manila and other countries for testing.

Genomics Sector

New Projects

Sugarcane Genomics for Increased Productivity, Profitability, Sustainability and Global Competitiveness of the Philippine Sugar Industry

Institute of Plant Breeding – UPLB

Sugarcane is traditionally an important crop for the Philippines. Sugar has myriad uses across industries and from home to factories. Developing the best sugarcane variety can lead to industry sustainability and contribute to food security.

Project 1 - Genomics-Assisted Discovery of Genes And Molecular Markers for Important Targeted Traits in Sugarcane

The project aims to generate molecular markers associated with important traits of sugarcane. It will identify sugarcane genotypes that possess relevant traits such as high sucrose yield, and resistance to downy mildew and smut. Markers will be searched and identified via a transcriptomics-based approach using next-generation-sequencing (NGS) platform and bioinformatics analyses.

Molecular markers are derived from differentially expressed genes associated with each of the traits mentioned, and generated from the transcriptomic sequence data. The project also wants to identify novel genes, if any, associated with each relevant trait important in improving sugarcane.

Project 2 - Application of Molecular Breeding Techniques in Sugarcane Improvement

The project builds on research efforts at the Philippine Sugar Research Institute (PHILSURIN) and Sugar Regulatory Administration (SRA), which haveactive sugarcane breeding program. PHILSURIN has fingerprinted part of its germplasm collection using 174 SSR-based markers. The germplasm collection has passport information and characterization data collated and put together in a database called Canepoint, in collaboration with IPB-UPLB. Canepoint

PHILSURIN Victoria's experiment station for sugarcane breeding

is a computerized sugarcane data and information management system developed through the CFC-ISO/20 project (Tetangco, 2006). The available molecular characterization data is in a similar database that will later be linked to the passport and characterization database.

This project aims to develop a better and comprehensive molecular database more useful to Philippine sugarcane breeders. Moreover, it aims to raise efficiency in the development of new sugarcane varieties through the use of molecular markers in pre-breeding, hybridization, and selection.

Project 3 - Development of New Sugarcane Varieties Using Marker-Assisted Selection PHILSURIN, SRA

PHILSURIN and SRA have active sugarcane breeding program. PHILSURIN has built a biotechnology laboratory to support its research activities through a previous project funded by CFC-ISO. PHILSURIN and SRA have existing sets of materials that can be used in this project. Priority will be given to crosses having VMC 86-550, currently the most preferred variety because of its high sugar content.

PHILSURIN has abundant segregating materials in the field. Those with VMC 86-550 as one of the parents totals 2,019 in FT1, and 173 in FT2. There are other populations in M1 and M2 stages that can be used. There are also several varieties in the Tassel Source with known reaction to the 5 major diseases of sugarcane (smut, downy mildew, leaf scorch, yellow spot, and rust). Additional segregating populations will be generated from crosses between sweet canes and known sources of resistance to the 5 diseases. The project can use the available markers for downy mildew resistance while waiting for the markers that the UPLB-based PGC Agriculture Program will develop.

The project's specific objectives are to [1] identify promising sugarcane clones with high sucrose content through the use of MAS, [2] identify promising sugarcane varieties resistant to at least smut and downy mildew, and [3] shorten the hybridization to dissemination time of new high yielding sugarcane varieties that are sweet and resistant to diseases.

On-Going Projects

Capability Building in R&D on Genomics

Project 1 - Establishment of the Philippine Genome Center DNA Sequencing Core Facility (PGC – DSCF) National Institute of Molecular Biology and Biotechnology- UP Diliman

DNA sequencing laboratory at the Philippine Genome Center

The primary mission of the PGC DNA Sequencing Core Facility (DSCF) is to provide sequencing and genotyping services to academic research groups in the country and to the wider scientific community. It will service the sequencing needs of the health, ethnicity and forensics, agricultural and biodiversity programs of the PGC (proposals attached). Next-Generation DNA sequencing (NGS) technologies, phenotyping and bioinformatics tools are essential research infrastructure components of the genome center core facility.

Project 2 - Establishment of the Philippine Genome Center Core Facility for Bioinformatics (PGC – CFB)

The PGC – CFB plans to acquire a set of high-performance computing equipment and to train personnel who will implement various bioinformatics research and user support programs. As a research facility, the CFB will actively contribute to the development/further improvement of theoretical and practical bioinformatics methodologies and will collaborate with PGC researchers to help find solutions to computational biological problems. Thus, the facility will pursue research in key areas of bioinformatics / computational biology, including data mining (such as drug discovery from transcriptome data; discovery of genetic markers associated with diseases in humans or with agronomic traits in livestock; systems biology, etc.); development of new platforms for high-performance biocomputing (particularly as new hardware and internet-based technologies, e.g. cloud computing, become available); and algorithms, software, and databases development (new algorithms or new software for sequence analysis and genome annotation, data management, phylogenetic or evolutionary analysis, structure/function prediction, etc.).

As a service facility, it will accept requests for a similar range of analyses as its research thrusts, as well as offer consultancy services to other academics and clients from both the government and private sectors. It hopes to be self-sustaining once the client base has been established, and it has generated or acquired the needed expertise.

Information and Communications Technology Sector

On-going Projects

3D Gestures on 2D / Multi-touch Screens

UP-Diliman

The popularity of mobile technology led to the creation of more interactive 3D apps especially in games. But depth in these 3D apps is constrained by the 2D screen interface that could only generate 2D coordinates of touch points. To ease this problem, most developers offer pre-programmed menu or gestures that users need to learn and practice. This approach is not intuitive and app-specific. To resolve these issues, it is proposed to enable the app to figure out the intended depth of the user based on context and real-time transform of objects in the scene. The algorithm will be verified by developing three complete 3D games.

The project aims to develop an algorithm that will enable unrestricted 3D gestures on 2D screens by approximating the depth information in the user's intent.

3D gesture mobile app

Capacity-building in Support of Pilot Testing of the DOST Tablet Computers

DOST – ASTI

This project promotes the use of efficient and affordable innovations in ICT, for students can adapt to new ways of learning in this information age. Spearheaded by the DOST-SEI. the project has procured the tablet computers and plug computers, installed developed courseware modules and other content. These have also been pilot tested in 10 schools. Further, Grade 1 Math courseware modules were converted to desktop, while additional relevant content for Grade 1 were already identified, tested, and updated the DOST tablet and plug computers in 4 schools.

Inter-Disciplinary Signal Processing for Pinoys (ISIP)

Electronics and Electrical Engineering Institute, UP-Diliman

ISIP Project 6 - Philippine Languages Database for Mother Tongue-Based Multilingual Education and Applications

The last five (5) years saw the growth of the basic education sector through the reform initiative of the Department of Education (DepEd) called B E S R A , or the Basic Education Sector Reform Agenda. Multilingual Education (MLE) is the most prominent topic to emerge from BESRA's Key Reform Thrusts (KRT) of improving teaching effectiveness, learning outcomes, and quality assurance. There are currently huge efforts towards the preparation of primary and elementary school materials for a mother tongue-based (MTB) MLE due to its proven effectiveness based on several case studies both here and abroad. The learner's mother tongue will be used as the primary medium of instruction from preschool to at least Grade 3 of elementary education.

With the intervention of MTB MLE, language databases of the major languages of the Philippines will play a big role as sources of information useful in developing teaching materials and computer-based classroom applications. Since there are currently very little if none available spoken corpora for the major languages of the Philippines, this undertaking would be very beneficial for the upcoming batch of research and development in the fields of linguistics, engineering and other sciences supporting the

endeavors of MTB MLE.

Databases of ten (10) spoken languages in the Philippines aside from Filipino will be created. These languages are Tagalog, Cebuano, Ilokano, Hiligaynon or Ilonggo, Waray-Waray, Kapampangan, Tausug, Northern Bicolano, Pangasinense, and a code mixed language of Filipino and English.

These language databases are not only meant to preserve the important heritage of our country but will also be used for a training and developing speech-based software applications that could benefit abled and differently-abled speakers, learners, or even those who are foreign to a particular language. Some applications relevant for this project includes (but are not limited to) the following: (1) Learning at home: Vocabulary reading lists with accompanying audio guides, Audio books of Philippine literature. (2) Computer-assisted learning: Pronunciation and Grammar tutors (through a grading device or in the form of a game). (3) Distance learning: Virtual Learning Environments, Web-based Language Exchange Applications, Language Portals. (4) Multimedia development. (5) Computer-based applications relating to automatic speech recognition, speech synthesis (text- to-speech systems), and machine translation.

The project has successfully accomplished the development of the speech acquisition software, the complete translation of all the materials needed in 10 major languages, the protocols for recording and the documentation of data preparation and data post processing. The collected speech corpora are composed of the following: 200 speakers of Tagalog, 200 speakers of Cebuano, 200 speakers of Hiligaynon, 200 speakers of Kapampangan, 200 speakers of Bicolano, 200 speakers of Waray, 200 speakers of Ilokano, 157 speakers of Tausug and 24 speakers of Pangasinense.

Completed Projects

ISIP Project 1 – Digital Database of Filipino Words (Bantay Wika)

The project intends to develop a language model for Filipinos which is important in coming up with language-based applications such as machine translators, grammar checkers and automated essay graders to name a few.

A web-crawler to search and process large amount of text information from the internet was developed. The large collection of Filipino text was analysed to develop a language model for the Filipino language. A language classification tool was also used for automatic classification of the correct context of Filipino words in the database. Finally, a web-based application was developed to track the frequency of use of Filipino words, to determine the trends on the usage of words in Filipino. The large collection of text database can now be used to provide a language model for print media and can later expanded for other applications.

Through the web crawler and document processing programs, a digital database of Filipino words was developed with around 1.6 million sentences, 41 million words with 746,060 unique number of words. To date, by combining all the digital Filipino text corpora of the database, the corpus contains a total number of 2,059,363 sentences, 1,605,904 unique sentences,

ISIP Project 3 – Real-Time Closed Captioning for Broadcasted News in Filipino

The Real-Time Closed Captioning System for Filipino is an initial undertaking for television. It consists of an Automatic Speech Recognition (ASR) system as its front end, recognizing the spoken sentences and transcribing them to text, to be shown in real-time on the television screen. The initial target is broadcast news since the data is readily available and that the speakers are almost always clear in diction and ronunciation. The ASR system will be statistically-based, which is currently the state-of-the-art, using open source tools for ASR development. The development of the necessary models to characterize the bases of the system, the acoustic and the language models, will be based on a number of methods that will be tested, compared, and optimized for the said task. Optimality will be based on a lattice scoring technique, where an error region is traversed to find the parameters for the system that would yield the smallest word error rate. Finally, once optimization is exhausted or once accuracy is already in a very acceptable rate, we can proceed with the integration of the system to an actual closed captioning software. The software can be used to showcase the possibility of embedding the actual software inside a television system.

The system is already implemented but a manual procedure will be developed to improve the software and make it user-friendly.

ISIP Project 7 – Development of an English Language Training Software for Call Centers Department of Computer Science, UP – Diliman

The project has developed the Learning English Application for Pinoys (LEAP) which seeks to help Filipinos improve their basic English proficiency via the use of a standalone, computer-based training program. This e-learning solution provides training in both speech and language to help improve written

and spoken English. The target users are Filipino high school and early collegiate students and call center agents. The software is meant to augment and complement face-to-face, classroom learning. The target English language here is accent-neutral and preferably free from culture-based idiomatic expressions.

Development of Affect-Sensitive Interfaces

Ateneo de Manila University

The project developed several emotionally intelligent embodied conversational agents (ECA) that can recognize and respond effectively to user affect. The project began with a selection of application areas for with it may be possible to build an ECA. These application areas included educational software, games, productivity tools, business tools and others. ThE ECA's physical appearance is designed after selecting the target domains and target audience. Several designs were tested using a Wizard-of- O z technique that determined designs most appealing to the users. The researchers conducted focus group discussions and observations of human-human and human-to-machine interactions and they determined the appropriate responses to certain user affective states. With a selected design, the models of user affect were integrated with the ECA. The emotionally intelligent ECA was tested again to determine whether it indeed recognizes user affective states, whether it responds appropriately and how it's responses affect users.

Empathic space program

Empathic Space Program

De La Salle University

The project developed an ambient intelligent living space for individuals afflicted with autism. The space recognizes its occupant and analyses his b e h a v i o r and reactions, recognizing his emotions based on his facial expressions, gestures and voice. The space responds by adjusting environment conditions such as temperature, brightness, and providing ambient support such as music. An educational software to learn facial expressions is also included. Knowing the difficulty of these individuals to understand and learn facial expressions, a software was developed to help them learn the meaning of basic facial expressions. The following were the project's components:

Project 1 - Development of Scalable Computing System for an Ambient Intelligent Empathic Space

Project 2 - An Adaptive Multimodal Affect Recognition System in the Empathic Space

Project 3 - Using Body Movement for Automatic Human Identity and Emotion Recognition in the Empathic Space

Project 4 - Adaptive and Self-Improving Emphatic Responses for an Ambient Intelligent Emphatic Space for Autistic Children

Project 5 - Developing an Adaptive Music-based Affect Model for Autistic Children a Self-Improving and Ambient Intelligent Empathic Space

Project 6 - Empathic Educational Software for Children with Autism

Development of an Educational Data Mining (EDM) Workbench

(Engineering research and development technology)

The EDM Workbench was conceptualized by Ryan Baker of Worcester Polytechnic Institute and Bruce McLaren of the Pittsburgh Science of Learning Center help learning scientists process raw educational data into a form that analysis software like SPSS, Weka, or RapidMiner can analyze.

The proposed EDM Workbench is a software tool that will accept as input raw data from intelligent tutors, reprocess it according to the specifications of researchers and analysts, and output it into formats that other analysis tools can read. Specifically, the tool will enable the researchers to define and modify behavior categories of interest, label previously collected educational log data with categories of interest, collaborate with others in labeling data by providing tools, validate inter-rater reliability between multiple labelers of the same educational log data corpus, analyze textual data (e.g., chat), in collaborative learning situations automatically distill additional information from log files, produce code that can be used to immediately transfer the detectors generated by the EDM Workbench and export resultant models of student behavior to tools which enable sophisticated secondary analyses.

The workbench allows learning scientists to define and modify behavior categories of interest. It supports researchers in automatically re-labeling data when labeling schemes change; label previously collected educational log data with the categories of interest, considerably faster than is possible through previous live observation or existing data labeling methods,; collaborate with others in labeling data by providing tools to communicate and document labeling guidelines and standards; validate inter-rater reliability between two labelers of the same educational log data corpus; automatically distill additional information from log files for use in machine learning, such as estimates of student knowledge and context about student response time (i.e. how much faster or slower was the student's action, than the average for that problem step); append data sets by importing raw log files, viewing data sets and importing log files to be added into the data set. The workbench was presented during the July, 2012 Educational Data Mining Conference in Chania, Greece. It was also used during the Pittsburgh Science of Learning Summer School in August 2012 in Carnegie Mellon University, Pittsburgh, PA.

Rain Monitoring and Alarm System Using Hybrid Wireless Networks as Sensors

Ateneo De Manila University

The project gathered data using a network of low-cost, Android-based acoustic rainfall sensors, a nationwide infrastructure of 5 GHz wireless broadband links, tipping buckets and remote weather stations. The low-cost Android-based acoustic rainfall sensors are deployed at high densities over a local area and the 5 GHz wireless broadband sensors gather rainfall information on a nationwide scale. The sensor network provides information about spatial-variations that are characteristic of tropical rain rates, and complement data from the scarcely deployed tipping buckets and remote weather stations.

The Android-based acoustic sensor is low-cost, mobile, and easily deployable. A high-density deployment of the sensors can provide more accurate information about the spatial distribution of tropical rainfall. Tipping bucket rain gauges, while widely recognized as the standard for accumulated rain measurement, are prone to inaccuracy during heavy rain events. The gauges rely on moving parts that are easily affected by environmental factors such as strong winds. Tipping buckets do not provide real-time rain data because they are accumulation sensors. The Android-based acoustic sensor design addresses these issues because the acoustic sensors do not rely on moving parts and can gather information in near-real time. Therefore, a high-density deployment of acoustic sensors can complement existing rain gauge deployments.

For this project, a nationwide infrastructure of 5 GHz wireless broadband links was integrated in the rainfall monitoring system as a high-density sensor network. This marked the first time that this nationwide wireless broadband link infrastructure was used to gather rainfall data. Through a partnership with a major telecommunications service provider in the Philippines, the Received Signal Levels (RSLs) between subscribers and access points of 730 wireless broadband sites from across Luzon and Visayas (Along the Pacific Seaboard) are collected in real-time. There are an estimated 25,000 access points in the Philippines with 7 to 12 subscribers each. This infrastructure gives approximately 250,000 points from which rainfall data can be remotely gathered in near real-time.

Using the said system, areas that lack access to rain event information (e.g. rural areas without the resources to deploy expensive and complex weather stations), can be provided with the data they need to respond to rain events. The system provides data that notify users if the rain event is exceeding safety thresholds (i.e. rain rates are reaching torrential levels). With such information, users can react to the situation accordingly, and generate the appropriate disaster management plan. The rain data gathered from the sensor network can be used to trigger an alarm system. The whole system offers great potential

to save lives and prevent losses/damages.

Materials Science Sector

On-going Projects

Establishment of an Advanced Device and Materials Testing Laboratory (ADMATEL) – Phase 2: Operation of ADMATEL

DOST- ITDI

The ADMATEL started operation in January 2013 with sophisticated equipment for failure analysis (FA) of semiconductor materials and devices. It has laboratories with class 100k clean room requirement, dormitories (for graveyard shifts), lecture rooms, conference rooms, and staff offices. The ADMATEL was established to reinforce/upgrade the FA and materials testing facilities of local industry, provide shorter turn-around time especially for companies unable to set up own FA and characterization laboratories, provide less expensive analysis (no need to send their materials and samples abroad), and attract potential investors seeking a more conducive business environment.

The phase 2 of the project addresses requirements such as manpower competency, additional workforce to support 24/7 operation, equipment and building maintenance, and accreditation for ISO 17025. It mainly supports the utilities to maintain the class 100k clean room and equipment power requirements.

Physical Vapor Deposition (PVD) of Advanced MAX Phase Materials

National Institute of Physics, UP - Diliman

The project makes use of the PVD process to deposit thin films of MAX Phase materials. It intends to establish a reliable and reproducible PVD procedure using a magnetized sheet plasma facility for obtaining advanced MAX thin films with desirable properties for functional and decorative applications. For the first year, color causing transition metals like Cr and Ti can be combined with an A group element like Al and nitrogen to induce the color blue. The nitrides of Ti and Zr can induce the color gold. Other colors for decorative purposes can be induced by combining any MAX phase. Specifically, the target is to come up with the color red (coded U33) and green aside from blue on titanium substrates similar to what the company Lindberg Subic Inc. wants for its eye glass frames which are made of titanium. The various colors on metal substrates coming out of the PVD process serves as menu for decorative coating of other substrate materials like polymers, ceramics and glass.

In the second year, other MAX phases can be combined to have the characteristic hardness, Young's modulus, thermal conductivity, decomposition temperature, oxidation resistance and machinability depending on the intended application. One such remarkable material with these excellent properties is the MAX phase Ti3SiC2 . It combines the chemical resistance, scratch resistance and thermal stability of ceramics and the durability, thermal conductivity and appearance of metals. It has application as a non-stick high temperature, ecologically-friendly coating for cookware replacing Teflon. Teflon-coated cookware is being discouraged as it contains hazardous chemical PFOA when heated above 360 oC. Ti3SiC2 can withstand temperatures above 800 oC and does not emit any toxic compound. Combinations of other MAX phases with remarkable properties open up new applications for heating elements, burner nozzles, reactor heat exchangers, high temperature bearings and components in the chemical and related petrochemical industries.

Chemical Sensors for Mine Site Monitoring Program

Project 1 – Mapping of Heavy Metal Contamination in the Philippine Mining Soils Using Laser-confused Breakdown Sectroscopy (LIBS) Field Sensors

This study is to provide a systematic approach for monitoring the soil quality affected by small-scale mining activities in nearby communities in the Philippines. A sensing instrument using a laser induced breakdown spectroscopy (LIBS) analytical method will be used for the real-time quantitative and qualitative analyses of heavy elements (Hg, Cd, As, Ni, Pb, Zn and others) in solids. The LIBS method is a nondestructive surface analytical technique that involves very little sample preparation and the analysis can be completed within a matter of seconds or longer.

The compact commercially available LIBS instrument will be integrated with other sensors where it would be able to communicate with other sensors by sending information. The LIBS monitoring device will handle direct measurements (without complex sample preparations) of contamination in soil samples. The collected data will be automatically transmitted to the control center. Each of the sensor devices in the program would represent a node in a network that would systematically cover the mining site feeding real-time or timely data to control center.

The level of detection that the LIBS instrument would detect is in the parts per million (ppm) level. Limit of detection also varies as the target element varies.

Project 2 – Optical Sensors for the Determination of Zn & Cu in ambient Water

An inexpensive, portable, robust and sensitive optical chemical sensors utilizing a flow injection system or a microfluidic paper-based system will be developed. The two systems will have the same main reactive component, a polymer membrane. The membrane can be suitably inserted either into a flow-through cell or in a paper depending on the most applicable detection system or technique for the particular environment.

Commercially available Cu and Zn certified standard solutions from reputable companies will be used in the preparation of solutions for use in the construction of standard calibration curve. Once the reactive polymer has been assembled, analysis of samples will be straight forward. The sensor will be designed such that minimal, if any sample preparation is required. The sensor will be a "pack, go and analyze" system. The target limit of detection is 50 ppb.

Project 3 – Gaseous Chemical Mercury Sensors for Atmospheric Monitoring

This project will develop a cost-effective sensor system for the monitoring of gaseous mercury levels at the ASGM sites. The standard mercury vapor mixtures will be prepared by dilution of mercury-saturated air. The mercury-saturated air will be prepared by bubbling air through mercury (which is liquid and spontaneously generates mercury vapor above it until equilibrium is achieved). The concentration of mercury in the Hg-saturated air can be obtained from its vapor pressure at the ambient temperature.

The commercially available devices for the measurement of gaseous mercury are analyzers, and not sensors. These equipment are portable versions of a cold-vapor atomic absorption spectrometer (Lumex, Ohil, US; AM-Series, Nippon Instruments, Japan; Gardis, Lithuania) or a cold vapor atomic fluorescence spectrometer (Tekran Inc., Toronto, Canada; Sir Galahad system, PSAnalytical, US). These instruments have been cited in papers on gaseous elemental mercury measurement.

The analyzers require sample collection and the introduction of the sample to the instrument. In sensors, air will be allowed to flow through the sensor which will consequently generate the signal for the measurement.

The interaction of Hg with gold is specific, so that interference from common gases and vapor are not expected. Gold has been used to preconcentrate mercury in several analyzers. However, because of the electrical nature of the signal, some electromagnetic interference could occur, but means are available to prevent this.

Project 4 – Integrated Sensing System Using Mobile & Cloud Technologies for Mining & Nearby Communities

The strip test will be developed and fabricated and will be read by a modified cell phone (Android-based) acting as the strip reader--the data will be analyzed through the cell phone application and sent through the web for further analysis and data archiving (cloud computing).

An image of the test strip will be taken using the camera of the cellphone. The image processing software that has been developed will be stored in the cellphone. It will automate reading of the test strip and send the result to the cloud. Furthermore, the software is able to calibrate the results in terms of different ambient lighting conditions. In addition, if it is desired to minimize human interference, a mounting platform can be developed to contain the strips and the cellphone and then readings can be taken at programmable intervals.

The limit of detection will comply with Environmental Management Bureau (EMB) requirements for a given analyte, usually ranging in ppm levels.

The sensor can also be used for water and urine samples as the analysis will be test liquids that can be dropped directly onto the test strip.

Metals and Engineering Sector

New Projects

Establishment of an Innovation Center for Motor Vehicle and Parts Development (iMOVE)

DOST - MIRDC

Project 3 - Establishment of a Die and Mold Solution Center in support of the Components and Parts Manufacturing Industry

The die and mold industry is one of the metal working sectors that has been recognized by the DOST and the Philippine Die and Mold Association (PDMA) for accelerated development under the MAKIBAYAN or Makinarya at Teknolohiya para sa Bayan Program as it enhances the overall growth of the manufacturing sector. It is a collaborative project with the industry aimed to enhance the competitiveness of the die and mold sector, the automotive parts manufacturing sector and the metals and engineering sector in general. The project will establish a die and mold solution center furnished with advance metal working machines and technology software tools to support the industry's localization and exports of dies, tools and molds, The project will also extend manpower training and technologies relevant to die, tool and mold industry.

Support Program for the Productivity and Competitiveness of the Metals and Engineering Industries

DOST - MIRDC

Design and Development of a Local Microwave Vacuum Dryer

Rice bran is the by-product in rice milling operation. As it is composed of protein, fat, ash and crude fiber, it has a very high nutritive value. It is an excellent source of vitamins B and E including small amounts of anti-oxidants. Rice bran is widely used as ingredient for poultry and ruminant feeds. Techniques for stabilizing rice bran in recent years have made it possible to use rice bran to other food products other than as feed ingredient. In the developing countries such as the Philippines, rice bran is underutilized due to lack of suitable stabilization techniques. The project

focuses on the design and fabrication and testing of a 30-liter capacity microwave vacuum dryer for process stabilization of fine grade rice bran for incorporation in pasteurized and sterilized emulsion-type meat/ fish system.

Mining and Minerals Sector

The mining industry has a crucial role to play in the responsible development of the world's natural resources, given the substantial and direct social, environmental and economic impact its activities can have. Responsible mining – one that is based on science and technology – can be a driver of the country's economic development.

New Projects

Minerals Extraction with Responsibility and Sustainability (MinERS)

UP – Diliman

Aptly, the PCIEERD is monitoring the program MinERs program that is directed towards providing science and technology-based processes to help the small scale miners.

Project A - Non-Hazardous Methods of Gold Extraction for Philippine Small Scale Mining Applications

Small scale mining has numerous economic, health, and safety challenges, but many families and communities continue to depend on this tenacious industry. Science and technology intervention can uplift the plight of marginal gold miners.

The project aims to determine the viability of using other lixiviants (liquid medium used in hydrometallurgy to selectively extract the desired metal from the ore or mineral) for gold leaching, and its subsequent recovery by electrowinning. For non-hazardous methods the project will identify the requirements of a fully-integrated cyanide and mercury-less gold recovery and extraction process and establish a simple, easier gold characterization method from process stream products for operational control. It will also conduct a fully functional and economically viable pilot scale operation of gold recovery and extraction.

It is expected that a full mineral characteristics on recovery and extraction using the alternative method will be established. Quick-assay method of gold in the process streams for operation control, laboratories with higher competency to conduct similar or related studies, and comprehensive economic analysis and protocols of the process will be established. Ultimately, awareness campaigns and training plan for small scale miners and operators will be conducted.

Project B - Modelling of Fate and Transport of Heavy Metals in Surface Waters from Source at Mining Site to Downstream Receiving Waters

This study will use and possibly modify an existing transport model to calculate the risk, which is important to determine the expected concentration of heavy metals in any location along any breadth of the surface water for the current condition and when there is possible significant discharge from or along any source.

It aims to [1] evaluate the hydrological conditions of the watershed where the mining site is located, [2] identify potential sources of contamination from mining site that contaminate nearby surface waters and characterize the mining wastewater that contains heavy metals, [3] measure and evaluate current water quality levels of the surface waters that are possibly affected by nearby mining site--from the source, upstream section, all the way to downstream section of the receiving water, and [4] perform a

Analysis of Nanofiber

stochastic fate and modelling using available software to estimate the expected heavy metals concentration, and calculate the risk of exposure.

Project C - Optimizing the Effectivity of Coco-Peat Filter Bed in Field Applications

Many studies have proven the effectiveness of the coco-peat filter bed in removing environmentally regulated heavy metals in both ideal and field conditions using different heavy metals in batch and column set-ups. A coco peat filter bed reactor was also designed for in-situ wastewater treatment applications.

The project intends to evaluate the pollutant preference of the coco peat filter bed reactor in removing heavy metals like mercury from gold and copper mine process wastewater, optimize the coco peat filter bed reactor design and operating parameters for use in treating process wastewater from gold and copper mining activities, and integrate the coco peat filter bed reactor into the proposed wastewater treatment systems for a highly efficient process wastewater treatment. Eventually. a water quality assessment of gold and copper mining with focus on process wastewater will be established together with the sorption capacity and preference of coco peat on heavy metals from gold and copper mine process wastewater. The coco peat filter bed reactor will also include optimized operational parameters for removal of preferred heavy metals from process wastewater and integrated wastewater system.

Project E - Nanofiber Membrane Adsorption for Third Level Wastewater Treatment Method for Small Scale Mining Operations

This research will evaluate the treatment capacity of PCL-clay nanofiber mat in remediating heavy ions, while increasing the production capacity of electrospinning set-up. Moreover, it will investigate the degradability and reusability properties of the nanofiber mat.

The gains expected from the research include the [1] determination of the nanofiber mat's adsorption capacity in treating heavy metals like As, Ba, Cd, Hg and Pb, [2] evaluation of selectivity of multi-ion heavy metal on the nanofiber mat, [3] determination of the nanofiber mat's efficiency in treating heavy metals like As, Ba, Cd, Hg and Pb and multi-ion system, and [4] determination of the nanofiber mat's desorption characteristic.

Project G - The Gold and Copper Chase: Life cycle Analysis of Sustainable Small Scale Production System

This research aims to help small scale industries through the development of feasible and simplified tool, system or technology that can address economic, environmental, and social concerns while maintaining their competitiveness and promoting their growth.

It will put together useful information that can be used as reliable reference for the small scale mining sector. These best practices in gold-copper mining/processing and refining operations, detailed life cycle inventory of existing and new gold-copper mining/processing and refining process, situational analysis using the triple-bottom line criteria--economic, quality and environmental, and socio-legal, identification of priority needs or areas of intervention, recommendation of improvement.

On-going Projects

S&T Program for Responsible Mining in Mindanao

The DOST is continuing its S&T Program for Responsible Mining in Mindanao which aims for a socially-acceptable, economically viable, environment-friendly and ecologically sound mining in the region. This is anchored on sound decision support system developed from information and technologies generated through R&D.

Project 1 - Assessment of Terrestrial Ecosystems in Selected Mining Environs in Mindanao Caraga State University

Mining areas in resource rich Mindanao experience gradual imbalance in biodiversity. If unchecked, this could lead to long-term consequences to living organisms including plant and animals in land and marine areas. These include displacement, depletion, and even extinction of species.

The ridge-to-reef approach in assessing the biodiversity of specified areas will enable comprehensive profiling and analysis of terrestrial flora and fauna near key mining areas in comparison to relatively pristine conditions. Assessment and profiling of terrestrial flora and fauna will cover species composition, conservation status, diversity, and distribution that would include birds, amphibians,

reptiles, and mammals (volant and non-volant) in selected key mining areas using GIS. GIS based species distribution modeling will be employed to predict the effect of changes in land cover and habitat. Nematode community structure will also be assessed as nematodes are good soil indicators because of their participation in many functions at different levels in the soil food web, hence the soil ecosystem.

This project aims to assess the biodiversity of terrestrial ecosystems in key mining areas in Mindanao such as Claver, Surigao Del Norte and Carrascal, Surigao Del Sur (large scale nickel mines); Bunawan and Rosario, Agusan Del Sur (small scale gold mines); Opol, Misamis Oriental (small scale gold) and Alubihid, Misamis Oriental (small scale nickel and chromite); Gango, Libona, Bukidnon (small scale gold); and T'boli and Bagumbayan, South Cotabato (small scale gold).

The project is expected to develop web-based database of flora and fauna, catalogued herbarium and voucher specimens, policy recommendations on flora and fauna conservation towards responsible mining, bio-acoustic libraries of bird, bat, and amphibian calls, nematode community structures and identified bioindicator nematode species, and species distribution models on how mining and vegetation changes affect the distribution and diversity of vertebrate animals.

Avifaunal sampling near mining area

Project 2 - Assessment of Aquatic Ecosystems in Selected Mining environs in Mindanao

The project will also use the ridge-to-reef approach in assessing the biodiversity of specified study areas like aquatic flora and fauna near these key mining areas. This will provide baseline record and insights on both freshwater and marine flora and fauna, and possible impacts of mining to their diversity. Studies on fish, phytoplankton, and macroinvertebrate diversity and physico-chemical dynamics of aquatic bodies near the key mining areas are scarce and mostly unpublished. This project will update biodiversity records and provide robust information on the aquatic ecosystems' status though assessment of health and size structure of bioindicator selected fish species, and water quality in this ecosystem. Tissue samples from key flora and fauna in this study will be used to jumpstart molecular/genetic biodiversity and bioremediation studies in subsequent phases of this project. The proposed establishment of Caraga Biodiversity Resource Center will serve as repository of vouchered specimens that will showcase Mindanao's rich biodiversity.

The project will assess the aquatic ecosystems' biodiversity in key mining areas in Caraga such as Claver, Surigao Del Norte and Carrascal, Surigao Del Sur (large scale nickel mines) and Bunawan, Agusan Del Sur (small scale gold mines). Results of the project's will be important in the formulation and implementation of policies, laws, and ordinances to mitigate the mining activities' adverse impacts on aquatic flora and faunal biodiversity. Moreover, the research outputs will provide a basis for development of strategies to mitigate the impact of mining on biodiversity in other areas of the country.

Project 3 - Monitoring, Assessment and Profiling of Artisanal and Small-scale Mining (MAP-ASM) in Key Areas in Mindanao

This research focuses on the importance of technological advancement and legitimized operation of ASGM sub-sector. As the title suggests, it will serve as information repository through monitoring, assessment, and analysis of mining practices by both operators and local miners in identified key areas in Mindanao. A mini-compendium and database as outputs will collate, integrate, analyze, synthesize, share, and publish current methods used. The expected outputs will provide significant guide in designing intervention for the improvement of mining, mineral processing, and marketing strategy involved in ASGM as part of technology transfer.

The project covers Study 1: Baseline survey of ASGM in the context of responsible mining in the Caraga Region; Study 2: Preparation of development strategy and massive information, education and communication campaign to the ASGM communities, and; Study 3: Capacity building, technology transfer, and technical assistance.

Ball mill equipment for gold processing

Project 4 - Contamination Pathway and Pollution Management of Mining in Mindanao

This project will monitor and assess environmental impacts attributed to mining activities in Mindanao to clarify the contamination pathways and recommend appropriate pollution mitigation measures.

The project aims to [1] conduct baseline environmental monitoring and impact assessment of mining in selected areas in Mindanao [2] determine impacts of heavy metals (Hg, CN-, Pb, Cu, Cd, Ni, Cr) on ecosystems affected by mining in selected areas in Mindanao, [3] determine impacts of heavy metals of mining activities on agri-fishery systems adjacent to mining areas, [4] determine vulnerability and impact of mining activities on agri-fishery systems adjacent to mining areas, and [5] conduct assessment and massive information, education and communication (IEC) campaign on pollution mitigation measures in ASGM

The project's expected output includes [1] comprehensive baseline data on environmental conditions of key ASGM areas in Mindanao, [2] reliable data on the presence or absence of pollutants on surface and groundwater, soil, mine tailing, riverbed sediments, and air quality, and [3] accomplished development of research manuscripts/monographs, database management of documents, and information sharing.

Project 5 - Rehabilitation of Areas Affected by Mining in Mindanao Towards Eco-restoration

The project will undertake 3 studies: [Study 1] Analysis of rehabilitation efforts in mining areas toward effective eco-restoration program, [Study 2] Population restoration of key species through assisted natural regeneration (ANR) in key mining areas, and [Study 3] Water contamination reduction through wetland restoration.

In Caraga Region, nickel mining firms started rehabilitation of areas affected by their operations and even in indirect impact areas where siltation from their operations flow. But negative environmental effects are still visible spurring critics' and environmentalists' 'mining ban' call. It is prudent to assess the mining firms' rehabilitation efforts and see if these can be improved to further reduce negative environmental impacts. Moreover, strategies implemented in countries that passed current stage of mining concerns are worth verifying such to reduce operation cost.

The expected output of the project are: [1] list of technologies for soil restoration, plant propagation, and ecobelt establishment, [2] technology package for restoration of degraded ecosystems brought by mineral contamination, and [3] information and technologies ready for policy recommendation and advocacy.

Project 6 - Rehabilitation of Mercury-Contaminated Gold Mining Sites in South Cotabato and Sultan Kudarat Provinces University of Southern Mindanao

The Philippines has the potential to be among the world's top 10 largest mining countries but there is a growing concern among government and environmentalists on the impact of mining activities, both from large and small scale, to the ecosystem.

The application of biological diversity for pollution abatement is an alternative option to costly environmental cleanup techniques. Bioremediation and phytoremediation are effective and innovative technologies for treatment of wide variety of contaminants. These require relatively low capital cost and have aesthetic value.

The project's expected output includes [1] list and collection of microorganisms and plants with high potential for bioremediation and phytoremediation, [2] determined biosorption and heavy metal uptake capacity of different microorganisms and plant taxa, [3] collection of plants propagated for phytoremediation, and [4] possible restoration of degraded ecosystems caused by heavy metal contamination.

Project 7 - Alternative Technology for Processing of Chromite and Laterite Ores: Crude Fe-Ni Cr Alloy Production Mindanao State University – Iligan State of Technology (MSU – IIT)

The project aims to determine the iron, nickel, and chromium recovery when laterite and chromite ore mixtures are mixed with carbon as reductant and brought into equilibrium at certain smelting temperature to produce crude Fe-Ni-Cr alloy and slug.

The project was designed to develop alternative technology that allows value adding to nickel and chromium minerals. This will possibly lead to development of new and more efficient technology for direct stainless steel production from laterite and chromite ores.

The project's expected output includes [1] development of new technology for processing of laterite ores and establish optimal conditions for reduction, and [2] proposed process for direct stainless steel production.

Project 8 - Development of Alternative Technologies for Small-Scale Gold Mining in CARAGA and South Cotabato Region MSU – IIT

The project will examine the gold processing technologies currently used by miners in CARAGA and South Cotabato Region. It will identify some alternative mercury/cyanide-free techniques that can be adopted in the region. As outputs, the project will develop alternative gold extraction technologies such as iodide-iodine leaching, chlorine-hypochlorite leaching to replace cyanidation, direct smelting method using borax to replace amalgamation process that is cheaper, non-hazardous, and suitable for small batches, and a technology that can recover very small gold particles and locked up ores that amalgamation cannot recover.

Project 9 - ICT Support to Responsible Mining in Mindanao Caraga State University

http://www.mindanaogrp.info/

The project aims to develop information systems and generate GIS-based threat analysis and assessment of selected mining areas in Mindanao. Specifically, it seeks to [1] build databank facility, [2] design and maintain an information system that will (a) capture and store data on remote site, (b) provide context-sensitive information to users, (c) provide 24/7 service to stakeholders; [3] employ GIS tools to combine datasets from various sources (actual/survey data, secondary data, and remotely-sensed data), [4] remote sensing data like satellite images, and digital elevation model (DEM), [5] employ spatial data analysis, and [6] generate environmental modeling. A database storage, web-enabled map, and decision support system and threat analysis of mining areas in Mindanao will be the outputs of the project.

Completed Project

Establishing the History of the Philippine Islands Arc System: Clues from the Rocks of the Zambales-Pangasinan Region

This study was conducted to determine the geochemical and geophysical signatures of rocks in west Central Luzon, propose a model on tectonic evolution and mineralization of west Central sedimentary and related igneous rock sequences, and re-assess the mineralization potential of the Zambales

Ophiolite Complex and related rock formations from geophysical and geochemical evidence.

The Zambales Ophiolite Complex in west Central Luzon is one of the well-investigated ophiolite sequences in the Philippines (e.g. Hawkins and Evans, 1983; Yumul and Dimalanta, 1997). Although a lot of information was gleaned from field mapping, geological, and geochemical investigations of the Zambales Ophiolite Complex, there are still aspects of its history which are difficult to understand. These include insights into the formation, docking, emplacement, and erosion of this oceanic lithosphere.

This project came up with the following: [1] baseline data on geochemical compositions of sedimentary sequences in west Central Luzon, [2] synthesis on the geochemical and geophysical data collected from west Central Luzon, [3] geochemical and geophysical data useful in the search for metallic and non-metallic resources, [4] paleogeographic reconstruction and model elucidating the early tectonic setting of Central Luzon and their implications on evolution and mineralization of the Philippine island arc system. Trainings for researchers were also conducted on the acquisition, processing, and interpretation of gravity, magnetic, and paleomagnetic data, petrographic and geochemical analysis of sedimentary rocks. Gathered information were also used for those taking up masters degrees for their theses.

Nanotechnology Sector

New Projects

Polymer Electrolyte Systems Based on Carrageenan for Solid State Dye Sensitized Solar Cell (DSSC)

De La Salle University

The current configuration of DSSC using nanoparticles of TiO2, Ru dye, and liquid electrolyte is unstable and poses long term reliability problem due to the volatile and corrosive nature of liquid electrolyte. Moreover, its manufacturability is not truly cost effective and practical due to leakage problem in sealing the liquid electrolyte.

The project aims is to develop and fabricate a solid type electrolyte system by investigating the use of carrageenan composites as polymer electrolyte. It will look into the optimization of self-assembly conditions, impact of carrageenan molecular weight, and electrolyte concentrations to achieve better ion transport.

Synthesis of Carbon Nanotubes (CNT)-silicon Heterojunctions for the Fabrication and Assembly of Solar Panel

University of the Philippines - Baguio

The development of cost-effective solar panel is critical especially in the face of unabated rise in oil prices.

The project aims to [1] design and build a deposition system for the synthesis of carbon nanotubes (CNT) in large scale, [2] enhance the energy conversion efficiency to values corresponding to or better than the 29% conversion efficiency of commercially available solar cells, [3] design and develop a system to integrate the solar cell with electrical storage device for testing, and characterize and assess the performance of the solar cell system, and [4] provide cost-benefit analysis of a CHT-based solar cell.

Development of Nanosensors and Nanostructured Materials from Agricultural By-products for Enhancement of Food and Agricultural Productivity and for Environmental Sensing and Remediation

The projects under this umbrella program intend to harness the power of nanotechnology for the benefit of the local agriculture and food sectors.

Project 1 - Removal of Arsenic from Contaminated Water Using Modified Biopolymer-Silica Nanocomposite Materials

University of the Philippines – Los Baños

This research will make use of nanomaterials from agricultural by-products for arsenic remediation of groundwater. It is expected to come up with purified silica from rice hull ash, nanosilica/ nanozeolite samples, a process for the production of nanosilica/ nanozeolite at less than 100g, modified chitosan and keratin hydrogels, nanocomposites materials from modified biopolymers and nanosilica/nanozeolite, performance data of nanomaterials produced based

on laboratory and field tests, kit for removal of inorganic arsenic from contaminated water, and two scientific publications.

Project 2 – Detection and Analysis of Arsenic in Contaminated Water
University of the Philippines – Los Baños

This research will use nanomaterials from agricultural by-products for arsenic detection and analysis in water samples. It consists of two studies: [1] development of colorimetric for arsenic detection or chromophore attached to abiopolymer nanomaterial suitable for coating test strips for arsenic detection or as components of test reagent kit; and [2] preparation of nano-gold-modified electrodes for detection of arsenic by differential pulse anodic stripping voltammetry.

Project 3 - Development of Nano-Biosensors for Detection, Monitoring and Diagnosis of Diseases of Banana and Abaca
University of the Philippines – Los Baños

This project aims to develop a usable nano-biosensor for detection, monitoring, and diagnosis of plant viral diseases Abaca Bunchy Top Virus (ABTV), Abaca Mosaic Virus (AMV) and Banana Bract Mosaic Virus (BBMV).

Project 4 - Development of a Zinc Oxide Thin Film for Gas Sensing
University of the Philippines – Los Baños

The project aims to develop functionalized zinc oxide thin film as gas sensor for ammonia, methane, and carbon monoxide, and sensor selective to a chosen gas. Specifically, it aims to [1] synthesize zinc oxide thin film using electrophoretic deposition, [2] determine the effect of ZnO solution concentration and deposition voltage on thin film morphology, [3] determine the effect of zinc oxide thin film morphology on its electrical properties, [4] determine the effect of substrates on the morphology and electrical properties of ZnO thin film, [5] determine the sensitivity of zinc oxide thin film to ammonia, methane, and carbon monoxide, and [6] functionalize the zinc oxide thin film to be selective to a chosen gas. Also part of the project is for undergraduate student graduating with a thesis and publications on this topic.

Project 5 - Development of Controlled Release Nano-encapsulated Plant Growth Regulators from Locally Isolated Plant Growth Promoting Bacteria (PGPB) for High Value Crops Production and Tissue Culture of coconut
University of the Philippines – Los Baños

This project explores the nanoencapsulated plant growth regulators produced by locally isolated plant growth promoting bacteria (PGPB). The specificity and controlled release of nanoencapsulated plant growth regulators to target plants will be determined in terms of effectiveness in promoting plant growth and potential biocontrol property.

The project's long term objective is to develop a nanoencapsulated plant growth regulator and a method for application for enhanced plant growth of high value crops and bio-control property.

Project 6 – Optimization and Bench-Scale Preparation of a Hemicellulose-Chitosan/Tripolyphospate (Polyphosphate) Nanocomposite Coating and Its Use in Post-Harvest Life Extension of Papaya (Carica Papaya) Fruits
University of the Philippines – Los Baños

Aged papaya (Carica papaya)

The food processing and agricultural industries generate huge processing wastes with low economic value. Waste disposal and pollution are main concerns of such industries.

The project aims to optimize the condition for preparation and bench-scale production of a hemicellulose-chitosan/tripolyphosphate (polyphosphate) nanocomposite coating, and evaluate its performance in extending the shelf life of some high-value Philippine fruits.

The project's expected output includes [1] optimized procedure for extraction of hemicelluloses from pineapple crown leaves or sugarcane bagasse, [2]

relatively large quantity of hemicelluloses, [3] optimized procedure for preparation of chitosan/ TPP (PP) nanoparticles, [4] chitosan nanoparticles of desired size, [5] nanocomposite films with desirable physiochemical and mechanical properties, [6] procedure for preparation of nanocomposite films, [7] high-value fruits with longer post-harvest life and improved quality, [8] MS Ag Chem, Chem or Biochem and Bs Ag Chem/chem students, and [9] terminal report and at least one article in a scientific journal.

Project 7 – Development of Pectin-collagen/ Nanocellulose Biocomposite Coatings from Mango Peel and Nata de Coco for Post-Harvest Life Extension of Mango (Mangiferaindica L. cvCarabao) and Papaya (carica papaya L.) Fruits

University of the Philippines – Los Baños

Mango samples for post-harvest life extension experiment

This proposal intends to prepare and characterize coating materials containing nano particles. The coating's components are bio-materials derived from waste of the agricultural and food processing sectors.

The project aims to prepare bionanocomposite coatings from polymeric materials derived from food processing and agricultural waste, and apply these to high-value Philippines fruits to extend their post-harvest life.

The expected output includes [1] polymeric materials-pectin and collagen, [2] nata de coco nanocellulose, [3] nanocomposite films with desirable physicochemical and mechanical properties, [4] process(es) for preparation of biananocomposites, [5] process(es) for application of coatings, [6] high value fruits with longer post-harvest life and improved quality, and [7] two publications from project's results.

Project 8 - Nanotechnology for the Philippines' Forest Products Industry: Cellulosic Nanocrystals from Selected Philippine Bamboo Species
DOST – FPRDI

The project involves selection of Philippine bamboo species based on abundance, distribution, growth, and cellulose content. A methodology and protocols for extraction and purification of cellulose from bamboo and wood waste will be developed subsequently to obtain cellulosic preparations with consistent properties. This eventually leads to the development of new products from bamboo that will improve utilization of these materials for increased productivity and better cost efficiency. A database on cellulose content of different Philippine bamboo species will also be developed.

Project 9 – Characterization and Performance Analysis of Nanosilica Powder Incorporated in Biodegradable Film Based on Cassava Starch for Food Packaging Applications

University of the Philippines – Los Baños

This study explores the mechanical and barrier properties afforded by rice hull ash nanosilica in cassava starch films. Rice hull is a waste by-product of agricultural processing industries.

This research aims to develop nanosilica powders from rice hull ash, and analyze the effectiveness of biodegradable film based on cassava starch incorporated with nanosilica powder for food packaging application.

Project 10 – Performance Analysis of Nanosilica-in-Fluid Dispersion (Nanofluid) Used as Coolant in Heat Exchanger

University of the Philippines – Los Baños

A nanosilica-in-fluid dispersion (nanofluid) derived from rice hull will be developed to enhance the performance of heat exchanger systems. This method may help find an alternative way to enhance thermal properties of heat transfer fluids. Fluids with nanoscaled particles form stable suspension, and provide impressive improvements in thermal properties of base fluids and heat transfer performance of heat exchangers.

Project 11 – Evaluation of Nanosilica Powder from Rice Hull Ash Used as Silicon Fertilizer for Tomato (Lycopersiconesculentum)

Silicon is an important element for a large number of plants including tomato. Tomato is one of the most important vegetables grown in the country.

This research aims to evaluate the potential use of nanosilica powder from rice hull ash silicon fertilizer for tomato.

Nanostructured Electrocatalysts Based on Graphene-Support Nanoparticles towards Direct Fuel Cell Application

University of Santo Tomas

Fuel cells can be a source of power for home and office devices, automobiles, mobile phones, and even spacecraft.

The project aims to develop anode materials by impregnation or dispersion of electrochemically synthesized noble metal nanocatalysts (e.g. Pd) and non-noble promoter metal (e.g. Ni) on carbon-based materials (e.g. graphene). The use of carbon-based materials could be a cheaper alternative as substrates for nanoparticles.

On-going Projects

Synthesis and Application of Novel Nanoscale Photocatalysts with Different Dopants for the Treatment of A) Dimethyl Sulfoxide, B) Chlorophenols in Aqueous Solutions, and C) Gaseous Formaldehyde

Department of Chemical Engineering - UPD

Environment cleanup is an urgent concern because of the many health and safety hazards that pollution brings. Photocatalysis or the "acceleration or retardation of reaction rate in chemical reactions by light" is a novel option.

The main objective of the project study is to synthesize novel doped-titanium dioxide catalysts, and evaluate the photocatalytic performance of these catalysts in terms of the extent and rate of a) DMSO, b) chlorophenol degradation in aqueous solutions, and c) CH2O degradation in air by photocatalytic oxidation under visible light.
Photocatalysis involves the use of light to activate the catalyst to speed up a chemical reaction. Current research focuses on extending the applicability of photocatalysis to visible light, and accelerating target compound degradation by catalyst modification. To the best of our knowledge, photocatalytic degradation of (a) dimethyl sulfoxide (DMSO) and (b) chlorophenols in water and (c) formaldehyde (CH2O) in air by K3[Fe(CN)6]-modified titanium dioxide catalyst under visible light has not been investigated.
The research project is a collaboration between the Philippines and Taiwan which promotes the exchange of scientific information to broaden the friendship and cooperative educational exchange.

Development of DNA-based Nano-Biosensor for Food and Environmental Applications

BIOTECH – UPLB

This collaborative project's long-term objective is to develop field-operable DNA based biosensor technologies for rapid detection and identification of disease-causing microbial pathogens transmitted through water, food, and environment. Specifically, it seeks to [1] do sample preparation and target DNA extraction from various sources, [2] synthesize nanoparticle, characterize, and functionalize, [3] construct thiolated DNA probe for E. coli, E. coli 0157:H7, and L. monocytogenes detection and

identification, [4] develop E. coli, E. coli 0157:H7, and L. monocytogenes DNA assay, do confirmation and electrochemical detection, and [5] conduct in-house validation of E. coli, E. coli 0157:H,7 and L. monocytogenes bio-barcode DNA assay.

Sequence of sample preparation for the DNA-based nanobio-sensor

Development of Electrochemical SPR Sensing using Electropolymerized MIPS and Nanomaterials for Detecting EDCs and Chemical Contaminants

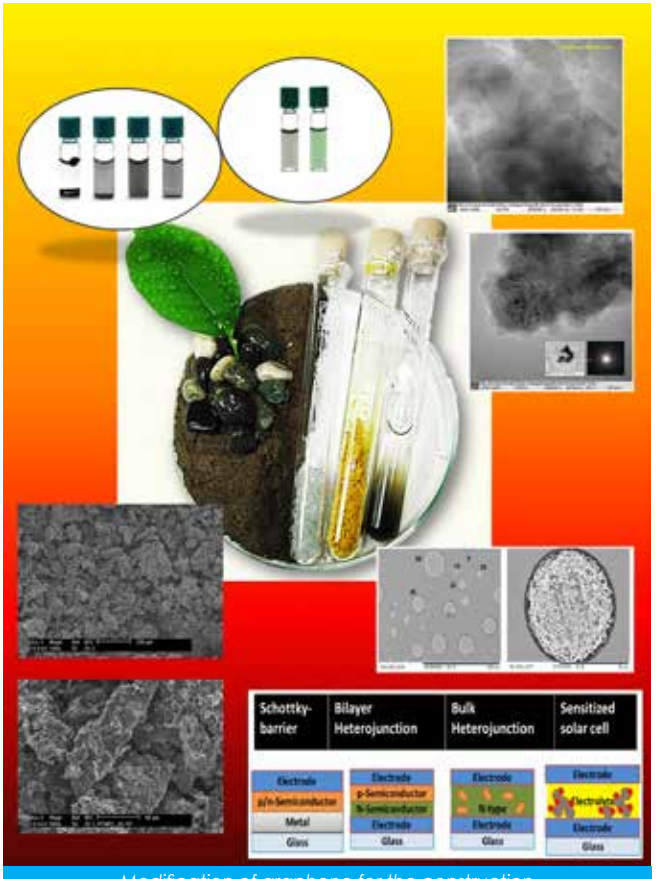
Institute of Chemistry - UPD

This project will develop a sensor based on novel ultra-thin films of molecularly imprinted polymer-nanomaterial composite as recognition elements for a variety of CCs ad EDCs. Hyphenated electrochemical-surface plasmon resonance (EC-SPR) technique will be used to provide the highest selectivity of MIP-nanomaterial composite thin films. Several organic macromolecular and oligomeric precursors capable of deposition as ultra thin films will be designed and synthesized. The synthesized functional and cross-linking monomers plus the functionalized nanoparticles are electropolymerized in situ on Au surface of SPR sensor chips in the presence of template molecule. Electropolymerization will be simultaneously monitored with changes in the reflectivity that indicates growth on the film. The imprinted template molecule is extracted with proper solvents. Electrochemical parameters combined with optical/dielectric parameters will be optimized for thin film fabrication and improved sensor performance. Sensitivity and selectivity of different MIP-nanomaterial composite films prepared will be tested and compared. This project will also modify a commercially available portable, low-cost SPR to obtain electrochemical sensing capability using a small potentiostat.

Nanostructured Solar Energy Devices

Project 1 - Nanostructures for Solar Cell Applications National Institute of Physics – UPD

A solar cell "directly converts the energy in light into electrical energy" through photovoltaic process. Solar cells are a promising alternative energy source that



Modification of graphene for the construction nanostructured solar cells

is also environment friendly. This project's focus is on solid state-based and dye-sensitized solar cells (DSSC). The use of novel conducting polymers will be integrated at the latter stage of the project. Fabrication and integration of nanosized materials such as graphene, porous titanium oxide, carbon nanotubes, GaAs nanowires, InAs quantum dots, and GaSb quantum wells will be pursued to improve the efficiency of solar cells.

This project aims to demonstrate a solar cell with III-V based nanoparticles with comparable efficiencies to commercially available counterparts (20% up efficiencies), develop a technique in fabricating solar cell with nanoparticles, and integrate the same technique using dye-sensitized cells and transparent grapheme electrodes.

Project 2 - Transparent Electrodes for Solar Cell Applications
National Institute of Physics – UPD

This project investigates the use of grapheme as transparent contact in semiconductor device, develop a technique for grapheme transparent electrodes, and integrate the same technique in the fabrication of dye-sensitized solar cell devices, GaAs based solar cell devices, and nanostructured solar cells.

The project's focus is on solid state-based and dye-sensitized solar cell, and to address issues such as [a] extension of absorption of the cells in both infrared (below the Si band-gap), [b] efficient conversion of ultraviolet and visible portion of the solar emission spectrum, and [c] better transport and collection efficiency of the generated electron-hole pairs.

Project 3 - GaAs-based Solar Cell Devices
National Institute of Physics – UPD

This project aims to develop GaAs based solar cell devices, and integrate nanostructured materials into GaAs based solar cell devices. This is an effort to alleviate the nation's dependence on oil for power generation. Among the leading options for solar energy exploitation are those based on solid state devices. While there are commercially available units, there is still room for improvement in efficiency. Silicon (Si) is an indirect band gap material and its efficiency in converting light to electricity is far lower than direct band gap semiconductors like Gallium Arsenide (GaAs). However, Silicon (Si) wafer and device fabrication is a mature technology, and the manufacturing cost of Si solar cells is still dramatically lower than those built on direct band gap semiconductor. This work will try to improve the efficiency of Si based solar cells by incorporating nanoparticles based on III-V semiconductor materials. These structures are direct band gap materials and might possibly extend the spectral sensitivity of the cell to longer wavelengths. It will also consider the use of graphene as a transparent electrode for solar cells.

Project 4 - Modification of Graphene for Nanostructured Photovoltaic Cells

Graphene is the newest allotrope of carbon to be isolated. It has attracted worldwide interest because of its electronic and other properties. Recently, a high-yield method of producing grapheme was developed at the Ateneo de Manila University. This project intends to incorporate graphene into a photovoltaic cell design, starting with the new generation of solar cell called dye-sensitized solar cell (DSSC). Graphene offers an advantage because it may be readily produced from graphite, which is readily available. It has no known environmental toxicity and it offers stability. This project aims to modify this molecule to render functions in key components of the DSSC, either to make cheaper components or improve cell efficiency and stability. Moreover, this project could also offer new discoveries on this newly discovered material. Chemically modified graphene could be suitable to other uses like in sensors, and in a different photovoltaic design such as p-n junction structures.

Optically Transparent Spinel-Based Ceramics from Natural Kaolinite Nanoparticles

The project aims to [1] develop optically transparent spinel/mullite-based ceramics from local raw materials and home-grown technologies, [2] evaluate the quality of transparent spinel.mullite-based ceramics, and [3] determine the optimal parameters to produce optically transparent spinel.mullite-based ceramics.

The techniques involved are similar in producing traditional ceramics. It will not be difficult to retrofit local ceramic manufacturing plants to produce this new high-value product.

Conjugated Diblock Copolymer Nanocomposite Heterojunctions--Nanostructured Materials for Improved Photovoltaic

The project aims to [1] synthesize conjugated diblock copolymers, [2] sequester nanoparticles in targeted domains of CP-BCP, [3] orient, characterize, and electropolymerize nanocomposites, [4] characterize functional properties of nanocomposite and correlate to hierarchical structure, and [5] fabricate and optimize photovoltaic devices.

The second year of this three-year project involves the fabrication of CP-block copolymer (BCP) nanocomposites, where NPs will selectively reside in one domain of microphase separated BCPs. Incorporation of NP into the polymer will improve exciton dissociation and charge mobilities, while the use of conjugated polymer microphase separated BCP as the matrix provides a level of control of dispersion, spatial distribution, and orientation of nanoparticle in the polymer matrix that is unavailable by any other method. Moreover, since a range of novel methods to synthesize CP-BCP will be developed, exquisite control over the polymer-nanoparticle interface will also be readily available. Control of dispersion and interfaces in these materials is expected to dramatically improve their photovoltaic (PV) properties.

Completed Project

Nanostructured Ultrathin Films Based on Electrochemically Grafted Polymer Brushes

Institute of Chemistry - UPD

The project has accomplished its objectives of developing [1] photovoltaic/electrochromic display application, [2] new nanostructured polymers with linear-Dendron architecture capable of electrochemical grafting on electrode surface, [3] smart polymer coatings that can enhance efficiency and incorporation of conducting polymer for photovoltaic solar cells and electrochromic display devices, [4] new polymerization methods. Notably, the project instroduced the use of living polymerization methods like RAFT or ATRP combined with electrochemistry – a new technology that will enable Filipino scientists to produce high impact publications in academic research and train Filipino scientists in state-of-the-art polymer-based nanomaterials. Also, the project produced 2 Ph.D. graduates and 2 MS graduates.

Packaging Sector

On-going Projects

Development of Transport Packaging Technology for Cut Flowers

DOST - ITDI

To enhance the competitiveness of cut flowers both in local and export markets, this project is developing an appropriate transport packaging technology that reduces the handling and distribution damage of selected cut flowers such as rose and chrysanthemum. Initially, the project has already extended the storage life of rose and chrysanthemum from 5-7 days to 30-35 days using MAP technology. Oxygen transmission rate (OTR) of a locally available packaging material was also found suitable for MAP application to rose and chrysanthemum. Using the technology, the percentage damage for roses and chrysanthemums were reduced from 30% to 1.04%-18%. Further, a graphic design and a brand name that will give a reputation for quality of cut flowers grown in the Philippines are also being developed. The project intends to transfer the results of the project to individual farmers and group of farmers (cooperative) of cut flowers in the countryside and help them expand their current market outlets.

Toxic Migrants in Packaged Foods and Beverage: Addressing the Safety Issues on Packaging Related Contaminants in Foods – Phase II

DOST - ITDI

The project aims to provide scientific data on toxic migrants in packaged foods and beverages addressing the increasing concern on safety issues on packaging-related contaminants in foods.

The project is now on its final phase of assessing BPA and acetaldehyde particularly in canned sardines and acetaldehyde in bottled water using their validated methods also established through the project. Overall migration tests were also conducted to assess if the packaging materials are compatible as food contact substance.

Moreover, with the recent use of paper and paperboard in fast food chain as alternative to plastic containers, issues on packaging-related contaminants need to be addressed. This Phase II of the project will further establish/validate methods for determination and assessment of benzophenone in printed paper and paperboard used as food packaging and phthalates in PET and HDPE containers.

The results of the project could be used by appropriate government agencies in the formulation of policy related to the safety requirements on the use of packaging materials, provide measures on issues concerning packaging related contaminants to avoid future market access problems related to these substances, and provide correct information to the general public and avoid misconception regarding certain issues on packaging related contaminants.

Enhancing the Competitive Identity of Philippine Products Through the Development of Packaging Design and Appropriate Packaging Technology

DOST - ITDI

Most of Philippine products remain unknown to many potential consumers and remain in their own limited market due to poor presentation, lack of product identity, and visual impact. The project aims to contribute in increasing the market potential and competitiveness of 8 Philippine products namele: tinalak, raffia, handcrafted bags, coffee, upland rice, sweet potato, queen pineapple and Philippine citrus. The project was able to develop a packaging design and country brand for raffia, tinalak, handcrafted bags, and coffee and have been launched in national and international trade fairs. For the second year of the project, an initial packaging design and technology of sweet potato, queen pineapple, upland/Ifugao rice and Philippine citrus were developed.

Completed Project

Keeping Pork Lechon Fresh and Crispy

DOST - ITDI

The project sought a new or improved packaging system and effective packaging technology to maintain the quality and freshness of pork lechon shipped out to outlying destinations in the Philippines and even abroad at a specified time and handling conditions.

Simulation studies on pork lechon sent from Tacloban to Manila were conducted using different structural designs and packaging materials to determine the appropriate packaging material/container. In this project, a new packaging system extended the shelf life of whole pork lechon from 15 hours to 21 hours, while the 1-kilo pack pork lechon was extended from 12 hours to 20 hours. The improved packaging system will be disseminated to other lechon producers throughout the country.

Photonics Sector

New Projects

99mTc and 99mTc Radiopharmaceuticals (RPs): Preparation and Quality Control for Nuclear Medicine Applications

DOST – Philippine Nuclear Research Institute (PNRI)

Nuclear technology is often associated with deadly force. But this vastly misunderstood technology can actually manage and restore health, and raise quality of life.

The project aims to develop and introduce locally the technology for preparation of the most 99mTc generators including the protocol for its production and related quality control procedures, [2] to develop protocols to prepare and characterize commonly used 99mTc radiopharmaceutical kits, and [3] to develop protocols for the preparation of 99mTc – biomolecules and radio-labelled compounds for medical research applications.

The use of 99mTc labeled pharmaceuticals is expected to rise as we approach the new age in nuclear medicine. It's a painless, safe, and cost effective method of imaging, treating, and diagnosing organ functions and diseases. The advantages of RPs over medical surgery methods are encouraging. Nuclear imaging procedures often identify abnormalities in early stages allowing early and less serious prognosis. There are about 25 hospitals in the country with nuclear medicine facilities, 23 of which are equipped with gamma cameras. The cost of imported 99mTc generator is higher than those in neighboring countries. Current local market price of 18.5 GBq 99mTc Generator is about $1,000 compared to about $388 in Indonesia and $4,070 in Japan. The most commonly used radiopharmaceuticals are MDP (Methylene Diphosphonate), sesta-MIBI (methoxy-isobutyl-isonitrile), DTPA (Diethylene Triamine Penta-Acetate), and DSMA (Dimercaptosuccinic Acid) that can be obtained in unit doses ranging from 40-80 units (1 unit about 50mCi) in nuclear medicine centers.

Automated Rapid Reef Assessment (ARRAS) Project 2. Computerized Reef Assessment and Visualization (CRAV)

National Institute of Physics – UPD

Reefs hold rich resources with vast potentials for medical/pharmaceutical development and food security. For these reasons, the project is conducted to develop tools for in situ computerized reef assessment and visualization, design protocols for multi-scale and multi-sensor reef assessment, build a database of coral reef images, video, and spectra, and later on deploy tools to coastal communities.

ARRAS uses fast classification and quantification of reef components using techniques in signal processing and computer vision to cut down on-site assessment using either color video/digital still camera or spectroradiometer. From video of reefs, color and texture features are extracted for pattern recognition of benthic classes such as corals, seagrass, sand, and rubble either in close up or underboat view. Video processing can be done continuously without interruptions since it is computer based. Signal capture can be done in either close-up view where

ARRAS training on reef survey in Batangas

sensor is ~30cm from benthic patch, or under-boat tow view where distance between sensor and benthic patch is actual depth. Overflight assessment will also be done to see if models developed using close-up and underboat mode can be modified for airborne assessment. Signals obtained must be corrected for atmospheric distortions, glint from surface waves, and red filtering of seawater. If successful, this will allow assessment of a greater area in shorter time. ARRAS will develop a monitoring system that will allow coastal resource managers and local government units to monitor reefs with easy-to-use tools. This rapid reef inspection system will also provide direct validation of remote sensing algorithms for marine researchers.

Process Sector

New Projects

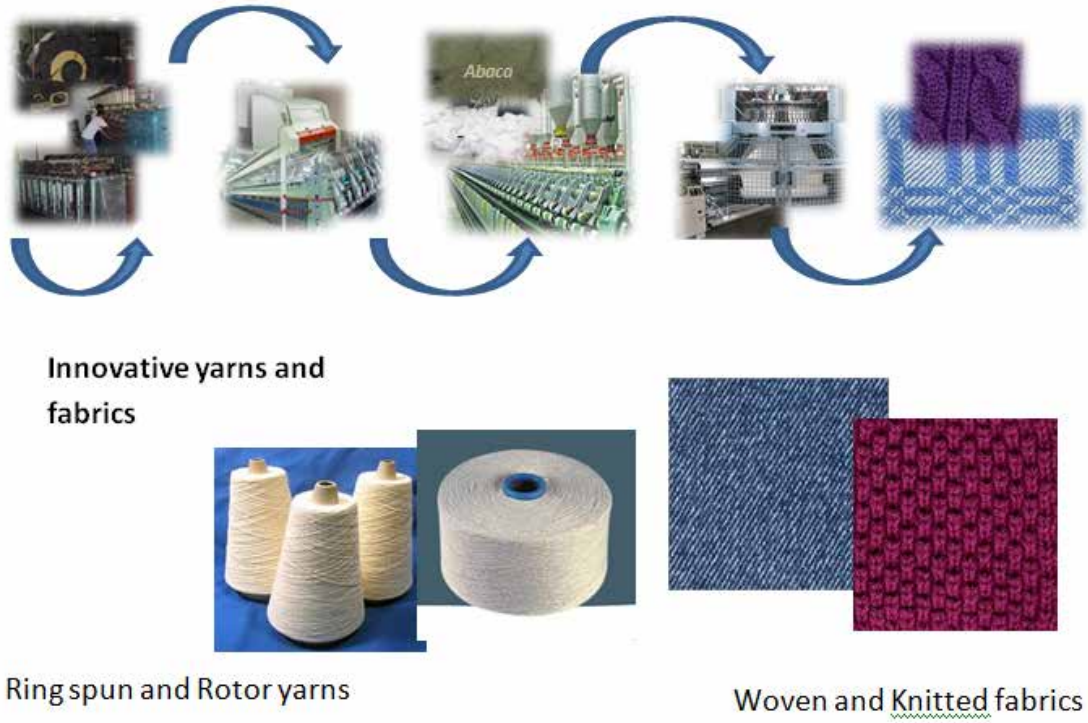
Revitalization of the Philippine Textile Industry through S&T

DOST – Philippine Textile Research Institute (DOST-PTRI)

Project 1 - Establishment of Innovation Center for Yarns and Textiles

The project shall catalyze production of innovative yarns and textiles from indigenous fibers thru standardized processing methods and state-of-the-art textile machines and equipment. The project shall implement its strategy thru five activities: upgrading of facilities, yarn and fabric innovation and development, human resource enhancement, textile performance specifications and marketing and promotion strategies.

The existing pilot plant facility of PTRI will be upgraded and enhanced to respond to the volume requirements of a full swing production of yarns. This shall entail both outright purchase of new equipment and rehabilitation to complete and balance the production output of the machines. The upgraded facility is expected to enhance the production output from the current 2.84 kg per day (8h) to 188 kg/day (8h) which can even be maximized to ~ 600kg yarns/day (24h operation). Innovations in yarns and textiles are hinged on new composition, character and construction of yarns and fabrics compared to what is available commercially. This project shall focus its interventions on further developments involving indigenous materials like abaca and pineapple blended with either cotton or polyester. Performance specifications shall be determined from fibers to yarns to fabrics and based on the set of materials developed from the innovation activities. The performance specification of knitted and woven fabrics will be in terms of: composition, construction, yarn count and specific end-use, such as garments, home linens, indoor upholsteries, etc.



The PTRI shall align and harmonize its existing training courses with the requirements of TESDA and apply for accreditation as a National Certificate Course such as yarn Spinning with focus on natural fiber-blended yarns, power loom weaving, handloom weaving (for SME's), knitting, textile dyeing and textile finishing. This will include the development of appropriate materials as reference and training tools. It is expected that DOLE and other government agencies will pick it up as requirement for local employment and as manpower augmentation for existing textile mills and later on for foreign employment/deployment.

Project 2 - Establishment of Handloom Weaving Livelihood at the DOST Innovation Centers

This project aims to enhance the handloom productivity in the countryside and targeting textile MSMEs to develop products not only for local but also for international markets. The PTRI will provide technical assistance on the start-up operations in every handloom weaving center, acquisition of handloom equipment including their proper use and maintenance, training of weavers, weave design development and loom execution and performance evaluation. On the other hand, the DOST regional offices in coordination with the LGUs will assist in the identification and assessment of beneficiaries as well as in the monitoring and impact assessment on the performance of the weaving centers. The LGUs will also provide the required financial support for the continued and improved operation of the weaving centers if necessary.

The assistance of the Department of Trade and Industry (DTI) provincial offices and the LGUs will also be sought to come up with a database on the profile of the intended beneficiaries. Once skills are developed on handloom weaving, another batch of training on natural or synthetic dyeing of indigenous fibers will be conducted to enhance product quality and build up further the skills and capabilities of the new weavers.

Project 3 - Upscaling and Expanding the Production and Application of Philippine Natural Dyes

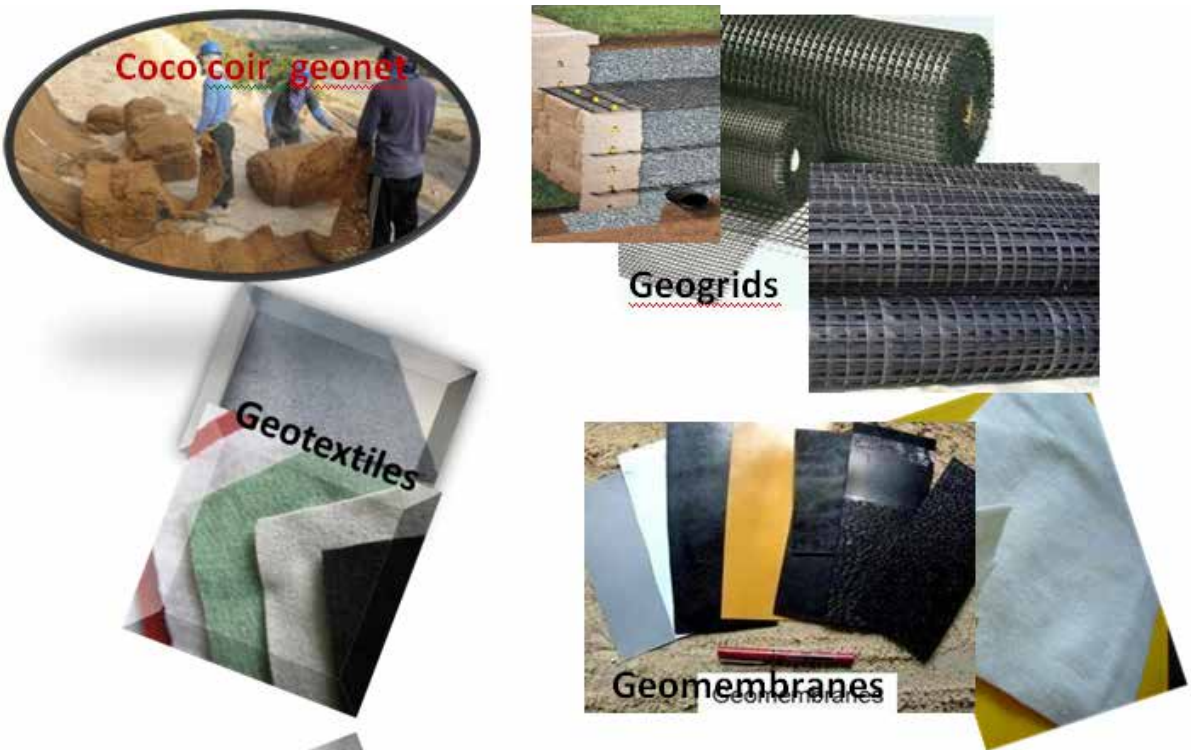
The Philippines abundant natural sources of colorants that can be used for various applications that go beyond their coloring property because of added multifunctional properties such as antioxidant, antibacterial and anti-ageing activities. However, the challenge with natural pigments is to maintain their color stability and shelf life. The natural dyeing R&D of the PTRI has further evolved from the conventional dyeing technology to various other textile application techniques such as silkscreen printing, compound dyeing and top-dyeing. This versatility of natural dyes in textile applications and the continuous growing demand for natural and eco-friendly treatment technologies further merit the necessity for continued R&D.

This project aims to propagate the production and application of natural dyes through upscaling of production technologies, validation of the technology's adaptability. Production hubs and satellite center and promotion of natural dyes will be established through the creation of a Philippine Textiles and Dyes ePortal. This will ensure massive promotion and accessibility of information relating to textiles and dyes. Further, a NatDyes Production Hub will be established in Occidental Mindoro and Abra while a Satellite NatDyes Center will be established in Paoay, IlocosNorte to link the natural dyes application in the hand weaving industry, particularly with the "abel" weaving.

Project 4 - Modernization of Geosynthetic Testing Services

PTRI does not only cater to the needs of the garment and textile industries but also to the handicraft, handloom weaving, chemicals, dyes and auxiliaries, carpet, automotive, construction, and other industries. The PTRI Testing Laboratory supports these industries to achieve global competitiveness through quality testing of their raw materials and products. For civil construction applications, geosynthetic materials such as geotextiles, geogrids and geomembranes are used. Geotextiles either woven or nonwoven fabrics are used in foundations of soils, rock, earth, or other geotechnical material as an integral part of a manufactured project, structure, or system. They are also known as civil engineering fabrics, erosion control cloths, filter fabrics, or support membranes which are used in foundations of structures to prevent wind and water erosion of the soil and achieve structural stability.

The PTRI is the only testing laboratory that conducts tests for geosynthetics in the country. In 2009, the Bureau of Research and Standards, the research arm of DPWH recognized the PTRI Testing Laboratory as an official laboratory to conduct testing of geosynthetics/geotextiles on breaking load, mass per unit area, tearing strength, tensile strength and thickness. Although the geotextiles coming from abroad have mill certificates, still the DPWH requires the suppliers or contractors to let their



materials tested at the PTRI. The laboratory's total income since then, increased by an average of 10% from 2009-2012. During the latter part of 2012, geotextile manufacturers and suppliers started requesting for additional tests to be conducted by the PTRI laboratory such as: (1) CBR Puncture - measure of the force required to puncture a geotextile; (2) Apparent Opening Size - reflect the apparent largest opening dimension available for soil to pass through.; (3) Water Permittivity – determine the quantity of water that can pass through a geotextile in an isolated condition; and (4) Tensile Strength for geogrids made of polypropylene which has a strength higher than 50 kN. Through this project, the PTRI's testing services will be modernized to include the above additional tests and evaluate the performance of geosynthetics thus, ensuring the suitability and durability of the geotextiles used in civil engineering works.

Development of Neo-Ethnic textiles Using Natural Fiber-Blended Yarns and Eco-Friendly Treatment and Dyeing Technologies

Ethnic textiles are fabrics distinctively produced by a certain tribe, community, locality or ethno-linguistic group that has become a part of its identity, culture and heritage. Although some of these fabrics have become prized items because of their novelty and the labor that went with the weaving, most have only become materials for costumes and ordinary household items such as table runners and cloths. International awareness on ethnic prints provides the impetus for reviving traditional designs. International fashion runways are increasingly adorned by ethnic prints coming from Southeast Asian textiles normally used as traditional costumes but are refurbished to create a contemporary look by designers such as Givenchy Gucci, Marc Jacobs, etc.

This project is oriented towards actively pushing to mainstream fashion these textiles in view of their eco-character and novelty as representative of local textile heritage. With the increasing interest in ethnic textiles, enhancing the fabric's value to fit with contemporary trends yet preserving its cultural identity is the objective of this project through science-based interventions. That have been developed at the institute. Use of natural and low-impact dyes, dyeing techniques to ensure reproducibility safe handling, use of indigenous fibers instead of synthetic fibers, enzyme treatment technologies including fabric construction are some of the technologies that are targeted to be verified, fine-tuned, demonstrated and transferred to selected groups and partners. New ideas are infused in traditional textiles, designs and production

The PTRI will conduct this project in tandem with identified partners and institutions in the region; it

will sustain the legacy of textile interventions done and spread assistance to other textile producing localities. Ethnic designs included in Year 1 of the project are the "inabel" from Paoay, the "tiniri" from Abra and knitting from the Nooks Co. Ltd.

Cyclodextrin Inclusion Complex for Multifunctional Finishing of Cotton and Cotton-Blended Fabrics

DOST - PTRI

This project is part of a chain of technologies under the functional textiles program. It intends to develop surface-modified cotton and cotton-polyester fabrics with specific mosquito-repellent properties through grafting of cyclodextrin inclusion complex treated with essential oils for antimicrobials and fragrance-release finish. Initial results on the current study on controlled-release system showed the feasibility of imparting added functionality such as fragrance-release on cotton fabrics. This added functionality is regarded as one of the vital and pressing needs of the market as a response of PTRI to the flagship programs of the DOST and the conspicuous need of society as a whole. This project addresses the concerns on priority health issues of the country specifically on the perennial problem of DHF. This development will form the string of technologies aimed at creating a new breed of high-end and customized textiles.

Enhancing and Increasing Local Content in Rubber for Motorcycle Tire Application

In the past, the rubber industry was one of the highest income-generating sectors in the country. However, with the closure of three major tire companies (Goodyear, Firestone and Goodrich), the industry's contribution to the country's economy drastically decreased. Recently, with the increased use of motorcycles as the mode of transportation in the Philippines, a high potential of growth is projected by the industry. At present, for every 350 Filipinos, one is using a motorcycle while in Thailand, Vietnam, Cambodia and other Southeast Asian countries, the ratio is ten times higher.

Given this, a similar extent of growth is also expected by the local tire manufacturing companies such as MBP Star Corporation which is a major supplier of tires to original equipment manufacturers (OEM) like Honda, Yamaha, Suzuki, among others. Being a medium scale enterprise, research and development is not a priority. But local companies felt the need to innovate especially with the impending free trade agreement between ASEAN countries. The projected potential growth is ten times the current production rate for domestic consumption. This is a serious consideration as this scale of production could be a prime motivation of large-scale tire manufacturing companies to locate in the Philippines which can threaten the sustainability of medium-scale Filipino-owned companies.

To improve the research capability of our manufacturing companies, ensure sustainability and enhance competitiveness the project will focus on innovations on materials for tire manufacturing. Investigation on the use of locally available nanocomposite materials that are expected to lower the cost of production and increase local content in the tire products will be done. In addition, it will also add income potential for clay mineral- producing companies. The project will utilize locally available rubber material and additives in the laboratory-scale production of compounded rubber material for the motorcycle tire manufacturing industry

Optimization and Improvement of Processes in the Production of Technically Specified Rubber (TSR) and Demonstration of Improved Facilities in Zamboanga Peninsula

The local rubber industry has long been plagued with problems that resulted to low share of supply in the world market. During the International Rubber Conference in 2010, it was reported that the Philippines contributed only 1.1% of the total NR production of the Association of Natural Rubber Producing Countries (ANRPC) members in 2010. The need for intervention from the government prompted DOST to launch the National Rubber R&D Agenda during the 1st Philippine Rubber Investment and Market Encounter (PRIME) on September 18-19, 2012 at the Holiday Inn, Clarkville, Pampanga.

Specifically, the National Rubber R&D Agenda has determined the need for Natural Rubber quality improvement through the assimilation of best practices and appropriate technologies in rubber

tapping and processing. Latex harvesting and handling, from tapping to coagulating, and in turn processing into crepe or crumb rubber has significant effects on the quality of the finished product specifically on dirt content, color and plasticity. Dirt and color may be easily detected upon inspection, but effects on plasticity may only be determined thru laboratory analysis of the final product. Optimization of process steps and quality control measures should therefore be implemented particularly on stages that significantly affect these parameters. This project aims to determine, validate and optimize process steps (including technologies and practices) that have significant effects on technically specified rubber quality and demonstrate these practices and technologies to increase quality consciousness of farmers, tappers and processors. The interventions shall be realized thru improvement of an existing NR processing plant which shall serve as a full-scale demonstration facility. At present, there is no rubber processing plant in the country capable of producing a sustainable internationally accepted TSR, hence, this proposal.

Upgrading and Accreditation of Laboratories to Include Rubber Analyses in Strategic Areas in Mindanao. Phase I. Integration of Rubber Testing Services in RSTL Region 9

The Philippine Rubber Industry Association (PRIA) identified the establishment of rubber testing facilities near the source in order to foster quality consciousness among producers and in turn, provide a means for buyers such as rubber manufacturers to verify quality of the product. The Philippines National Standard for technically specified rubber (raw natural crumb rubber) outlined the specifications for standard Philippine rubber (SPR). The only problem remained to be implementing the standards and laboratories to carry out the required analyses.

This project aims to provide testing services where needed. The rubber testing laboratory shall be located at the Regional Standards and Testing Laboratories of DOST 9.Initial survey of target clients for the testing laboratories were identified as Region 9 (having the highest production in MT of natural rubber: 171,126MT in 2010) followed by Region 12 (149, 965MT in 2010) and ARMM mostly in the Basilan area (33,497MT in 2010). The only testing facility existing in the country is the Philippine Rubber Testing Center (PRTC) housed at the University of Southern Mindanao at Kabacan, North Cotabato where the second highest cluster of rubber crumb producers are located. A newly installed rubber testing facility housed at the facility of ZAMPIARC is not yet operational. This testing facility is funded by the DA but indications when the said facility is targeted to be operational are not yet clear. For the meantime, producers from Zamboanga and Basilan areas bypassed testing requirements mostly due to relatively high cost of sending samples to PRTC as opposed to readily selling their product even at a lower price.

Activities involved are validation of the feasibility and sustainability of offering rubber testing services in Region IX, benchmarking rubber testing services, procurement of laboratory test equipment and facility refurbishment, training of personnel including proficiency, methods validation and operation of the testing facility, documentation of quality systems for laboratory accreditation, promotion of testing services and assessment and coordination with other regions for the implementation of Phase II. Phase II of the project shall be started during the third year of implementation of Phase I.

Tapping of latex from the bark of rubber tress

Natural rubber crumb

Rubber plantation

Completed Projects

Rapid Mapping of Rubber Trees in Mindanao (Rubb3Map)

Department of Geodetic Engineering – UP,Diliman

The growth and performance of the industry can be better assessed if periodic information on the ages of the rubber tree stands is available. As such, mapping and monitoring tools are necessary in order to accurately plan for future development.

In order to complement current efforts on updating statistics on rubber, this project shall develop a methodology for mapping rubber trees and for monitoring rubber tree growth and plantation expansion using space technology. Field works will be conducted for the purpose of collecting training areas for the classifier as well as validation areas for the image classification accuracy assessment. Various image classification methods will be applied and compared with each other to ensure higher classification accuracy. The images will also be processed to extract indices that are useful in discriminating rubber trees from other trees in the study area. These include Tasseled Cap transformation indices, NDVI, and other vegetation indices. Thus far, the project has done Moderate Resolution Imaging Spectroradiometer (MODIS) Data and found that 130,000 hectares for mature trees generated are planted with rubber trees. Mapping tools such as LIDAR and SPOT will be used to verify the mapping activities.

Technological Support for the Upgrading of Local Cacao and Cocoa Industry

DOST-ITDI

Cacao bean or cocoa bean is a major agricultural commodity traded worldwide. Major products from cocoa beans include cocoa butter, cocoa powder, and cocoa liquor (tablea), from which chocolates are derived. In 2010, global cocoa production had risen to 3.6 million tons from 1.5 million tons in the 80s. Now, demand for cocoa is estimated to rise by nearly 30 percent in the next ten years, with growth driven primarily by rising world population and rapid development of countries such as China, India and Brazil (Africa Business News, 2012).
The program will provide technological support to the industry sector in order to make them globally competitive. As a traded commodity, the price may vary but origin plays a significant role in pricing mostly due to flavor and other bean characteristics.

The program which has four projects, aims to upgrade and develop the capability of enterprises in the production of quality cacao and cocoa products that meets the minimum quality requirements of local and international standards.
It will address selected gaps of the sector in:

- Primary processing [fermentation and drying]
- Secondary/industrial processing of intermediate cocoa products [cocoa liquor, cocoa powder and cocoa butter].

Microbial Community and Biochemical Profiling for Microbial Augmentation and Development of Quality Indicators for Cacao Fermentation and Processing

The general objective is to determine the microbial community and biochemical profile of cacao fermentation for microbial augmentation as well as to develop quality indicators for cacao fermentation

and processing. The project aims to [1] determine the microbial community profile involved in cacao fermentation using molecular methods, [2] determine the biochemical profile of cocoa during traditional fermentation, during microbial augmentation, after drying, and after roasting isolate, [3] identify and characterize important microorganisms from local practices and BIOTECH and other culture collections that participate in cocoa fermentation process, [4] develop and formulate a concoction of adjunct inocula consisting of selected yeasts, lactic acid bacteria, and other beneficial fungi for faster and more efficient cocoa fermentation, [5] validate the performance of formulated inocula in actual cacao fermentation condition in the field, [6] establish quality indicators for physico-chemical properties and flavor, aroma, and appearance evaluation of fermented, dried and roasted cacao.

Development and Evaluation of Improved Drying Technologies for Fermented Cacao/Cocoa Beans in the Philippines

The project aims to further improve the design of Multi-Commodity Solar Tunnel Dryer (MCSTD), and Fixed-Bed Dryer with Biomass Furnace for drying cocoa beans in terms of technical performance, bean quality, cost, and end-user acceptability. Specifically, it seeks to [1] design and fabricate improved prototypes of Multi-Commodity Solar Tunnel Dryer, and Fixed-Bed Dryer with Biomass Furnace, [2] field test the improved dryer prototypes and evaluate their performance on technical efficiency, bean quality, cost, and end-user acceptability; and [3] field test the adequacy and reliability of SHEGA III moisture meter modified and calibrated for cocoa beans.

Primary processing of cacao beans starts with fermentation, which must be finished at the right time. Otherwise, it could end up overfermented with very dark color and low market value. Drying reduces the beans' moisture content from 50-60% to 7% for storage. Sun drying is the most common method. On a fine weather, drying takes about 8 to 10 days but stretches during cloudy periods. Delays in drying result to over fermented, moldy, and poor quality beans. Alternative drying technologies are important to maximize production and quality.

Design and Fabrication of Equipment for the Production of Local Cocoa Products

The project aims to design and fabricate appropriate equipment in support of the local cacao industry, particularly the following: cleaning/ sorting equipment, deshelling/ winnower, roaster, grinder/ refiner, hydraulic press, breaker/ pulverizer – cocoa powder, filter/ blender for cocoa butter, melanguer and conching machine.

The project aims to [1] review and document current and traditional equipment used in the production of molded cocoa nibs, [2] design and fabricate appropriate processing equipment for production of molded cocoa nibs, [3] design and fabricate processing equipment for production of cocoa liquor, cocoa powder, and cocoa butter, and [4] conduct trial runs and field testing of processing equipment.

Local cacao farms are generally small (less than 3 ha), and cacao is planted as intercrop between coconuts, bananas, fruits, and vegetables. Small processors of 'tablea' use different improvised equipment and methods. Such equipment should be assessed and documented to improve the quality of tablea. The basic equipment critical to be made available to processors are roaster, desheller/winnower, and grinder/refiner. Production of industrial products such as cocoa liquor, cocoa butter, and cocoa powder is another principal component of a profitable cacao industry. Primary processing of cacao beans is important for flavor development, and secondary processing produces high value products. Industrial cocoa processing equipment that shall be fabricated under this project include [1] cleaning/sorting equipment, [2] deshelling/winnower, [3] roaster, [4] melanguer, [5] grinder/refiner, [6] hydraulic press, [7] conching machine, [8] breaking/vibrating screen, and filter/blender.

On-going Projects

Improving the Quality of Solid Cocoa Liquor including Molded Cocoa Nibs, and Developing the Capability of Small Scale Processors in the Manufacture of Intermediate Cocoa Products

The main objective of the project is to improve the quality of locally produced solid cocoa liquor and develop the capability of small-scale processors in the manufacture of intermediate cocoa products. In achieving this objective, the will [1] review and document traditional and existing practices in the processing of molded cocoa nib [tablea]/solid cocoa block, cocoa butter, and cocoa powder, [2] establish processing parameters for solid cocoa liquor/ molded cocoa nib and improve hygiene properties and sensory properties ("sandy" mouth feel), [3] establish parameters for alkalization of cocoa beans, [4] establish processing parameters for intermediate cocoa products using the equipment designed and fabricated under the program, and [5] determine appropriate storage conditions for developed/ improved products [cocoa liquor, cocoa butter, and cocoa powder].

The project has documented the existing practices in cocoa processing in Regions 2, 5, 6, 9, 10, 11, 12 including analyses of samples (physical, chemical and microbiological properties) of cocoa beans and tablea in these areas.

Establishment of Processing Methods for the Production of Natural Sweeteners from Nipa (Nipa fructicans wurmb)

The project shall provide recommendations on appropriate processing methods for the production of "natural" sweeteners from plant materials specifically for nipa sap. The result of the study shall be the basis for establishing commercial scale processing of nipa sap sugar in the regions. In the project, the processing conditions for the production of natural sweeteners from nipa sap will be optimized including the evaluation and improvement of collection and harvesting systems, screening of raw materials and the characterization of the products produced using the developed methods. The sensory and acceptability of the natural sweeteners will also be profiled and compared to conventional sweeteners.

Development of National Standards for Chemical Measurements

The ability to make accurate measurements is one of the essential foundations of a growing economy. The program will formalize the institutionalization of a metrology in chemistry in the country.

Inter-laboratory Comparisons of Additives and Contaminants in Foods Dr. Benilda Ebarvia, Filipino Scientist

This project aims to develop a Metrology in Chemistry infrastructure in the country. Specifically, it seeks to [1] institutionalize a network of specialized testing laboratories focused on the elements of metrology in chemistry (MiC), [2] promote awareness on MiC among decision makers, analysts, standards developers, regulatory staff, and industry sector, [3] develop a core group of trainors who can provide training on MiC awareness seminar and special topics such as methods validation, organization of proficiency testing scheme, uncertainty of measurement, statistical evaluations, and quality assurance, [4] conduct method validation of the measurement procedures on specific commodity/analyte, [5] handle inter-laboratory comparison of selected CRM/SRM/RM analysis among participating laboratories, [6] establish comparability

through traceability of chemical measurements to defined standards, and [7] disseminate knowledge on measurements infrastructure.

Enhancement of Biotechnology Products and Services for Agro-Industrial Applications

University of the Philippines – Los Baños

This program aims to improve and upgrade the production scale of biotechnology products developed by UPLB-BIOTECH through its extensive research efforts over the years which has the potential to become mainstream products or expand its present market reach. This is in support of the institute's commitment to promote the use of biotechnology and use its researches to aid in attaining sustainable economic development for the country. The program is divided into three (3) sub-programs focusing on improvement of strains and formulation, product shelf life and quality, and large scale production of (1) enzymes and (2) probiotics for food and feed applications, and (3) improvement of microbial based fertilizers and plant growth promoters for enhanced agriculture crop quality and yield.

Sub-Program 1: Large-Scale Production and Application of Enzymes for Food and Feed Applications
UPLB - BIOTECH

Project 1 - Validation of scale-up production of microbial rennet

In this project, the production capacity of the microbial rennet will be upgraded to meet the projected demand for rennet at about 42,848 kg. Local cheese producers including the local dairy cooperatives, private cheese producers and multinational companies use about 37 metric tons of rennet to process milk into cheese. Rennet is "curdled milk from the stomach of unweaned calf" that contains rennin used in curdling milk for cheese.

At present, BIOTECH is producing about 20 liter of liquid and 10 Kg granulated form rennet per month. The project will target to produce 350 liters and 350 kg/month and will look into the development of the quality assurance system of rennet production and applications. Utilization of the rennet in the production of different types of cheeses other than white cheese. The production of functional ingredient, rennet casein will also be studied, as well as utilization of the fermentation by-product (biomass) as feed supplement for dairy animals and fish.

Through this project, the production capacity for microbial rennet will be upgraded to meet projected demand at about 42,848 kg. Local cheese producers including local dairy cooperatives and multinational companies use about 37 metric tons of rennet to process milk into cheese.

Project 2 - Pilot Scale Production of BIOTECH Cellulase and Alpha-amylase for the Food, Feed, and Other Industries

In this project, optimized pilot-scale enzyme production using the upgraded and refurbished pilot plant equipment will be done. Storage shelf-life and enzyme kinetics of BIOTECH produced cellulase and alpha-amylase will also be conducted. Locally produced enzymes for enzyme-catalyzed syntheses of high value products will be advantageous to the country since it can stem the outflow of dollar reserves for import of commercial enzymes.

The project's expected output include [1] optimized pilot scale enzyme production using the upgraded and refurbished pilot plant equipment, [2] enzyme kinetics of BIOTECH produced cellulase and alpha-amylase, [3] optimum conditions for downstream processing of produced enzymes, [4] storage shelf-life of BIOTECH produced cellulase and alpha-amylase. Stable solid form of produced enzymes, [5] publication in websites Linkages, [6] feasibility study report on commercial enzyme production using BIOTECH –UPLB technology, [7] development of additional studies for applications of enzymes produced, [8] collaboration and/or transfer of enzyme technology, and [9] upgraded and refurbished pilot plant equipment.

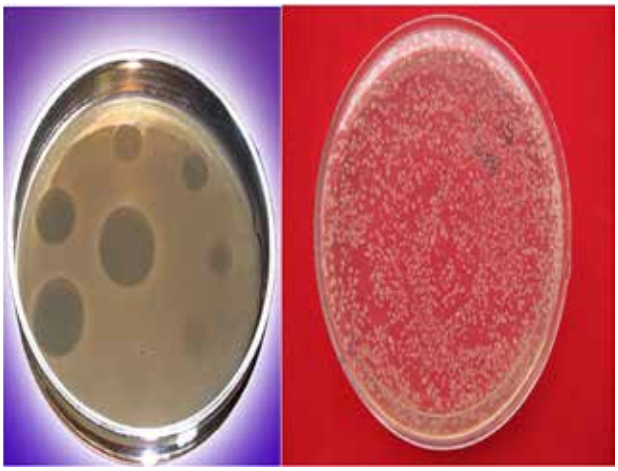
Project 3 - Establishment of Bioprocess Systems for the Production of Pili Pulp Oil and Protein Enriched Residue for the Food and Feed Industries

A biotechnological method for extracting pulp oil was developed at BIOTECH which uses enzyme rather than the toxic organic solvents. The principle of the enzymatic aqueous extraction is based on the mechanical and enzymatic degradation of the cell wall of the oil containing material, freeing the oil. Based on the structure of the pili pulp cell wall, 10 commercial enzymes were tested. Amyloglucosidase and neutrase enzymes gave the highest oil extraction but only neutrase (a bacterial protease) was used in the pilot scale aqueous enzymatic production because of its ready availability.

A protein enrichment production system was also established by using solid substrate fermentation at pilot-scale level Among the microbial strains obtained from the Feed and Specialty Products Laboratory, Aspergillus niger BIOTECH 3104 gave the best protein enrichment of pili pulp residue. This inoculant increased the crude protein content of the residue to 22.1% from the 6.1% present in the raw pulp.
The pili pulp oil may be attractive to the nutraceutical industry because of the presence of minor components such as carotenoids, tocopherols and sterols which shows a good lipid profile. In this project, the process for bioextraction and downstream procesing of Pili Pulp Oil will be established. Inoculants to be used will also be produced and feeding trials will be conducted in poultry and swine.

Sub-Program 2: Scale-up Production of Probiotics for Food and Feed Applications
UPLB - BIOTECH

Project 1 - Development of Probiotic Starter Cultures and Adoption of Technology for Functional Food



Growing public awareness of diet-related health issues has incurred the demand for probiotic foods. The health promoting properties of the probiotic products put them under the category of "functional food" which is defined as foods that provide health benefits and basic nutrition. Probiotics are bacteria, generally lactobacilli or bifidobacteria associated with a lot of health benefits ranging from alleviation of symptoms of lactose intolerance, treatment of diarrhea, serum cholesterol reduction and cancer suppression.

Fermented foods are essential components of diets in many parts of the world especially in Asia. With increased preference and for a particular fermented food, small and medium scale industries ventured on their production. It has been established that in order to have a fermentation product of consistently good quality, it is necessary to have standardized starter cultures. But, the local dairy industry has been importing the starter cultures for yoghurt and for the different types of cheese for their production

There are several continuing studies on some of the fermented products in the country by the Institute of Food Science, University of the Philippines Los Baños and at the BIOTECH including the research collaboration with Kyushu University, Japan. Using these as references, the project will optimize pilot scale production of starter cultures that were previously studied. The scope of study including shelf-life, stability and DNA fingerprinting will depend on the technology gaps that needs to be addressed per organism (Lactobacillus plantarum (BS), Pediococcus acidilactici (AA5a), Pediococcus pentosaceous (K3A2-2), P. acidilactici (3G3) and 1Y9).

Project 2 - Application of Probiotic for Fish and Prawn

The project aims to [1] produce biotreated copra meal (BTCM) in commercial scale using BIOTECH technology, [2] register the products for marketing, [3] market BTCM as protein ingredient in feeds for swine, broiler, fish, prawn, etc.

The project's expected output includes [1] feeds products, [2] data on production of biotreated copra meal and feeding trials will be statistically analyzed and compared to the controls, [3] periodic written reports submitted for evaluation, [4] final report

Sub-Program 3: Improvement and Commercialization of Microbial-based Fertilizers and Plant Growth Promoters

UPLB - BIOTECH

Project 1- Improvement and commercialization of microbial-based fertilizers and plant growth promoters

BioGroe™, a microbial-based plant growth promoter containing selected Plant growth promoter bacteria (PGPB), has been developed, packaged and tested in the propagation and production of crops and ornamentals by BIOTECH. BioGroe™ formulations were effective in the production of vegetable and other crops and in the propagation of ornamentals, cassava, coffee, abaca and rubber.

The cost of production of BioGroe™ is approximately PhP40 per 100-g. Similar products abroad such as Botanicare (US$12/quart) and Florel Plant Growth Regulator (US$70.72/gal) are much more expensive.

In the project, a new BioGroe™ formulation will be developed and tested to withstand stress level conditions such as climate change effects. The previous formulation was tested from pot experiments or limited field trials under favorable conditions. There is a need to develop microbial inoculants tolerant to these soil stresses in order to improve soil productivity. The production capacity is also aimed to increase from about 2,500 100-g packets per year to 234,000 packets per year. BIOTECH started producing BioGroe™ in 2007.

Project 2 - Large-Scale Production, Improvement and Commercialization of NitroPlus™ Legume Inoculant

Rhizobial legume inoculants called NitroPlus™ produced at BIOTECH, UPLB can increase legume crop yields. The production of NitroPlus™ started in 1987 on a semi commercial scale.

Important developments on the aspect of inoculant preparation, selection of inoculum strains and ecological studies have been done. The cost of production of NitroPlus™ was reduced by substituting sucrose or the table sugar for mannitol as a source of carbon for the bacteria (Paterno et al, 1989). Further reduction in the cost of inoculant production was attained by using diluted broth culture as inoculum (Paterno et al., 1993). The quality of NitroPlus inoculant was not affected by handling and distribution (Paterno et al., 1993). A significant progress in the production of NitroPlus™ occurred in 2008. An effective liquid form of NitroPlus™ which is easy to prepare and apply, cost effective, uniform and contains high cell density even after long term of storage has been developed. (Torres, 2008). The packaged NitroPlus™ legume inoculant has been granted full registration by the Fertilizer and Pesticide Authority on June 13, 2007. FPA registration is required before NitroPlus™ is distributed, sold and commercialized. The trademark NitroPlus™ was issued a certificate of registration on December 24, 2007.

The project will develop an enhanced NitroPlus™ using beneficial organisms as co inoculants with capacity to increase nodule occupancy and affect symbiotic N fixation and solubilize phosphorus. Interaction effects of selected microbial isolates with the existing commercial inoculum strains will be determined in terms of plant growth promotion and increased nodulation and occupancy. Potential co inoculants will be packaged after development of formulations and appropriate inoculation technology.

Another activity that will be undertaken is the packaging of the previously developed liquid formulation of NitroPlus™. Packaging of the liquid form of NitroPlus™ will be done simultaneous with the side by side field testing with solid based NitroPlus™ in comparison with the control and farmer's practice or recommended rate of chemical fertilizer.

Project 3 - Optimization and scale up production of Myko Plus for the biofertilizer and bio-organic fertilizer industries

The project aims to [1] hasten fungal growth and reproduction through manipulation of cultural and management practices, and carrier, [2] enhance performance of mycorrhizal inoculant through enrichment with beneficial microbes, [3] screen effectiveness of new formulations of mykovam to agricultural crops, and fruit and forest trees.

UPLB-BIOTECH has developed mycorrhizal inoculant (fungus-root association) with brand name "Mykovam", a soil-based biofertilizer composed of spores infected roots and other infective propagules of endomycorrhizal fungi. Mycovam inoculant is an efficient biofertilizer input for high value props, ornamentals, fruit crops, and forest trees.

The project's expected output includes [1] development of lighter weight and equally effective mycorrhizal-based inoculants, [2] optimized bioprocess of microbial strains combination, [3] forged collaborations with private entrepreneurs for tests in various production systems.

Screening and Optimization of Conditions for the Local Production of Food Colorants from Microbial Cultures

BIOTECH – UPLB

There are a number of natural pigments but only a few are available in sufficient quantities for industrial production. The advantage of producing pigments from microorganisms compared with other sources is that microorganisms can grow rapidly which may lead to high productivity of the product (Jiang et al., 2005). In addition, the use of fermentation-derived ingredients into the food industry is steadily increasing. Some fermentation-derived pigments, -carotene from the fungus Blakeslea trispora and pigments from Monascus which were developed in Europe and Asia, respectively are now being used in the food industry (Dufosse, L., 2006).

The project developed local technology for microbial colorant production by liquid culture fermentation. Specifically, the Monascus red colorant produced was tested to be safe for food application. Output of the project will enable Filipino researchers to conduct efficacy and further application studies of locally produced Monascus colorant in several biochemical processes.

Preliminary Studies on the Production of Laccase for Food and Wine Applications

BIOTECH – UPLB

Laccase is an enzyme produced by fungi (sp. White-rot fungi), plants, insects and other bacteria. Its function as an oxidizing agent for wide variety of organic and inorganic compounds makes the enzyme useful in several industrial applications such as elimination of dissolved oxygen to improve quality of oils and food items, elimination of undesirable phenolics, responsible for the browning, haze formation and turbidity development in fruit juice, beer and wine, leavening of dough for baking, bleaching of textiles, modification in the surface of fabrics and synthesis of dyes and decolorization of effluents. Since these enzymes are imported, local production of commercially important enzymes would reduce importation of enzymes, saving of the much needed dollar reserves, assured supply of the said products all time of the year, minimized shipment cost on enzyme delivery and loss of enzyme activity during transit will

be prevented.

The project developed local technology for laccase production using inexpensive agricultural by-products. Application of laccase to bread showed improvement in terms of its machinability and quality. Output of the project will enable Filipino researchers to conduct efficacy and further application studies of locally produced laccases in several biochemical processes.

Establishment of Microbial Succession of Starter Culture for Rice Wine (Tapuy) Processing

Food Science Cluster, UPLB

Rice wines fermented from various rice varieties

Samples of bubod and freeze-dried starter cultures

With an ultimate goal to develop a technology that will produce an export quality product, the project has potential to create a competitive market for the country in the production of Philippine Rice Wine, also popularly known as Tapuy. The project involves identification of novel microorganisms and development of starter culture specific for efficient rice wine processing. A microbial succession of the developed starter culture will be established along with an optimized condition for up-scale rice wine processing using multi-parallel fermentation technique. The end-product will be analyzed for physico-chemical, functional and sensory properties after refinement and aging processes to validate quality of the rice wine produced.

Enhancing Capacity for Industrial Applications of Gamma Column Scanning Technology

DOST – PNRI

The project aims to re-establish the capacity and capability of PNRI to conduct gamma column scanning services which is a non-destructive and non-invasive tool for online diagnosis of process malfunctioning, optimization and predictive maintenance due to its capability to provide rough estimations of froth heights, down-comer liquid level, tray flood, potential tray damage and depict operational profiles of transition sections and distributions inside the process levels. The use of gamma column scanning technology is relevant in industries such as petroleum, gas installations, etc. The project shall establish a pool of trained personnel on the gamma column scanning technique; upgrade the institute's gamma scanning services and the laboratory-based demonstration column set-up. Laboratory and fields tests will be conducted in order to establish both manpower and infrastructure competency. The personnel have undergone trainings on Basic Offshore Safety Induction and Emergency Training (BOSIET) which is a requirement in conducting a column scanning service in offshore industries. The scanning system and gamma column demonstration setup have been upgraded and field tested. Validation and finalization of the scanning protocol is on process after data analyses from the conducted field testing of the gamma column scanning.

Space Technology Application (STA)

New Projects

Baseline Research of the 10-Year National Space Technology Applications (STA) Master Plan

The country held the first nationwide assembly for space technology during the National Congress on Space Technology Applications and Research or NC-STAR in November 2005 where plans of action and collaborations among DOST agencies, institutions, private companies, universities, and experts were forged. The PCIEERD likewise conducted surveys and workshops to identify issues and problems that STA could address.

The project aims to provide information essential to the development of the 10-year national space technology and applications master plan. Such information are on status of STA in the Philippines by sources (i.e. agencies, key respondents, and other sources), and Philippine contributions to international STA-related initiatives by STA-related institutions.

The project's expected output includes [1] database on (a) nationwide directory of space activities to provide stakeholders with an overview of institutions with STA activities (completed, ongoing, and planned), (b) compilation of STA sectoral plans and roadmaps of key public and private STA-related agencies/organizations and institutions, (c) nationwide directory of STA users, practitioners, and affiliation, (d) list of working groups, key respondents, and sources of information.; [2] Three workshops conducted /proceedings, quarterly reports, and final paper.

Implementing a Satellite-based Monitoring of Rehabilitation in Typhoon-effected Regions (Smarter Visayas)

A Dedicated Tasking Services (DTS) shall be used to acquire, analyze and process high-resolution multispectral and time-series satellite imagery to rapidly assess the damages left by the massively destructing super-typhoon "Yolanda" and to continuously monitor the progress of the recovery and rehabilitation efforts in the typhoon hit areas. This project is expected to produce feature extraction techniques using algorithms, geocoding on damaged areas and rehabilitation in 171 typhoon-hit municipalities and cities (at least within 50 kms from the path of the eye of the typhoon equivalent to 26,800 sq.km.) and basic datasets in GIS compatible format linked to population data, administrative boundaries of baranggay, municipalities and cities.

Before and After satellite images of Tacloban City as a result of Typhoon Haiyan

Drought and Crop Assessment and Forecasting (DCAF) Project

Institute of Envrionmental Science and Meteorology - UPD

Among the outputs of this project is a tool that can provide early warning system for drought events which will be beneficial to several government agencies. Particularly, PAGASA can use this tool together with their current capabilities to provide substantial forecast on temporal and spatial extent of drought. This information can be used by the Bureau of Soils and Water Management and related agencies to make informed decisions, policies and advisories on the distribution of water supply for various purposes such as irrigation, power generation and human consumption.

With the early warning system, the agricultural agencies will be able to respond appropriately to lessen the impacts of drought on crop productivity. With the availability of satellite data, the analysis on the temporal and spatial extent of drought can be done more swiftly and comprehensively than other methods. With satellite data readily accessible, monitoring of crops can be made on a regular basis by updating crop classification and crop vulnerability maps.

On-going Projects

The DREAM: Disaster Risk Exposure Assessment for Mitigation Program

Traning Center for Applied Geodesy and Photogrammetry, UPD (UP-TCAGP)

A nation resilient to natural disaster risks and climate change is every administration's challenge. The DREAM program aims to [1] acquire a national

elevation and resource information dataset in three-dimensions (3D) at sufficient detail and resolution from which various base and thematic map features can be extracted, [2] operationalize the development of flood hazard models to produce updated and detailed flood hazard maps for the major watersheds and river systems, [3] develop the capacity to process, produce, and analyze various proven and potential thematic map layers from the 3D data useful for government agencies, and [4] transfer product development technologies to government agencies with geospatial information requirements.

The UP-TCAGP will tap state-of-the-art geospatial data acquisition technologies particularly Light Intensity Detection and Ranging (LIDAR) and Airborne Radar Interferometry (INSAR) to cover environmentally critical areas in the Philippine archipelago in rapid, accurate, and cost-effective manner. LIDAR data is very accurate and high-resolution 3D data. Captured using special sensors from the air or ground, it results in a set of "dots" suspended in three-dimensional space. These dots can be displayed in special software or converted into a 3D mesh for use in many modern 3D software packages. The detailed topographic information derived from LIDAR and InSAR will lead to more accurate flood inundation and hazard maps.

The DREAM program is composed of five (5) components:

DREAM Project 1. LIDAR and SAR Data Acquisition

The project's objectives include [1] verification of the geometry of topography and bathymetry of project areas, [2] ground validation of processed data (digital surface model and digital terrain model), [3] reference points and benchmark recovery for the project area, and [4] assessment of correctness and completeness of feature classification.

This will lead to a nationwide spatial dataset in three-dimension (3-D) at sufficient detail and resolution from which various base and thematic map features can be extracted.

DREAM Project 2. LIDAR and SAR Data Calibration and Validation

Project 2 will verify and validate LIDAR and INSAR data as quality control which are the outputs of project 1.

DREAM Project 3. Extracting Digital Elevation Models and Salient Features for Flood Modeling

The project's objectives are to [1] obtain the Digital Surface Model (DSM) of each watershed and floodplain area, [2] extract the Digital Terrain Model

CESSNA Plane RP-C9022 carrying the Pegasus LiDAR System at AAC Hangar in NAIA.

(DTM) from derived DSM using various filters and employing necessary geometric corrections, and [3] extract features significant to flood modelling and flood hazard assessment.

The huge amount of LIDAR data will be filtered to extract the Digital Terrain Model (DTM) from the Digital Surface Model (DSM) essential in GIS-based flood modelling.

DREAM Project 4. Integrating High Resolution Digital Elevation Models (DEMs) into GIS-based Flood Modeling

In this project, the following will be conducted: [1] develop a dynamic GIS data model for hydrological simulation of major watersheds in the country, [2] apply derivative products from analysis of remotely-sensed data to parameterize land cover information in the hydrological model, [3] apply derivative products from LiDAR and INSAR acquisition to characterize geometry of watershed and affected floodplain, and [4] establish a rainfall-runoff response as source of input for flood forecasting, and guide for disaster contingencies during extreme rainfall events.

DTM and DSM will be used to present the impact of flooding to man-made and natural features on the floodplain. This will establish a rainfall-runoff response that can serve as source of input for flood forecasting and guide for disaster contingencies during extreme rainfall events.

This project is expected to produce [1] a working hydrological model for the major watersheds in the country, [2] spatial database of target basins designed for hydrological studies, [3] estimate of the spatial temporal distribution of soil saturation, and runoff discharge from each target basin, and [4] hazard mitigation guide for potential severe discharge events based on hypothetical rainfall and cover scenarios.

DREAM Project 5. Training for LIDAR Data Acquisition and Flood Modeling

The project's objectives are to [1] develop proficiency in acquiring airborne LIDAR data from actual airborne laser equipment, [2] develop skills in processing airborne LIDAR data for generation of derivative products including Digital Elevation Model, Digital Surface Model and Features, [3] develop tools in assessing the accuracy of generated LIDAR-sourced products and validate processing results, and [4] develop proficiency in generating flood models for watersheds and floodplains, and conduct assessments using flood modelling tools.

Thirty two (32) personnel will be trained to operate the LIDAR scanner, process the data, and validate the results of derivative product, [2] 24 personnel trained in flood modelling and flood hazard mapping, [3] fully developed capacity for LIDAR data acquisition, processing, and analysis ready for deployment, and [4] training materials from lectures and hands on activities.

SAGO Project II.1. GIS-Assisted Assessment on the Potential Yield and Bioresource Availability of Sago in the Wild for Sustainable Industry Utilization

UP – Mindanao

The project involves assessment of current and future potential yield and availability of sago for sustainable sago-starch industry that considers the impact of existing land use and tenure in sago areas, stages of sago phenological development, and current demand and future needs of sago products.

The project aims to [1] determine the net sago areas or general sago areas reduced by existing land use and land tenure, [2] determine existing status of sago stands in their natural habitats, [3] determine existing potential gross yield of sago, [4] determine existing potential net yield of sago, [5] determine current demands and potential future needs of sago products, [6] develop empirical model on allometry of sago palm, and [7] forecast future availability of sago palms in the wild for sustainable industry utilization.

It is expected that a general sago area maps (existing land use and land tenure maps) in shapefile format covering Mindanao and Visayas from results of component project will be developed. The existing potential gross and net yield of sago, current demands and potential future industry needs of sago starch, allometric model of sago palm, and sago bioresource forecast will also be determined.

Completed Projects

SAGO Project III.2. GIS-assisted Assessment on the Potential Yield and Bioresource Availability of Sago in the Wild for Sustainable Industry Utilization

UP – Mindanao

The project conducted mapping of sago habitats and sago suitable sites in Visayas and Mindanao using an integrated approach utilizing optical and radar remotely-sensed images and use of suitability rules derived from in-situ measurements that resulted to a land-cover map of Eastern Mindanao. The map shows the following data: land-cover types: sago stands,, dense vegetation, grassland, barren lands, croplands,, water bodies, exposed river beds, mangroves, banana, coconut, nipa,, and palm oil; an accuracy assessment of the generated land-cover map, including measures how accurate the mapping of each land-cover type are, most especially the sago stands; maps of location of sago stands in the Eastern Mindanao provinces of Agusan del Norte,, Agusan del Sur and Surigao del Sur; and 4. Estimates of the area of sago stands at the provincial and municipal levels.

Satellite and field detection and analysis of ground subsidence in KAMANAVA, Metro Manila, and other coastal areas such as Hagonoy and Obando, Bulacan
National Institute of Geological Sciences (UP – NIGS)

This three-year project determined the extent and rates of ground subsidence or sinking in Metro Manila, particularly the KAMANAVA area where alarming rates of subsidence is noted.

Since 1997, scientists at the UP-NIGS, and the Marine Sciences Institute (MSI) had studied the worsening floods and tidal incursions around northern Manila Bay including the northern coastal cities of Metro Manila (Siringan and Rodolfo, 2003; Rodolfo et al., 2006; Rodolfo and Siringan, 2006).

The increased flooding is usually blamed on upland deforestation, urbanization, channel encroachment by illegal settlers and fishponds, and garbage dumping in estuaries. But physical and sociological data demonstrated that the biggest cause of subsidence is over-pumping of groundwater, which causes the ground to subside by centimeters and even more than a decimeter per year (Rodolfo et al., 2003; Siringan and Rodolfo, 2003; Rodolfo and Siringan, 2006).

In Metro Manila, subsidence rates typically range between 4.5 and 9 cm per year. In 2000, these data were verified following a resurvey by National Mapping and Resource Information Authority (NAMRIA) of elevation benchmarks established in 1978 (Jacob, 2004). Still uncertain is a possible tectonic contribution to this incremental drop in ground elevation. Levelling and PSInSAR processing of nearly two decades of radar data will be used to quantify the amount, rate, and distribution of subsidence in Metro Manila. When compared with the stratigraphy of Metro Manila, this record will determine the nature of ground subsidence whether it is purely anthropogenic or not.

Transportation Sector

New Projects

Intelligent Transport System (ITS) Program

Development of the Philippine Metropolitan Advanced Traveler Information System (PhilMATIS)

National Center for Transporation Statistics – UPD

The project aims to [1] develop and pilot-test an advanced traveler information system (ATIS) that will measure and record traffic volume and flooding incidence along major roads in Metro Manila, [2] benchmark the prototype against information on traffic volumes and flooding including data/outputs from existing MMDA Traffic Navigator, based mainly on data from crowd sourcing, using suitable level of service (LOS) criteria, [3] develop online user interface for ATIS in both internet and app forms, and [4] pilot-test the system during inclement weather when it is supposed to provide travelers with information on alternate routes and estimate travel speeds along affected roads.

The proposed PhilMATIS will draw information from cameras and sensors installed in strategic locations (major intersections) that will detect traffic and measure its characteristics (volume, speed, composition, etc.) using digital image processing techniques. It is envisioned as an automated system, ultimately with significantly reduced or minimal human influence or factors on system outputs. The ATIS is an effective means to address potential congestion problems. Applied during bad weather conditions, ATIS should be able to manage factors such as traffic

volume, rainfall data, routes, and related information and provide alternative routes aside from advisories on what vehicles may still traverse flooded street sections.

ATIS has the ability to monitor traffic flow along different roads in a metropolis, derive rainfall and flood data from existing systems while also monitoring flood incidence at critical points in the road network. Traffic flow data that ITS collected can be used for trending analysis and decision making tools. Flood monitoring of major/arterial roads in Metro Manila may lead to collaboration of ATIS software to mobile application developed for Project NOAH. To support DOST's Project NOAH, mobile communication firms Smart and Sun Cellular will allow DOST to install automated rain gauges in 600 cell sites in target river basin systems. The user interface (via internet or mobile apps) will take advantage of existing features for NOAH. This project is under a larger ITS initiative that will include projects on incident management systems (IMS), advanced traffic control (ATC), advanced public transport systems (APTS), and other ATIS applications.

CCTV and Vehicle Locator Sensors

Advanced Traffic and Pollution Monitoring and Analysis System (ATPMS) based on GPS Trajectory data, Air Quality Data, and Engine Status Data Collected from Taxis in Metro Manila - Year 1

Ateneo De Manila University (ADMU)

Probe car technology is already in the Philippines. It has been developed since 2008 with published algorithms and mathematical theory to transform trajectory data into Flow pattern, Origin Destination matrix, and other routing information in several international journals and conferences. Hypothetically, these algorithms could provide real-time best route advisories, monitor observance/non-observance of traffic rules, and help detect traffic accidents.

The next step is to set up a pilot project to prove the concepts and implement algorithms into real traffic information system. Current MMDA traffic information is very useful for public, but many MMDA personnel update it manually. Sustainability of current system is problematic if expanded to whole Metro Manila. There is great need to integrate the current system with automation of data gathered using GPS trackers to substantially reduce personnel related costs, and allow the system to be easily expanded to cover entire Metro Manila or beyond. A web-based Advanced Traffic Information system will be developed in the project. Further, the project will: [1] improve traffic mobility in Metro Manila through provision of collective behavior of PUVs to the control management of PUVs and MMDA, [2] induce efficient traffic flow through provision of public information on current and predicted traffic flow in major routes, and [3] enhance policy formulation among government agencies and universities through provision of shared data for transportation planning and operation.

Establishment of an Innovation Center for Motor Vehicle and Parts Development (iMOVE)

Project 1 - Establishment of a Finite Element Analysis (FEA) Design Center

The general objective of the study is to establish a FEA Design Center in support to the Customized Local Road Vehicles (CLRV) Industry. Specifically, Finite Element Analysis (FEA) will be conducted on structural body design of existing CLRVs, recommend design improvements, and eventually develop local expertise on FEA and initiate future FEA related activities. Manufacturers have agreed to use the designs and existing units for the FEA simulation tests through a Memorandum of Agreement (MOA) in September 2013.

Project 2 - Revitalization of MIRDC's Testing Facility in Support of the Automotive Components and Parts Manufacturing Sector

The establishment of automotive components and parts testing facility at the DOST-MIRDC will have a critical role in improving the competitiveness of the manufacturing industry highlighted in the Philippine roadmap for the automotive parts and motorcycle manufacturing industry.

The project addresses this need through the provision of automotive parts testing facilities. It will acquire, install and provide testing facilities for the automotive parts and components manufacturing industry, develop testing personnel's skills in conducting different tests for automotive parts and components, and establish, develop and standardize test methods for automotive parts and components.

Support Program for the Productivity and Competitiveness of the Metals and Engineering Industries

Project 1 - Development of a 120-Passenger per Coach Capacity Automated Guide-way Transit (AGT) System

In an effort to reduce environmental pollution and public transport problems as well as develop low cost mass transit for the country, the will build an alternative and economical transit system model at the Science Community Complex in Bicutan, Taguig City for technology demonstration.

The project will be implemented by DOST in cooperation with industry and academe. It is divided into three parts: Civil Designs and Constructions, Electro-Mechanical Design and Fabrication, and Mechanical (Rolling Stock). The project is expected to produce a prototype Automated Guideway Transit (AGT) as an alternative technology and efficient transport model in the Philippines for demonstration; identify cost-effective opportunities to develop local capability and industry on Mass Rail Transit (MRT) and Light Rail Transit (LRT) systems.

The AGT elevated track under construction in Bicutan

Project 2 - Design and Development of an AGT System Depot and Passenger Stations

Part of the AGT project is the design and development of depot and passenger stations with safety features, communication and automatic fare system in UP Diliman, Quezon City. The concept design have been completed in consultation and recommendations of the UP College of Architecture. The draft Terms of Reference (TOR) for the depot will be finalized while the ticketing system has already been coordinated with the private passenger ticketing company.

Project 3 - Study of Three (3) Potential AGT System Routes

A detailed design, drawing and cost estimate of elevated test tracks, stations, maintenance depot, etc. of various identified routes equipped with safety features, communication and automatic fare collection system will be brought out of this project in relation to the development of a fully equipped and operation-ready Automated Guide-Way Transit (AGT) System.

The project has already shortlisted potential transport and traffic consultants who will conduct the pre-feasibility study and prepare the detailed engineering designs for the 3 AGT system routes.

Project 4 - Prototype Development of a Five Coach Centrally Powered Hybrid Electric Road Train (CRT)

The Road Train was introduced as one of DOST's proposed advanced transport systems that could help ease traffic conditions in Metro Manila. This project which includes automatic ticketing system will be demonstrated along selected urban areas to determine public acceptance, and assess how Road Train will affect transportation needs in Metro Manila. The project aims to develop a centrally powered prototype of hybrid electric road train for public transport by harnessing locally available technology. Specifically, it seeks to [1] design and fabricate a five-coach prototype road train public transport unit or CRT, [2] study and design a road train that uses locally available battery systems, [3] design, test and develop a safe and efficient control strategy for a hybrid electric road train public transport unit, [4] provide performance-based recommendations on components for standard testing procedures on local hybrid electric road train, and [5] promote the hybrid electric vehicle (HEV) technology to cities in Metro Manila affected by traffic congestion, safety degradation, air pollution and inefficient public transport.

Project 5 - Development of Prototype Trainset

The key developmental objective of the project is to develop local capability into design and manufacturing of train sets. The project will design and fabricate two (2) units of prototype trainset, with five coaches in each trainset and develop a. control system for the prototype trainset.,Also, a comprehensive material selection process for the local production of train parts will be conducted.
The different prototypes - AGT at UP (60 passenger capacity), AGT 120, CRT (3 different prototypes: Chassis 1&2, CRT 5 coach, & CRT 3 coach) can be tested under the Project 2 - Revitalization of MIRDC's Testing Facility in Support of the Automotive Components and Parts Manufacturing Sector and the Project 1 - Establishment of a Finite Element Analysis (FEA) Design Center.

KRA 5: Integrity of the Environment and Climate Change Adaptation and Mitigation

In the last few years, we have witnessed climate change scenarios that are causing almost unpredictable deviations in atmospheric, geophysical, and astronomical events and patterns.

Rapid urbanization and overexploitation of natural resources pile on the degradation of natural environment spanning marine and freshwater resources, biodiversity, and mineral rich areas. The pollution scale ostensibly demands innovative management and remediation methods. Moreover, natural disasters such as earthquakes, landslides, subsidence, typhoons, and floods apparently grow in intensity and frequency resulting to huge losses in lives, property, and infrastructure.

In 2013, PCIEERD poured its R&D resources on initiatives to raise national technology capability and achieve technology self-reliance over the long term in adapting to a changing—at times hazardous--natural environment. In this way, the nation will be better equipped technologically and psychologically to mitigate the varied impacts of a badly damaged environment and climate change.

DISASTER MITIGATION

New Projects

Specific Earthquake Ground Motion Levels that would Affect Medium-to-High Rise Structures in Metro Manila DOST

Philippine Institute of Volcanology and Seismology (PhiVOLCS)

The project will cover 16 cities and 1 municipality in Metro Manila and parts of Rizal province. It primarily aims to enhance the capacity of PHIVOLCS personnel in conducting microtremor array surveys, analysis and interpretation; identifying the shear-wave velocity of deep sedimentary layers reaching the seismic basement, mapping long-period site effects in Metro Manila., providing realistic ground motion levels that could affect the structures, and specific site amplification needed by structural designers/ engineers

Enhancing the Ground Deformation Monitoring Capability of PHIVOLCS in Bulusan and Taal Volcanoes Through the Development of Real-Time Geodetic System

DOST - PhiVOLCS

The project is an initiative to enhance one of the fundamental tools for predicting volcanic eruptions, which is to monitor volcanic ground deformation in response to subsurface magmatic, gas, and related processes. To achieve this, the project will commission fully operational real-time geodetic network consisting of GPS and electronic tilt system (equipped with end-to-end remote station-volcano observatory-main office) in Taal and Bulusan volcanoes to acquire high-quality volcanic ground deformation data. This will also generate high resolution ground deformation data that can authoritatively support decision making during volcanic unrest, help constrain parameters as precursor to eruption, and support research in underlying magmatic and related source processes that produce observed patterns of volcanic deformation.

Enhancing Philippine Landslide Hazard Maps with LIDAR and High-Resolution Imageries

National Institute of Geological Sciences (NIGS) – UPD

The availability of high resolution topographic maps of the entire Philippines generated by light detection and ranging (LIDAR) surveys provides sophisticated means to identify landslide prone areas. Identification of landslide vulnerable sites is narrowed down through computer assisted analyses of mountainsides with landslide scars, concave platform areas, storm runoff convergence, and structurally controlled failure slopes.

This nationwide landslide mapping project seeks to improve existing landslide hazard maps by using state-of-the -art techniques to construct landslide hazard maps, which can assist in emergency preparedness, planning, and decision making regarding development in areas susceptible to slope failure.

The projectwill come up with digital geohazard maps, stability index maps, structurally controlled landslide potential maps, and downscaled risk maps (barangay level).

Earthquake Hazard Assessment: Active Fault Mapping and Ground Shaking Hazard Assessment

DOST - PhiVOLCS

Active faults are known sources of strong earthquakes. In shallow earthquakes, the movement of fault generates ground rupture that may extend offshore causing underwater/submarine faulting and may sometimes be tsunamigenic.

This research aims to accurately map the active land and offshore faults using a set of non-invasive geophysical tools to assess the seismic hazard along the valley fault system (VFS) and offshore extensions of the PFZ. A detailed active fault map of the VFS with sufficient accuracy as verified by survey, underwater extension of the VFS along Angat dam reservoir, Pasig river, and selected sites of the PFZ, and enhanced ground shaking amplification map of selected sites will be developed.

System to Identify, Quantify, and Map Storm Surge Threat to Philippine Coasts

DOST – PAGASA

Storm surge acquired deadly clarity after super typhoon Yolanda whipped Visayas last year. Its generation in any coast and the magnitude of inundation it spurs involve numerous factors. These include, but are not limited to the typhoon's travel velocity and track; area, eye radius and radius out to its maximum winds, and wind speeds; timing with respect to the tides; geometric relationships of typhoon trajectory and configuration of threatened coastline; depths and slopes of adjacent sea floor; topography of coastal land; absence or presence and structural integrity of coastal infrastructure, and; density and distribution of threatened populace.

The project aims to enhance PAGASA's disaster forecasting capabilities by generating detailed storm surge maps and inundation susceptibilities. The maps will be used to warn coastal communities threatened by approaching typhoons. The maps will also be a guide to plans in developing structures to protect housing and infrastructure in vulnerable areas, and in developing or expanding construction in areas indicated to be safe.

The project's expected outputs include [1] upgrading and updating of existing storm surge models, [2] storm surge inundation maps of all Philippine coastal areas derived from 6-meter SAR-derived topography, Lidar topography, and numerical simulations, [3] risk analysis of coastal areas due to storm surge inundation, [4] storm surge inundation maps output in Project NOAH, [5] predicted storm surges' availability in the internet at least 24 hrs before a tropical cyclone's landfall.

Regional Disaster Science and Management S&T Capacity Development-- Regions 2, 3, 11

This project is an integration of a concept that is based on core understanding of risk within the natural hazards and disaster risk reduction community. In this context, risk is defined as interaction between a natural hazard event and the vulnerability of exposed element.

The project aims to [1] strengthen the disaster science regional capacity through state universities and colleges, [2] establish regional and provincial hazard exposure databases, [3] conduct regional and provincial risk assessments, [4] establish inventory database of disaster risk reduction and climate change adaptation studies and hazards maps.

In the project a regional and provincial network of S&T service providers and support for disaster science and management will be established including a multi-natural hazard exposure database. A preliminary study on hazard assessment, vulnerability, and capacity, regional and provincial inventory of DRR and CCA studies, hazards maps, and existing multi-hazard early warning systems, and a disaster science and management (DSM) training module and curriculum program will be conducted.

Development and Deployment of Early Warning System for Deep-Seated Catastrophic Landslides

DOST - PhiVOLCS

DYNASLOPE: Development of Site-Specific Threshold for Deep-Seated Landslides and Slope Failures

The project is taking off from previous programs that collected data from landslide-prone areas to make improvements in the monitoring and data analysis software. Drafting of protocols for implementation and validation of landslide thresholds with LGUs and communities are also being done.

At the end of the project, potential deployment sites in the Philippines should be identified to promote community involvement, deploy sensors, gather and analyze data from sensors, transfer the technology and conduct IECs. With this study, it is expected that socioeconomic losses associated with relocation of communities will be reduced by developing the capacity of a community to monitor potential landslides, wherever landslide monitoring is deemed a viable alternative risk mitigation measure.

SENSLOPE: Development and Deployment of Landslide Sensors and Data Communication System

The project intends to refine previous landslide sensor system design, develop readout devices for piezometer systems with telemetry, manufacture refined landslide sensor system for 50 sites, establish a critical backend to store and manage all the data from sensors, deploy, monitor and maintain landslide sensors and transfer the technology

During its first year the project has already completed design upgrades to the previous system, conducted initial tests for accelerometers and soil moisture sensors, developed calibration procedure for accelerometers and soil moisture sensors, prepared complete bid documents for system fabrication through manufacturer. Continuous monitoring and updates on health and data of the previously deployed systems and communication with the local landslide monitoring committee are conducted.

Disaster management using Web-GIS

The project will develop a disaster management system for the Philippines using Web-GIS technologies. It will compile all disaster-related data from government and non-government sectors such as spatial data, non-spatial semantic data, associated metadata, and the latest communication technologies as centralized hazards decision support system for disaster management. Rendering of large volume LIDAR data online and viewing of the Philippine landscape and communities alongside hazards shall be made available.

The project is expected to produce [1] a visual web-based platform and [2] a central active repository of hazards and disaster related information as disaster information geodatabase system. The web-based platform shall provide visualization of data, while the geodatabase system shall contain updated hazards and disaster related information.

Design and Development of Aerial Mapping and Imaging Systems and Standards

ADMU

Unmanned Aerial Vehicles (UAVs) are multi-role assets and platforms that when combined with a national IT platform enables research in new sciences and technologies/techniques to tackle the problems facing the country especially in terms of agriculture, disaster science and environmental sustainability. In conjunction with other Remote Sensing technologies that employ satellite imagery, manned airborne imaging and LIDAR, UAV sensing techniques can enable new capabilities for "ground truth" or for targeted missions.

Through the project, aerial remote sensing UAVs for monitoring the critical infrastructure, precision farming and disaster risk reduction in Luzon and the Visayas will soon be used. This will allow the conduct of risk assessment decisions and enable the efficient management of agricultural assets and rural and semi-urban developments in complement to the satellite images being procured by the DOST and DoA. It will eventually create in the Philippines the capability to engage in aerial remote sensing using UAV for monitoring critical infrastructures, precision farming and disaster risk reduction.

On-going Projects

The Second Phase of the Taiwan-Philippines Geodynamic Integrated Project

Project 1 - The Geology of an Overriding Plate: Constraints from Field Geology, Sediment Geochemistry and Paleontology
NIGS – UPD

What happens deep below land surface is largely unknown to common people. But knowledge of deep earth conditions and movements can help town and city land use planners in coming up with decisions where and what to build like houses, buildings, communities, and roads, among others. It can also guide investors where and what minerals can be extracted.

The Philippines is an ideal laboratory to study complex convergent systems. Its existing setting is tectonically elaborate and dynamic. The Central Philippines, which includes the islands of Masbate, Negros, and Samar form the rigid overriding plate of the Philippine convergent system. Plate movement on above subduction zones is .enigmatic and no individual parameter has accounted for overriding plate deformation (Grevemeyer and Tiwari, 2006; Schellart, 2008; Van Dinther et al., 2009). These

issues are complicated by compounded effects of two bounding convergent systems and a young but extensive strike-slip fault zone.

The study aims to obtain a clear understanding of the region's geodynamic history as a necessary element in [1] constructing comprehensive land use plans, [2] geohazard susceptibility assessments, and [3] mineralization potential maps.

Project 2 - Linking Active Margin Tectonics and Overriding Plate Dynamics: A Look at the Geochemical Nature of Central Philippines NIGS – UPD

Overriding plates are direct recipients of mantle-derived magmas and magmatic fluids. Such materials are highly enriched in metals and other rare earth elements. These can be concentrated by certain tectonic processes resulting in economically viable deposits. The Central Philippines is known to significantly host such metal deposits with large gold and copper mines in Cebu, Leyte, Masbate, and Negros.

The Philippine convergent system's complexities had not been fully realized and those identified are still poorly understood. The dynamic nature of subduction and collision boundaries gained more interest in previous studies. Consequently, most tectonic researches in recent past tried to understand the natures of different subduction and collision systems on the archipelago's western and eastern margins.

The project is expected to generate an updated geologic, petrologic, and geochemical data pool on ultramafic and mafic rocks that make up the central segment of the Philippine overriding plate represented by the islands of Masbate, Negros, and Samar. Together with results of three other complementing studies included in this program, it is hoped that the region's tectono-magmatic history can explain the structural rotations and resulting distributions of magmatic and mineralized zones.

Project 3 - Retracing the Central Philippine overriding plate motion NIGS – UPD

The country's only Electron Probe Micro-Analyzer (EPMA) used for chemical analysis of geological materials at small scale housed at the UP-NIGS

The Philippines is one of the world's most geodynamically interesting places but there is a scarcity of basic geological information. The archipelago's subduction/collision boundaries are the subject of several recent researches (Yumul, et al.,2005; Dimalanta et al.,2006) and significant advances were achieved in understanding Philippine and regional tectonics. Plate movement above subduction zones is enigmatic and no individual parameter has accounted for overriding plate deformation. In the Philippines, these issues are complicated by compounded effects of two bounding convergent systems, and a young but extensive strike-slip fault zone.

The study aims to understand the region's geodynamic history as a necessary element to [1] construct comprehensive land use plans, [2] geohazard susceptibility assessments, and [3] mineralization potential maps. It will come up with new geologic, geochronologic, and paleomagnetic data from islands that consist the central segment of the Philippine overriding plate such as Masbate, Negros, and Samar. Reconstruction of the region's paleo-geography and trace the islands' motion histories over geologic time based on paleomagnetic information to be collected and the extent of structural rotations due to convergent tectonics that affected the region will be done. Further, the timing of movement relative to other tectonic events will be assessed with the use of information to explain current environmental conditions in the region. Maps will be generated on geohazard susceptibility and mineralization potentials.

Project 4 - Geophysical Characterization of an Overriding Plate: Arc-continent Convergence and Its Implications to Natural Hazards and Resource Distribution in Central Philippines
College of Science – UPD

The many islands and sedimentary basins in Central Philippines form part of the rigid overriding plate of the Philippine convergent system. It is bound on either side by subduction systems of east verging Manila-Negros-Sulu trench, and the west verging Philippine trench systems. The opposing directions significantly induce compressive stresses on the overriding plate and result to the formation and shear partitioning along the Philippine fault system (Aurelio, 2000).

The study aims to characterize the effects of fast plane motions of Central Philippines overriding plate segment on goephysical character of the different lithologic units in Central Philippines. Moreover, regional gravity and magnetic surveys will be done to delineate different geologic terranes particularly their boundaries (faults and shear zones). These potential field techniques can illustrate the lateral extent of large scale tectonic (both structural and lithologic) features associated with the arc-continent collision in the region.

MECO--TECO: Philippine-Taiwan Integrated Predictive Studies of Geo-Meteorological Hazards

NIGS – UPD

This study aims to build and strengthen human resource, institutional capacity, tools and approaches towards sound flood forecasting, and early warning system aspects in the Marikina River Basin.

Moreover, the studies seek to [1] calibrate spectral values of selected satellite imagery with ground data to estimate and forecast rain rates, [2] establish flood threshold values in different basins through generalized watershed runoff calculations, [3] examine the accuracy of quantified rain/flood forecast to be generated from this study, and [4] develop flood hazards protocols for different basins.

Rainfall-Induced Landslide Susceptibility Zonation Along the Cagayan de Oro-Bukidnon-Davao City Route Corridor

Central Mindanao University

This research will produce landslide susceptibility zonation map and predictability of rainfall induced landslide along the CDO-Bukidnon-Davao Route Corridor based on the soil's yield stress. It will characterize landslide inducing factors along the CDO-Bukidnon-Davao route corridor using GIS, [2] evaluate landslide inducing factors using bivariate statistical method following the frequency ration approach, and generate landslide susceptibility zonation map along the CDO-Bukidnon-Davao route corridor path, and [4] evaluate the effect of moisture content on yield stress of soils along the identified slip-prone areas

Development of a Low-Cost and Locally-Designed Meteorological Buoy (MetBuoy)

DOST – ASTI

This is a joint project of Advance Science and

Off-shore mooring of meteorological buoy

Technology Institute (ASTI), Metals Industry Research and Development Center (MIRDC), and Project Management and Engineering Design Services Office (PMEDSO). It will develop and deploy low-cost and sustainable moored meteorological buoy to monitor weather disturbances at sea in real time. This is seen to improve maritime safety, and enhance weather forecasting system in the Philippines.

Support Program for the Productivity and Competitiveness of the Metals and Engineering Industries

Project 6 - Improvement of Flood Control Facility through the Development of Automatic Trash Rake
DOST – MIRDC

The project aims to develop an improved automatic trash rake equipment in Binondo pumping station with higher capacity, improved trash collection rate, minimal power trip, and a capability to lift sizeable trash during pumping process. This can be achieved through conveyor rake, trash gate, and clamshell.

It is expected to rehabilitate one Bank of Automatic Trash Rake in Binondo Pumping Station by equipping it with Trash Gate and Clamshell; and to develop and construct one Bank of Automatic Trash Rake along San Juan River, specifically in Balinghasa creek.

A detailed design for the Binondo pumping station has already been completed and submitted to MMDA. This will be used for the rehabilitation project of MMDA in Binondo.

The Establishment of Meso-Scale Meteorological Monitoring Infrastructure in Davao City

Ateneo de Davao University

Meteorological monitoring infrastructure, which measures and documents the amount of rainfall, temperature, and relative humidity is a concern of public and private sectors.

This project aims to establish a robust weather monitoring system that meets the peculiar physical and institutional contexts of selected localities. It will also delineate the roles of public and private stakeholders and partners in maintenance and use of the system. Collaboration among stakeholders in resource allocation, risks, responsibilities, and rewards sharing will constitute the Public Private Partnership (PPP) models that will be developed. A pilot meso-scale meteorological monitoring infrastructure that will be installed in Davao City. Data gathered after long-term deployment of the infrastructure will be used in climate pattern analysis and climate policy modelling to support disaster risk management, climate change adaptation, and watershed and agricultural management. In the long run, it will establish a PPP model based on the project's development phase

The Use of Radon in the Monitoring of the Philippine Fault and Valley Fault System and Its Implication as an Earthquake Precursor

DOST – PNRI and Central Luzon State University)

Radon (Rn222) is a radioactive gaseous nuclide formed by the emission of alpha particle from the disintegration of radium in the uranium decay series. It has been widely used as an important geochemical indicator of an impending quake. Since the well documented April 26, 1966 M7.5 Tashkent earthquake in Uzbekistan in the former USSR, radon in soil, near surface air and groundwater has been extensively monitored in many countries particularly in tectonically active regions of the world as supplementary predictive tool for large earthquakes. The use of radon as an earthquake precursor is based on the positive or negative correlation between anomalous radon concentration and seismic activity. Many studies have indicated that the near surface air, soil and groundwater commonly show significant variations in radon concentrations before, during and after the occurrence of a large earthquake (Scholz, C. H., et al, 1973, Ramona, et al, 1990, Dubinchuk, V. T. 1993 and Vinciguerra, S., et. al., 2010).

Radon gas sampling points

The rational on the use of radon as an earthquake precursor lies in the fact that large earthquakes are commonly accompanied by anomalous changes in radon concentrations and therefore can be utilized as a potential indicator of impending quakes. It is believed that long before an earthquake occurs, there is a gradual release of energy which exerts pressure on surrounding rocks, resulting in the development of micro-fracture systems and reactivating pre-existing fractures, which serve as pathways or avenues for the escape or migration of radon and other terrestrial gases (CO2, He, H2, CH4, N2) and volatile metals (Hg, As, Sb) towards the surface, giving rise to abnormal increase in radon concentrations. If detected it could be utilized as a precursory signal of an impending quake.

This project aims to use radon as potential geochemical precursor of earthquake along the northern segment of the PF and VFS and to contribute in strengthening the monitoring program being undertaken along the northern segment of the PF and VFS.

Regional Disaster Science and Management S&T Capacity Development for SUCs

PhiVOLCS, CLSU, Isabela State University (ISU), University of Southeastern Philippines (USEP)

This project seeks to strengthen the disaster science regional capacity through the State Universities and Colleges (SUCs), establish regional and provincial hazard exposure databases, conduct regional and provincial risk assessments and establish inventory database of disaster risk reduction and climate change adaptation studies and hazard maps.

It is expected to come up with Regional and Provincial Network of S&T service providers support for disaster science and management; a multi-natural hazard exposure database; hazard assessment, vulnerability and capability preliminary study, and Regional and provincial inventory of DRR & CCA studies, hazards maps and in-placed multi-hazard early warning systems.

Electronics Sector

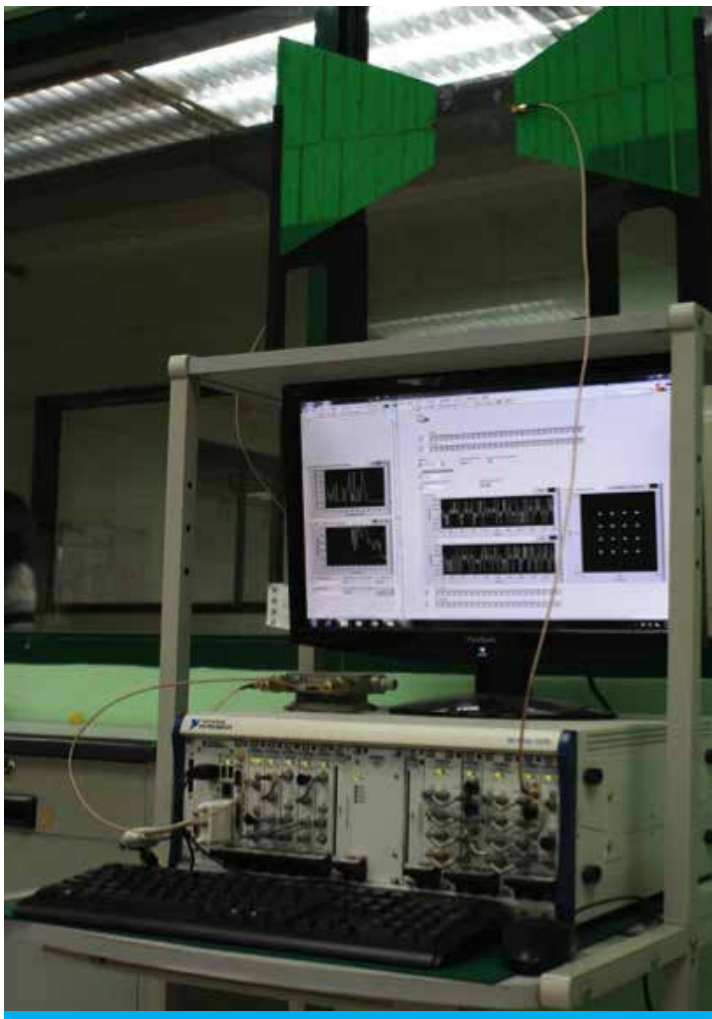
New Projects

Resilient Communications Infrastructure and Signal Processing for Use in Emergencies and Disaster (RESCUED) Project

Project 1 - ROGER - Robust and Rapidly Deployable GSM Base Stations and Backhaul for Emergency Response
Electrical and Electronics Engineering Institute (EEEI) – UP)

In the shadow of the catastrophic typhoons and other natural disasters that regularly hit the Philippines, a team of researchers from the Electrical and Electronics Engineering Institute of the University of the Philippines Diliman (EEEI-UPD) sought to develop robust, rapidly deployable communications infrastructure at times of emergencies and disasters.

A ROGER (Robust and Rapidly Deployable Global System for Mobile communications (GSM) Base Stations and Backhaul for Emergency Response), aims to develop, deploy and test a system for achieving standby and backup communications capacity when regular infrastructure breaks down or becomes unavailable in the aftermath of a disaster. Low-cost GSM base stations shall be combined with local design and development of long-range point-to-point wireless backhaul link using TV white space (TVWS) frequencies. Additional hardware components such as power amplifiers and antennas that provide additional robustness and resiliency shall also be designed



TV white space set-up

and tested. Applications that are customized for emergency response and public safety shall also be developed to run on this platform. In all, the system is intended to provide emergency response personnel and managers with a reliable communication platform that enables effective coordination of relief, rescue and recovery efforts at times of disasters.

In 2013, the project team was able to conduct rapid prototyping of the TVWS spectrum scanning and chancel occupancy algorithm. The team also integrated the algorithm with a Quadrature Amplitude Modulation (QAM) radio and conducted functionality and bit error rare tests. The researchers are pursuing various architectural approaches to building the TVWS radio, including identifying suitable chipsets.

Project 2 - LADDERS - Local Capability of Development of Radar Systems
Electrical and Electronics Engineering Institute (EEEI) – UP)

Data acquisition system interface to the old PAGASA radar

Because of its geographic location in the Pacific, the Philippines is frequently visited by typhoons that bring flood and destruction to both lives and crops. The Doppler weather radar systems installed in the country are purchased and imported from foreign countries. The training on the equipment that comes directly from foreign manufacturers or their local sales representatives are focused solely on mechanical operating procedures of the equipment and does not necessarily include proprietary information that enables more in-depth understanding of radar operation. A team of researchers from the Electrical and Electronics Engineering Institute of the University of the Philippines Diliman (EEEI-UPD) with the aid of PAGASA, took on the challenge of understanding the design, troubleshooting, test and expert operation of some of these radar systems.

LADDERS intends to enhance current capability in the Philippines in the sustainable operation of radars by investigating opportunities for local design on both radio frequency (RF) front-end and radar signal processing blocks or sub-systems. These research activities and outputs are intended to provide a better collective understanding of this technology that will enable the Philippines to achieve technological independence in this area in the near future.

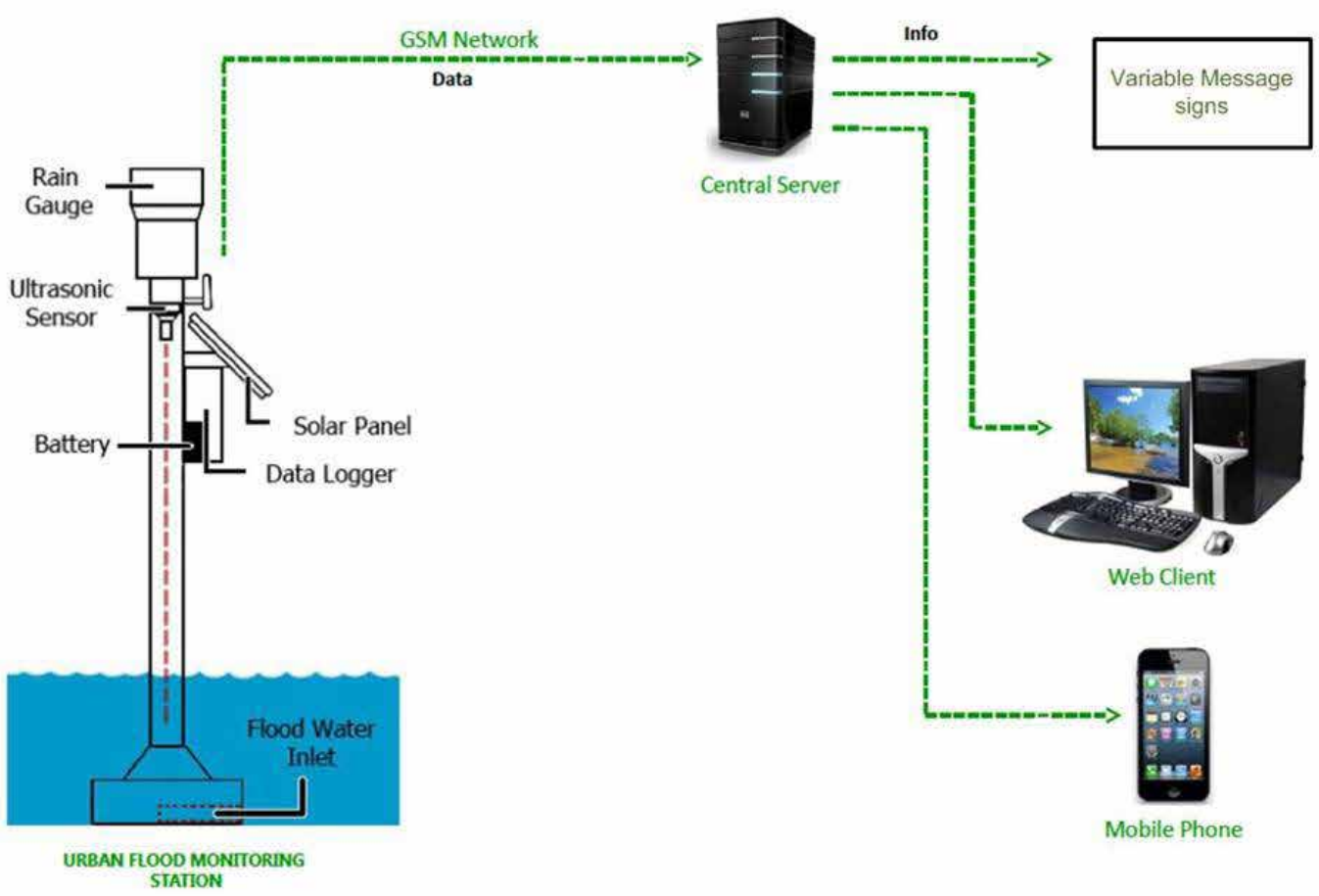
In 2013, the project team has visited radar sites in Aparri, Cagayan and Guiuan, Eastern Samar. Recently, the team literally took apart the decommissioned radar unit in Aparri for testing and characterization with the goal of providing a technical "blue print" of its architecture and design principles. Radar signal returns have been gathered from a similar decommissioned but functioning unit in Guiuan. The radar display has been roughly emulated using the teams's own signal processing techniques. Further filtering and processing will be done to free the display of unwanted noise and clutter. Tests will still be performed to compare the accuracy and correctness of the display.

Flood Sensor Development, Installation and Monitoring of Urban Flooding in Metro Manila

DOST –ASTI

The system to be developed consists of standalone stations, computing devices, display elements, and a redundant data transmission/communication system as follows:

Urban Flood Monitoring Station: A standalone unit that has 3 sensors; a rain gauge to measure rainfall and an ultrasonic sensor plus camera to monitor flood level. Flood level is measured by allowing flood water to enter a screened (to deter entry of solid matter which may affect readings or clog the tube) slot located



at the bottom of the pole that supports the sensors and electronic components. The data readings from the two sensors are passed to the ASTI developed ArQ datalogger, which acts as the controller of the station. The ArQ datalogger then transmits the data to a central server (refer to description below) thru two possible communication channels for redundancy: GSM or RF/Wireless. GSM uses the cellular network to transmit text-based information while RF/Wireless communication requires Repeater Station/s (refer to description below) that will relay the data to the central server.

Central Server – A computer that receives and processes data from the urban flood monitoring stations. The information generated is passed to the public and other stakeholders thru the web. This web information can be accessed using computing devices such as computers, tablets and mobile phones. Information can also be displayed in widescreen monitors deployed at strategic areas in Metro Manila's street/road system.

Repeater Station – A station which receives information from the urban flood monitoring station then re-transmits it to another station or straight to the central server depending on the circumstance. It is an in-between structure that ensures the data will reach the central server. RF/Wireless communication cannot cover very long distances hence the data has to be passed to a Repeater Station (or series of Repeater Stations) so that the data will reach the central server. A Repeater Station is used only to support RF/Wireless communication option. It is important to note that an Urban Flood Monitoring Station can also act as a Repeater Station if the situation deems it necessary.

Weather-Proof Monitor – A wide screen monitor which displays warnings and useful information (flood level, alternative routes, etc) for motorists, on-the-road public, or nearby residents and establishments.

On-going Projects

Emergency Distribution of Hydrometeorological Devices in Hard-hit Areas in the Philippines (HYDROMET)

DOST – ASTI

There is a need for strategically distributed hydrometeorological devices in the country to forecast the onslaught of rising waters, along with a reliable network in which data can be transferred and share resulting information. The PAGASA installed automated rain gauges (ARGs) and water level monitoring sensors (WLMSs) throughout the country with assistance from international partners and DOST - ASTI. But since currently deployed devices are not enough to cover the country's entire land area ASTI, in coordination with PAGASA, proposed the emergency distribution of additional ARGs and WLMS near river basins across the Philippines. The devices shall integrate ASTI's data logger to transmit data gathered via GSM/GPRS to the server.

The project has completed the production of 1000 units of ARGs and WLMS devices and released 876 devices to DOST-regional Offices (ROs). Of these, 569 ARGs and 307 WLMS were installed through the DOST-ROs and DOST-ARMM and integrated satellite module and reconfigured 99 out of 100 ARGs. Remaining ARG in Jolo, Sulu are due for upgrade within 2013. Other activities are completion of retrofitting and recommendation of 50 existing flood monitoring devices; IEC campaigns to increase the general public's level of awareness on the HYDROMET Project and the project NOAH; database optimization to accommodate data storage and query; and provision of technical support to other Project NOAH components and 24/7 up -time of visualization tool.

The project is extended for 6 months to accommodate the request of additional flood monitoring devices from LGUs, DOST-ROs and DOST-ARMM. A total of 212 additional devices (177 units of ARG and 35 units of WLMS) are being requested.

Improving Weather Forecasting through Project NOAH

The project aims to use smarter analytics and high performance computing (HPC) to improve the capabilities of FloodNet and Climate X components of Project NOAH. Improvements will focus on providing more timely information and more accurate models for predicting rainfall. Specifically, it seeks to [1] extend the temporal range of NOAH's current weather forecast from 6 hours (now-cast) to 7 days and integrate the extended forecast into the Climate X and project NOAH system, [2] improve the accuracy of weather forecasts by assimilating data from ground measurements, Automatic Weather Stations (AWS), Doppler measurements, and satellite retrievals into numerical weather prediction models, [3] provide forecast accuracy validation protocol for the model outputs, and [4] demonstrate proof-of-concept infrastructure and automation with focus on HPC, visualization, and system and user integration.

Completed Projects

Disaster Risk Management Using Sensor Network & Computing: Early Warning System for Landslide, Slopes & Debris Flow (DRMS) Phase 1

Project 1 - DYNASLOPE – Development of Dynamical Models for Landslide, Slope Failures and Debris Flow

Institute of Civil Engineering, UPD

Approximately one-third of the land area of the Philippines consist of steep mountains and slopes making it prone to landslide that result in significant loss of life and property. While the mechanism underlying landslide is fairly understood, actual prediction or forecasting of landslide has been hindered by the lack of field measurements over large temporal and spatial scales. In order for scientist and engineers to make accurate and timely landslide forecast, critical data must be made available in real time.

This research programs aimed to develop a method for landslide forecasting by extending the observational method widely used in geotechnical engineering. Two key components of this approach are predictive model for calculating observational parameters in the field, and a monitoring system for measuring observational parameters, and iteratively refining predictions made by the model.

Project 2 - SENSLOPE – Development of Dynamical Models for Landslide, Slope Failures and Debris Flow
EEEI – UPD

A team of researchers from the Institute of the Electrical and Electronics Engineering Institute of the University of the Philippines Diliman (EEEI-UPD) is developed a locally-designed sensor to be deployed in unstable slopes to observe tilt and soil moisture at different levels below the ground, which is intended to meet the need for early warning systems crucial for preventing disasters from shallow and deep-seated landslides. The technology will use embedded accelerometers, soil moisture sensors and electronics to make obtain measurements up to 40m below the slope surface, which, when combined with rain gauges mounted above the ground, will provide valuable data that will be synthesized to come up with prediction models and critical thresholds for impending catastrophic slope failure. The end result is to come up with an early warning device and protocols that can be used to protect life and property in landslide-prone areas.

The project team was able to completely upgrade the design of the landslide sensor system. Further, initial tests were conducted and developed calibration procedure for accelerometers and soil moisture sensors. Continuous monitoring and updating of data of the previously deployed system is being undertaken the team.

Environment Sector

On-going Projects

Program for Rehabilitation and Restoration of Mined-Out Areas through Phytotechnologies

UPLB, DLSU, ADMU

The program is one of the initiatives of the DOST to provide support to the Mining Industry. Phytotechnologies refer to use of plants for environmental protection and mine site restoration that can be applied as a plausible solution to various mine-related environmental problems. A very important genetic resource is the group of plants known as 'metallophytes' (plants that naturally thrive on metal enriched landscape). Within the metallophytes is yet another group referred to as 'hyperaccumulators' – those that accumulate heavy metal in their above ground tissues in concentrations that are much higher than what is in the substrates. Because of their unique adaptations to these chemically and ecologically challenging landforms, the identification and technology development of these native plants are the main goals of the program for future ecosystem restoration of mined-out areas.

Project 1 - Conservation of Native Metallophytes, Phytochemistry of Nickel Hyperaccumulators and Phytostabilization to Restore Mined-out Areas in Palawan, Surigao, and Zambales
UPLB

The project has established biodiversity monitoring plots in mining sites in Zambales and Surigao del Norte, recorded the flowering and fruiting of 25 species of native metallophytes, discovered new populations of nickel-hyperaccumulators, and characterized seed of eight species of metallophytes. Furthermore, the team has established nurseries of native metallophytes. From the nurseries, they have produced 760 seedlings and cuttings of native metallophytes. They have planted, tagged and monitored 620 seedlings of these native metallophytes in 5,000 m2 mined-out area in Zambales and 450 seedlings in Surigao. They have also identified four (4) species of mycorrhiza within the root zone of the metallophytes. Lastly, they have developed vegetative propagation protocol of four (4) species of metallophytes

Project 2 - Metal Bio-Indicator Plant Species of the Philippines
DLSU

To complement on-going studies on ultramafic soil environments and hyper accumulator plant species, this study is focusing on selected sites in Benguet, Kalinga, Albay, Cebu, Negros, and Compostela Valley. These sites represent phytogeographic regions in the Philippines.

The project has established partner institutions in six (6) target mining sites and has conducted extensive plant survey and plant collection in each site. The researchers have also identified the collected plant samples. Through chemical analysis of plant and soil samples, morphometric description of some plant samples were generated. The team has drafted and produced training modules and video as a guide reference for vegetation analysis and plant collection techniques. Initial kits for sampling were also donated to partner institutions. A database (BRAHMS) was also installed and the DLSU Herbarium collection were already inputted for all plants surveyed. The National Greening Program (NGP) of the Philippines will also benefit from the findings of this study.

Project 3 - Copper and Arsenic Recovery as Post-Mining Activity Using Indigenous Plant Hyperaccumulators
ADMU

The project has established partnerships in Benguet and small-scale miners in Baguio City and Cagayan de Oro City and have conducted plant survey, plant and soil collection and identification in each site. Protocol development for in situ detection of copper in plants is on-going in the constructed nurseries. They have generated preliminary results of plant and soil Cu/As content.

The project is focused on identifying indigenous plant materials that are capable of hyperaccumulation of Copper (Cu) and Arsenic (As) collected from areas of the small scale miners and mining companies in Benguet and Surigao. In the third phase of the project, the community and the LGU as well as support from the mining sector will be tasked to do mass propagation of the hyperaccumulators in the mining areas.

Use of Microbial Biofilms for the Rehabilitation of Heavy Metal Contaminated Wastewater

Institute of Biological Sciences, UPLB

The project was able fabricate a laboratory scale bioreactor for the treatment of copper-contaminated wastewater and was able to isolate and identify six (6) potential biofilm-forming, heavy metal resistant microorganisms from the wastewater of their partner semiconductor company. Optimization of parameters to run the bioreactor as well as the immobilization of microorganism in the bioreactor is ongoing.

Green Technology and Active Community Engagement (Green ACE) Model Towards Estero de Paco Revival

Adamson University

For continuous support to the advocacy to revive and save Pasig River, the project endeavors to offer opportunities for the sustainable and replicable rehabilitation of wastewater via integrated application of technologies that make use of local biominerals, solar energy, hydraulic and dissolved oxygen modeling, and community-based waste management. The Green-ACE Model utilizes the combined benefits of remediation technology, ecological revival, and community-based wastewater management.

Project 1 - Hydraulic Characterization of Estero de Paco

With a surrounding urban environment, the amount of solid waste dumped including sediments as well as alterations in the channel configuration has significantly altered the hydraulic characteristics (bank-full capacity, peak and duration) of Estero de Paco both for flood discharge and material transport. The impact is further exacerbated by the reduced

carrying capacity of both higher and lower order drains due to encroachment of banks of the rivers, drains, and flood-ways.

The project was able to set up hydraulic model and specific parameters were altered. The model is simulated for a specific year and the results are compared with the actual observed hydraulic parameters like water levels and velocities. The same set up is simulated for another year and similar comparison is done. Using calibrated and validated hydraulic model of Estero de Paco, the model is run for different design storm events in addition to the standard normal scenario. The model is ready to run different management alternatives. Results of the simulation that will be analyzed will be presented to PRRC as the adoptor of the technology. A good scientific understanding of the hydrologic and hydraulic response of Estero de Paco will serve as decision support in the selection of effective water quantity and quality management strategies.

Project 2 - Dissolved Oxygen (DO) Modeling of Estero de Paco
UPD

The project conducted household surveys of pollution loading to assess the estimate wastewater loadings along each reach that affects the condition of the estero. Currently, ongoing water and sediment sampling variable points in the wet season are conducted for analysis. The Dissolved Oxygen Sag curve for an initial identified reach has been prepared. Based on the DO behavior along the length of the river, the Estero de Paco can be divided into three (3) main reaches along the length. Using the Qual2k software, model has been established and data on possible remediation techniques will be generated. Initial calculation using the model has been started and Qual2k model will be prepared to compare with the Streeter-Phelps model to see the effect of pollution loadings in the estero.

Project 3 - In situ Remediation of Estero de Paco by Local Biominerals
Adamson University

Six (6) sampling sites for the characterization of the estero water before remediation were established. Batches of samples from the sampling points were collected to determine the water quality before remediation. Results showed that all parameters tested such as pH, TSS, DO,BOD and COD are very high which fails the estero for class C standards. Among the 6 sampling sites, the remediation cells were installed in site 3 having the highest pollution loading and is the widest area (9.7 m) among the 6 sampling sites, the chamber was installed at site 3 between paco market and UN bridge. The installation was supported by ABS CBN KBPIP as one of the cooperating agencies. Initial remediation was conducted on the estero water which was placed inside the chambers during installation. Remediation will be done in the chamber and quality of water in and outside the chambers will be determined.

Production of Dome Type Ceramic Water Filter

DOST - ITDI

Access to clean and safe water remains a challenge to many communities in depressed and far flung areas. The project aims to produce dome type ceramic water filter, and conduct field performance testing in Vigan, Ilocos Sur. The expected output includes [1] pilot plant production setup and molds available for use, [2] optimized production process and developed protocol, [3] performance properties of the ceramic water filter, [4] water filtration units available for field testing, and [5] results of field performance testing acceptable/passed the Philippine National Standards for Drinking Water.

Setting up of Sewage Treatment Plant (STP) in the DOST Bicutan Compound Project 1

DOST - ITDI

The project aims to design, construct, and evaluate the efficiency of biological treatment technologies such as rotating biological contactor (RBC) and sequencing batch reactor (SBR) in removing nitrogen and phosphorous of sewage effluents from septic tanks of DOST buildings in compliance to RA 9275 and serve as demonstration facility. Specifically, it seeks to [1] characterize sewage/wastewater, [b] develop conceptual and detailed designs of SBR and RBC based on volume and characterization of wastewater from various DOST buildings within the DOST Complex, [3] construct /set-up/fabricate for four identified locations of STP within the DOST compound, [4] evaluate/compare the performance of constructed STPs to determine their treatment efficiency in removing nitrogen and phosphorous and optimize operating parameters.

Completed Project

Establishment of Baseline Sedimentation Rates During Extreme Rainfall Events: Pasig River Basin

NIGS - UPD

The project established scientific and technical basis as monitoring tool for development and maintenance activities in the Pasig river basin, and came up with policy recommendations as basis for evaluation of related projects.

The project specifically [1] checked the claimed extent of dredging by using cores from different portions of Pasig River where dredging was done, [2] estimated sedimentation rates after the dredging activities especially in view of unusually large discharges due

to Habagat flooding, [3] determined the chemical and structural characteristics of recent flooding events and compare these with older sediments, and [4] determined the effectivity of dredging operations in view of large rainfall events such as Habagat or Ondoy flooding scale.

Information and Communication Technology Sector

On-going Project

NOAH Weather Information-integration for System Enhancement (WISE)

IBM Philippines, DOST – ASTI, DOST – PAGASA, Environment Science - UPD

The project aims to improve weather forecasting in the Philippines by using numerical weather prediction models, and high performance computing and analytics. Improvement on weather forecast accuracy can be done by integrating real-time data from various sensors including automated weather stations, Doppler radar and satellite data; increase in area forecast resolution from 12 km (low resolution) to 3 km (high resolution) to be able to have weather forecasts down to municipal level; enlarge coverage beyond Philippine Area of Responsibility (PAR); fast-track computing time enabled by IBM Blue Gene/P Super Computer; perform data assimilation and accuracy assessment of outputs of the Weather Research and Forecasting (WRF) model; and identify trends and patterns in observed weather data that can be used to fine tune weather models.

This two-year project can simulate 7-day forecast at 12 km resolution covering PAR. Simulation is done using different configurations of WRF model for different weather parameters such as accumulated rainfall, temperature, wind speed and direction, and surface pressure updated every 6 hours. The public can access this weather information in the NOAH website (www.noah.dost.gov.ph) in Four-Day Weather Forecast. Rainfall forecast accuracy ranges from 70 to 73% and will continue to improve as data assimilation improves. Data assimilation is currently done for quality assessment of surface data from Automated Weather Station (AWS), Automatic Rain Gauge (ARG), and satellite data from MODIS such as brightness temperature and true-color images.

The project is expected to meet its goal and deliver the required output when Blue Gene/P Super Computer becomes operational in February 2014.

Human Resource and Institution Development

The development of S&T human resource is a major commitment of PCIEERD to the national development agenda. The country's competitiveness and economic sustainability also hinge on a strong, reliable, and creative human capital.

In this light, PCIEERD strives to optimize its resources to open up opportunities for individuals and institutions whose knowledge and capability development direction complements its HRID mandate and objectives.

In 2013, PCIEERD managed and carried out the following:

I. HUMAN RESOURCES DEVELOPMENT PROGRAM

A. Support for the Scholarship and Fellowship Programs

a. Scholarship Program Implementation

Status	PCIEERD	ASTHRDP
New MS		5
PhD		
Ongoing MS	1	2
PhD		1
Total	1	8

One (1) employee-scholar is currently supported under PCIEERD's Staff Development Program.

Graduates

Shown below is the total number of scholar-graduates as of end of first semester SY 2013-2014:

	Graduated Scholars 1st sem 2013-2014	Total number of graduates (Cumulative)
ASTHRDP		
MS	28	190
PhD	2	15
Total	30	205
PCIEERD		
MS	5	355
PhD	3	123
Total	8	478

b. Fellowships in Advanced S&T (FAST) and Overseas Research Enrichment/Sandwich and Post-Doctoral programs

Program	Program	Scholar	Research work	University/ Host Institution	Status
PCIEERD FAST	PhD	Rosalie Reyes, PhD in Remote Sensing and Geographic Information Systems	Defining the Height System and Vertical Datum in Metro Manila based on an Equipotential Surface	Asian Institute of Technology, Thailand	Extended until December 2013
	PhD	Joel Sadol, PhD in Remote Sensing and Geographic Information Systems		Asian Institute of Technology, Thailand	Ongoing
	Sandwich program	Mark Anthony Badua	Kinetics of Growth and Ethanol Production on Xylose with Hybrid *Saccharomyces cerevisiae* Developed using Genome Shuffling Technology	Osaka University, Japan	New

B. Support for Conduct of Seminars/Conferences/Trainings/Workshops

Requests evaluated/processed	20 processed
Requests approved	
Conferences, Seminars, Workshops	13
Group Trainings	3

C. Faculty Immersion

Ongoing

1. Hamdi Muhyuddin Barra
   Mindanao State University – Marawi City

   Host institution: UP Diliman - National Institute of Physics
   Host researcher: Dr. Henry Ramos
   Duration: December 2012 to May 2013. Extended until July 2013
   Project Title: "Physical Vapor Deposition of MAX Phase Thin-Films using the Magnetized Sheet Plasma Negative Ion Source for Advanced Decorative and Functional Applications."
   Amount of grant: ₱148,100.

2. Marlo Lampitoc
   Darrel Pasalo
   Meynard Nicolas
   Mariano Marcos State University

   Host institution: UP Diliman – Electrical and Electronics Engineering Institute
   Host researcher: Dr. John Richard Hizon
   Duration: May 14 to July 14, 2013
   Project Title: "Development of FPGA Laboratory Experiments"
   Amount of grant: P224,600

3. Giovanni Malapit
   UP Baguio

   Host institution: UP Diliman – National Institute of Physics
   Host researcher: Dr. Henry Ramos
   Duration: September 15, 2013 – March 15, 2014
   Project title: Metal Ion Implantation for Antibacterial Applications
   Amount of grant: P330,825.54

D. Visiting Professorship

Visiting Professor: Dr. Masahiko Nagai
Host institution: Central Bicol State University of Agriculture
Date of visit: June 22, 2013
Activity: Conducted a seminar on "The Role of Remote Sensing Technology in Agricultural Productivity and Disaster Risk Management."

II. DOST-BCDA PROJECT: "Bridging the Human Resource Gaps in Support of the National R&D Agenda."

This project, funded under Republic Act No. 7917, "An Act Amending Section 8 of R.A. 7227, otherwise known as the Bases Conversion and Development Act of 1992 ," aims to:

- generate human resource essential for successful implementation of the National R&D Agenda through individual short-term trainings overseas, research attachments, and post-doctoral fellowships
- raise the DOST RDIs' capabilities through benchmarking activities
- provide training to Grade I public school teachers on the use of existing digital mathematics courseware

III. DOST Balik-Scientist Program

The BSP encourages foreign-based Filipino scientists, engineers, and technology entrepreneurs of Filipino descent to return and work, and actively participate in the government's efforts to step up the development of Science and Technology in the country, and consequently its socio-economic progress. The program strives to bolster the scientific and technological human resources of the academe, and public and private institutions.

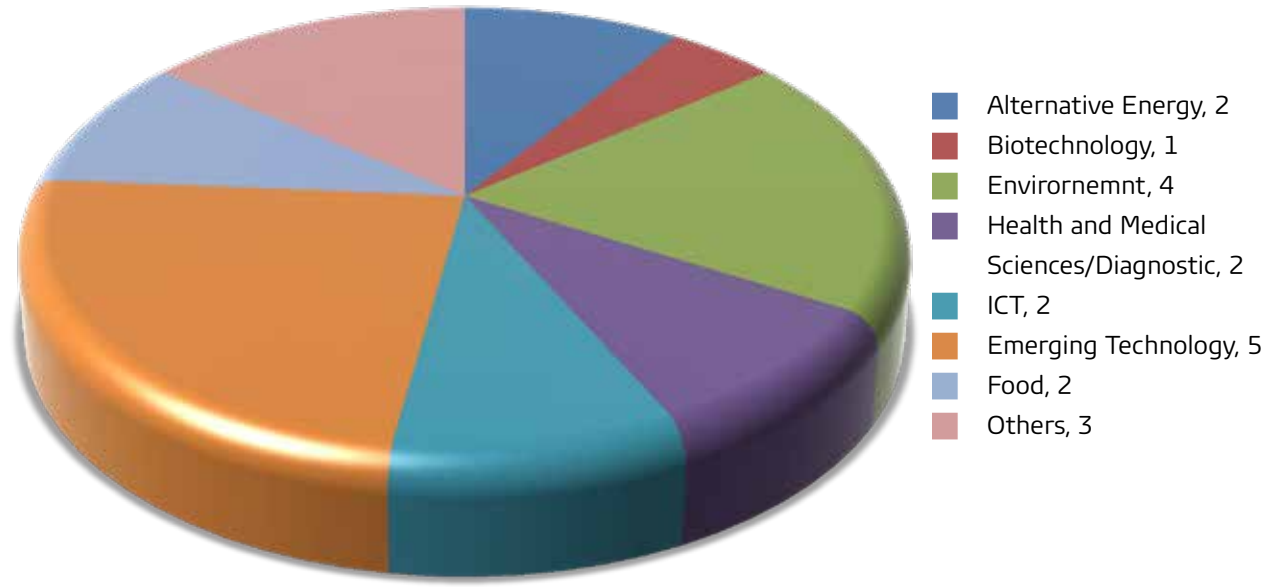
Effective April 2013, the implementation of DOST BSP is handled by the DOST Sectoral Councils. PCIEERD is responsible for the industry, energy, and emerging technology fields.

BALIK SCIENTIST PROGRAM
2013 GRANTEES

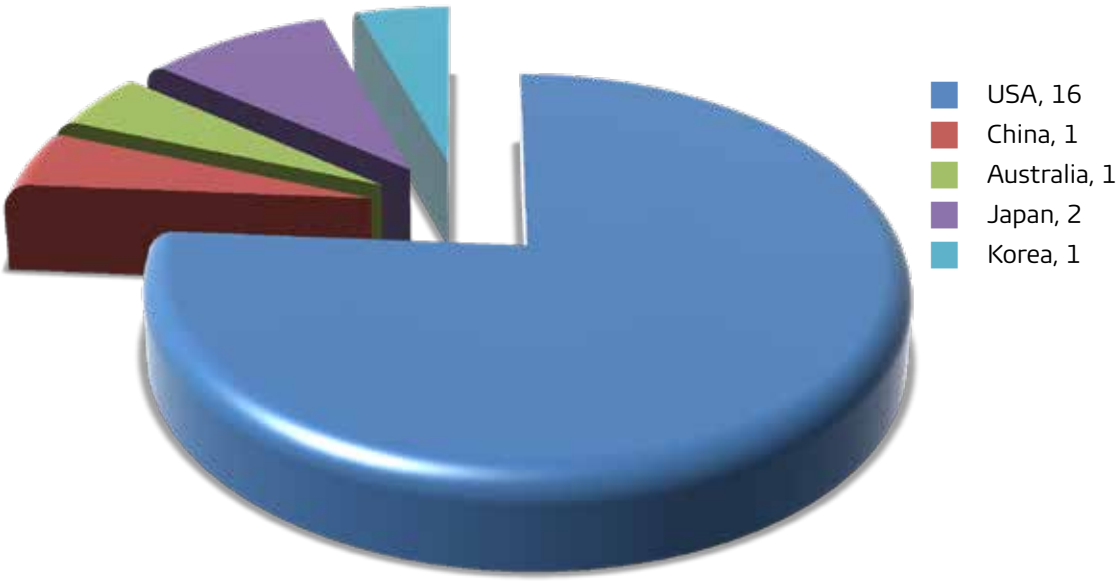
Expertise	No. of grantees	Name of grantees	Base station abroad	Host university/institution in the Philippines
Alternative Energy	2	1. Fiorello Abenes	Retired - USA	Mariano Marcos State University, Central Luzon State University and PhilRice
		2. Melanie David	Osaka University, Japan	De La Salle University (DLSU)
Biotechnology	1	1. Annabelle Villalobos	Retired - USA	Central Mindanao University and University of the Philippines (UP) - Manila
Environment a. Climate Change/ Disaster Mitigation	4	1. Mylene Cayetano	Advanced Environmental Monitoring Research Center, Korea	Clean Air Inititative Asia
		2. Leorey Marquez	Computational Informatics, Australia	UP Dliman (Department of Mining, Mettalurgical and Materials Engineering)
		3. Doris Montecastro	Ashworth Leininger Group, California, USA	Ateneo De Manila University (ADMU)
		4. Ariel Pinto	Old Dominion University, Virginia, USA	UP Diliman
Health and Medical Sciences/ Diagnostics	2	1. Marites Melancon	MD Anderson Cancer Center, Texas, USA	ADMU
		2. Roanna Padre	3R Biosystems, California, USA	UP Manila
ICT	2	1. Francis Molina	National Science Digital Library Colorado, USA	UP Diliman - NISMED
		2. Felixberto Buot	George Mason University, Virginia, USA	University of San Carlos (USC)

Emerging Technology a. Microscopy	5	1. Imee Martinez	University of Houston, Texas, USA	UPD-Institute of Chemistry
		2.Elmer Estacio	Japan Society for the Promotion of Science, Japan	UPD-National Institute of Physics
b. Polymers		3. Gonzalo Serafica	Xylos Corporations, Pennsylvania, USA	UPD (DMMME and ChE), DOST- ITDI and PNRI, MSU-IIT
		4. Ariel Melendres	Shanghai DSG Mega Thin, Co. Ltd., China	UPLB and DLSU
c. Nanotechnology/ Biosensors		5. Zoraida Aguilar	Ocean Nanotech, Arkansas, USA	UP Diliman
Food a. Equipment Fabrication b. Biosensors	2	1. Manuel Hernandez	University of Florida, USA	DOST-MIRDC
		2. Evangelyn Alocilja	Michigan State University, USA	UPLB-BIOTECH
Others: a. Science education b. Intellectual property	3	1. Corazon Salumbides	Retired - USA	Philippine Foundation of S&T
		2. Zenaida Magbanua	Mississippi State University, Mississippi, USA	Intellectual Property Office-Philippines
		3. Lawrence Ilag	Finnegan, Henderson, Farabow, Garrett & Dunner, LLP, Washington D.C., USA	UP-Philippine Genome Center
Total	**21**			

Distribution of Balik Scientist by Field of Expertise



Distribution of Balik Scientist by Country of Origin

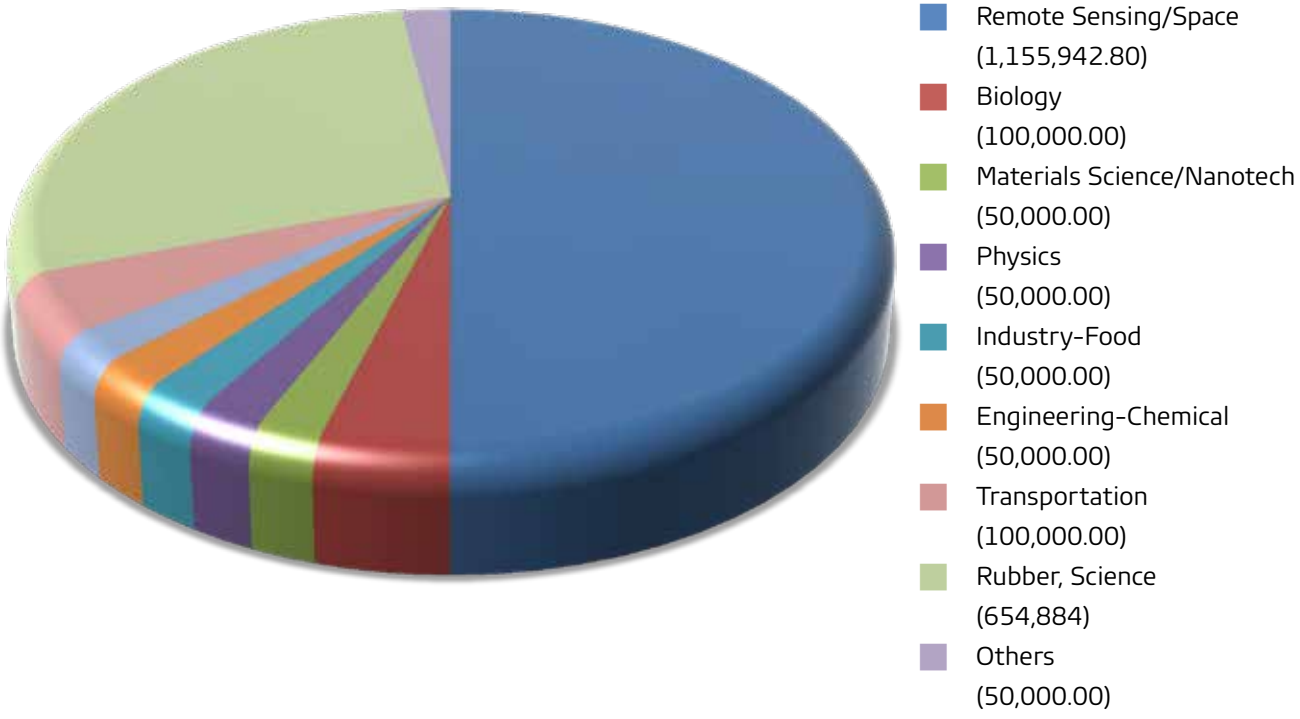


PCIEERD
CONDUCT OF SEMINARS/CONFERENCES/TRAININGS, ETC
REQUESTS APPROVED FOR 2013

Area		Title	Institution	Date	Amount approved	Total per area	Items approved	Venue	Date approved
REMOTE SENSING	1	3rd National Remote Sensing Conference	Phil RS Society	May 30-31	50,000.00	160,000.00	honoraria, accommodation, supplies & materials, printing of book of abstracts, printing of promotional materials	UP Diliman	2/13/2013
	2	Capacity Building in Basic Space Technology Development - Implementation of a CanSat Design as a Demonstration of the Overall Satellite Development Process	UPD - GE Department	Feb-March	110,000.00		Supplies and materials	UP Diliman	1/24/2013
BIOLOGY	3	42nd Annual Convention of the Philippine Society for Microbiology (PSM)	PSM	April 18-19	50,000.00	100,000.00	Printing of souvenir	Summit Hotel, Tagaytay City	3/11/2013
	4	Symposium on the Status Review of Microbiology Research in the Philippines	PAM-PSM	April 17	50,000.00		Printing of proceedings		2/8/2013
ENVIRONMENT	5	2013 International Conference on Sustainable Environmental Technologies	Mapua Institute of Technology	Sept 30-Oct 1, 2013	50,000.00	50,000.00	Partial printing expenses	Crowne Regency, Ortigas	6/26/2013
MATERIAL SCIENCE	6	MACROMANILA 2013: Frontiers in Polymer Technologies	UPD-IC	May 23-24 5-Jul	50,000.00	100,000.00	Partial printing expenses (reimbursement)	UPD-IC	6/21/2013
	7	6th International Conference on Humanoid, Nanotechnology, IT, Communication and Control, Environment and Management (HNICEM)	DLSU	Nov 12-14	50,000.00		Partial printing expenses	DLSU	11/6/2013
PHYSICS	8	31st Samahang Pisika ng Pilipinas Physics Congress	SPP	Oct 23-25	50,000.00	50,000.00	Partial printing of proceedings	USC	7/11/2013
INDUSTRY - Food	9	National Makapuno Summit	DOST IV-A	Oct 3-4	50,000.00	50,000.00	Partial: transportation, supplies, printing of proceedings/promotional materials	Southern Luzon State University, Lucban, Quezon	9/24/2013
ENGINEERING (Chemical)	10	20th Regional Symposium on Chemical Engineering (RSCE)	DLSU	Nov 12-13	50,000.00	50,000.00	Partial printing of proceedings	Alona Kew Resort, Boholo	10/21/2013
TRANSPORATION	11	Asia Pacific Drive Tourism Conference and Exhibition	AAP	Jan 30 - Feb 2, 2014	50,000.00	100,000.00	Printing of souvenir program	Subic Bay Exhibition Center, Subic, Olongapo	11/21/2013
	12	Inauguration of the Subic Children's Road Safety Park	AAP	Jan 30, 2014	50,000.00		Printing of promotional and training materials	Subic Bay Freeport Zone	11/27/203
OTHERS	13	1st International Symposium on Emerging Technologies and 1st AASSA Executive Board Mtg	NAST	Oct 22-24, 5-Jul	50,000.00	50,000.00	Partial printing expenses	Manila Hotel	6/27/2013
		TOTAL (Support for conduct of seminars/conferences/workshops)				**710,000**			
GROUP TRAININGS									
Rubber	1	Characterization, Processes and Design of Rubber Materials – Basics to Advanced Knowledge in Rubber Science and Technology: A Short-Course	UPD - COE	Nov 11-15	654,884.00	**654,884**			10/11/2013
Space Technology	2	Trainor's Training on Imaging SAR Data, Processing and Applications: A Short Course	UPD-GE	Nov 25 - Dec 6	995,942.80	**995,943**			10/11/2013
Nanotech	3	Third Bioanalytical Nanotechnology School	UST	Jan 29-Feb 1	250,000.00 496,000.00 (total grant)	**250,000**	partial release - total grant is 496,000		
						1,900,826.80			
				GRAND TOTAL		**2,610,827**			

PCIEERD
CONDUCT OF SEMINARS/CONFERENCES/TRAININGS, ETC
2013 GRANTS

Remote Sensing/Space Tech	1,155,942.80
Biology	100,000.00
Environment	50,000.00
Materials Science/Nanotech	350,000.00
Physics	50,000.00
Industry-Food	50,000.00
Engineering - Chemical	50,000.00
Transportation	100,000.00
Rubber science	654,884
Others	50,000.00
	2,610,826.80

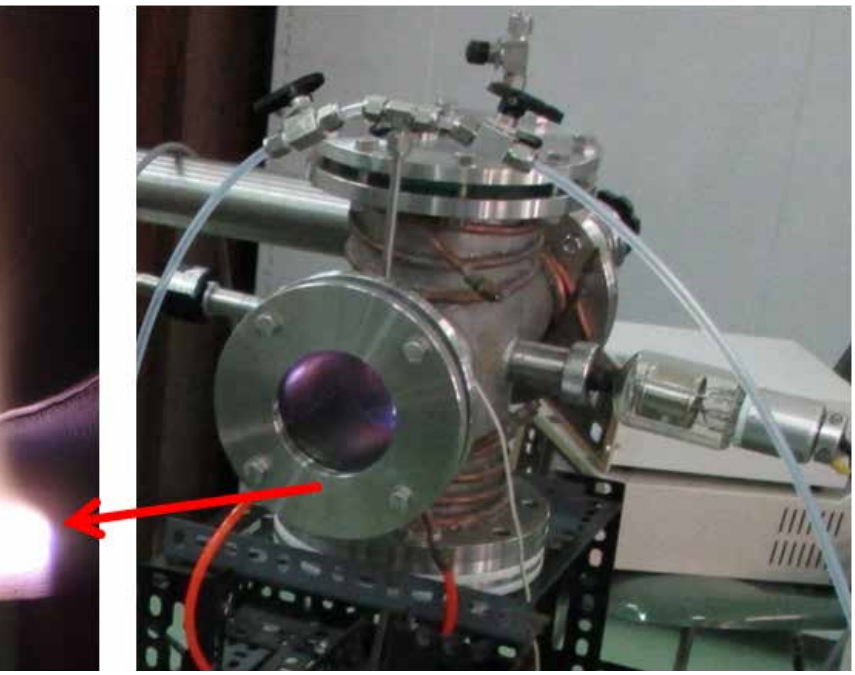


Human Resource Development Projects

Joint Research Program: Dual Planar Magnetron (DPM) for Ti02 base photocatalytic wastewater treatment system

A planar magnetron is a coating device that normally consists of a cylindrical chamber whereby an atom or ion with high kinetic energy is used to dislodge atoms from the surface of the source material to coat a thin film on the surface of a target material. The process, called reactive magnetic sputtering occurs in a low-pressure inert gas or a vacuum chamber. In the DPM, there will be two (2) targets facing each other in a minor configuration with two (2) reactive planar magnetrons.

For this project, titanium dioxide (Ti02) or titania will be used as coating material. Titania is a widely studied material in terms of its chemical and optical properties. It is a component of many commercial products such as paints, toothpaste, makeup pigments and thickeners. Also, the anti-UV capability of sunscreens is attributed to the material. The applications of titania depend on its crystal structure. Anatase with gas sensitive devices. Rutile with its body-centered tetragonal structure has a high resistivity and dielectric constant and finds use in capacitors. In depth analysis of glass and paper, also show that they contain Ti02.



The primary gains expected from this project include the training of graduate students with capabilities in the fabrication of a dual planar magnetron, and in the synthesis and characterization of useful thin films like Ti02.

DOST Online Practice Test for PSHS and DOST-SEI Examinations

The Philippine Science High School (PSHS) system and DOST Science Education Institute (SEI) undergraduate scholarships provide scholarship benefits to successful examinees with strong encouragement to follow Science and Technology track. These scholarships are very competitive. In some cases, external parties offer review classes particularly for the PSHS National Competitive Examination. Some schools also offer review classes to increase their students' passing rate. These review classes provide advantages to examinees in terms of familiarization with the examination itself (types of questions, examination format, time restrictions, topics covered, etc.).
To expand accessibility to these examinations, this project proposes to provide free internet-based reviewers (practice tests) for aspiring examinees and gives opportunity to students unable to enroll in private review centers. It is expected to develop internet-based program for authoring and delivery of PSHS and DOST-SEI practice examinations including executables and source code, and create corresponding documentation to enable program maintenance.

Coils, Cells and Gels

Project 1. Coils in Gels: Developing capability to investigate gel composite viscoelasticity.

Project 2. Flow to Gel: Developing capability to implement optical tweezers with microfluidics for homogenized gelling

Project 3. Cells as Gels: Developing capability for high throughput cell elasticity sorting

The Philippines has rich sources of biomaterials that can be extracted from a vast number of species with great potential to discover bio-active compounds for drug development. Biomaterials can also have immediate use in development of additives or supplements for various applications (including development of scaffolds for artificial tissue implants). Such applications require biocompatibility and characterization of mechanical properties of

biomaterials, considering that cell function is affected by the mechanics of cell's immediate environment. The result of this study will enable the development of a viscoelastically tunable biomaterial using alginate-DNA composites as a model. This has potential applications for drug encapsulation or as artificial tissue scaffolds. This result anticipates extension to other composites based on locally derived biomaterials, where biopolymer inserts of known properties are used for viscoelastic fine-tuning.

The project aims to develop human resource with capabilities in developing instrumentation for investigating microrheology of biopolymers and networks, and in designing microfluidics chambers for mixing multi-component gels and fast elasticity characterization of living cells through hands-on experiments in research projects, which require collaborative effort across disciplines at the University of San Carlos.

Human Resource Development for Nanoscale Metrology, Tribology, and Instrumentation Control (Human resource Development for Magnetic Storage Recording Head Technology)

Semiconductor and electronics companies have rising need for human resource proficient in nano-scale metrology. In the Philippines, companies such as Western Digital/Hitachi Global Storage Technology Philippines, Maxim IC, and SunPower recently announced opportunities for engineers who can figure out electronic circuits at die-level, do wafer level analysis, and nanometer distance of read heads and disk media. The skills to be developed in the course of this project will include nanometer-scale metrology using atomic force microscopy and Wyko interferometry, instrumentation control system using NI development system, and tribology using scanning thermal microscopy, scanning tunneling microscope, and Raman spectroscopy. This skills set covers the diverse needs of the whole semiconductor and electronics industry in the country.

Following this initiative, 15 MS Physics/MSE graduates with the preceding identified skills are expected each year.

Establishment and Operation of the Philippine Institute for Integrated Circuits

The main objective of the proposed PIIC is to enhance the performance and economic contribution of microelectronics industry in the Philippines. This is envisioned through improved microelectronics education, development of proficient R&D personnel, and IC design training. PIIC can also stimulate R&D activities in microelectronics through technology incubation and more academe-industry collaborations. Specifically, the proposed PIIC will strengthen the fundamentals of microelectronics in academe by improving faculty capability in universities and hosting of student-interns to work on specific IC design activities, encourage academe-industry linkage through graduate level R&D activities, retool engineers who want to pursue a career in microelectronics through certification based training courses, including industry defined basic courses that will allow engineers to apply directly in IC design companies, develop a training curriculum to address short-term and long-term industry needs in close coordination with academe, enable Filipino-owned companies to develop home-grown intellectual property (IP) by providing a venue for real-world technology and applications.

PIIC is projected to provide training for 42 faculty members immersed with industry partners and 25 faculty members immersed with university partners, and to develop 100 short courses, and 3,000 students after three years of operation.

Human Resource Intervention for Sustainable Growth, Productivity and Competitiveness of the M&E Sector: Dev't & Implementation of Appropriate Training Curriculum Design for CNC Machine Tool Programming and Operations"

To address "brain drain" of skilled CNC machinists and programmers in the country, this project will develop an effective CNC training program and enable the M&E sector to attain a level of competence that is critical to improving its productivity and competitiveness. It will involve drafting of a training curriculum design, implementation of the developed training program and review/ assessment/ improvement of the

curriculum with the inputs from the industry and other stakeholders. Qualified trainees are provided support for 62-day training after a rigid selection process. The trainings are undertaken in MIRDC and other partner support organizations (TESDA, industry) that could provide CNC facilities and enhancement of MIRDC capability to undertake training activities in CNC programming and operations.

At the end of the project implementation, a total of 800 trainees are expected to graduate as CNC operators/ programmers.

Y Chromosomal DNA Variation of Filipino Population using Rapidly Mutating (RM) V-Chromosomes Specific Short Tandem Repeat (STR) Markers

Thirteen (13) rapidly mutating (RM) Y-STR markers of one regional (NCR) population will be analyzed in this project. To make this happen, validation procedures for analyzing 13 RM Y-STR markers as part of global multi-center study to characterize the distribution and types of alleles for each marker in different populations, generation of RM Y-STR database, characterization of genetic variation between the Filipino population and other population based on RM Y-STR data, and assessing the ability of 13 RM Y-STRs to differentiate closely related males shall be conducted.

The project will evaluate the use of RM Y-STRs in differentiating related males in regional populations. An RM Y-STR database of the National Capital Region, a microcosm of the Philippine population, will be constructed. The Philippine data shall be compared to those generated in a worldwide multi-center study on RM Y-STRs, which aims to produce a global frequency data by many participating laboratories for forensic applications. The result of these efforts is the ability to successfully resolve a wider spectrum of forensic cases through combined use of conserved and rapidly mutating Y-STR DNA markers.

The project is expected to produce a reference of the Philippine frequency database of RM Y-STRs that will be used to complement existing database of more conserved STRs markers and a research paper describing extent of genetic variation and relationship among regional population, which serve as a microcosm of the entire Philippine population, using RM Y-STR markers.

Institution Development

Developing PNRI capability for electron beam technology applications

The project aims to establish an electron beam (EB) facility for R&D on different applications of EB technology. Specifically, it will seek to [1] coordinate with IAEA in the acquisition of EB accelerator (cost-sharing scheme), [2] construct shielding for the EB accelerator and install new electrical service entrance for power supply, [3] install and commission the electron beam accelerator, and [4] pursue foreign training of operators and users of EB accelerator.

In many applications, EB processing creates useful changes in material properties and performances. In polymers and plastics, EB crosslinking improves properties including tensile strength, durability, and chemical resistance. Other EB improved products include wire insulation resistant to heat and chemicals; heat shrinkable tubing and sheets for food packaging; products with insulation and protection against corrosion; weather resistant crosslinked rubber sheets; super heat resistant SiC fibre, and; vulcanized rubber. They are also used in auto industry to improve temperature and abrasion resistance in wire and cable sheathing, produce heat shrinkable connectors and films, and modify melt flow properties of bulk polymers. The use of EB in these industrial products can be localized.

Upgrading the National Personnel Monitoring Services thru the Establishment of Optically Stimulated Luminiscence (OSL) Dosimetry System

There is an urgent need to look for another dosimeter system to replace the film badge personnel monitoring services in order to continue the provision of sustainable and reliable personnel monitoring for the safety of the workers.

In this project, Optically Stimulated Luminescence (OSL) Dosimeter for personnel monitoring of authorized users of ionizing radiation is proposed to replace the film badge system. A web-based information system for personnel monitoring services will be developed.

S&T Information Dissemination and Promotion

Communication permeates effective organizations. Access to reliable information expands awareness, builds trust, and promotes informed decision. As a public funded R&D organization, PCIEERD strives to bring its many lab-to-market programs and activities to key stakeholders and the general public through multiple communication platforms. These include broadcast, print, online, domestic S&T shows, in-house publications, printed materials and activity-oriented information formats.

In 2013, it held press conferences [3], interviews on radio [10] and TV [2], produced press releases, participated in national and regional S&T fairs, and published information materials, among others. It has received print and online media coverage following press conferences and anniversary celebration that highlight specific achievements.

The OED-IG essentially pulls together streams of information from PCIEERD's executive offices, different functional divisions, and inter-agency and industry partnerships in a continuing effort to deliver evenhanded public interest perspective.

I. Media Relations

Press Conferences

- Technical Forum, PCIEERD 3rd Anniversary, June 24, 2013
- The LEAP Project, July 25, 2013
- PCIEERD Call for Proposals, November 13, 2013
- Walk-through the NOAH Website, December 17, 2013

Radio Interviews

- DZEM 954 kHz INC Radio,
  June 7, 2013, 3:30 PM
  Program Lingap sa Mamamayan
  Host Rex Salvador
  Resource Person Dr. RCL Guevara

- DZRB 738 kHz,
  June 16, 2013, 11:30 AM
  Program Journey to Discovery
  Host Mely Tenorio
  Resource Person Dr. Rowena Cristina L. Guevara, Topic LEAP

- DZEC 1062 kHz,
  June 29, 2013, 7:30 AM
  Program Pambansang Almusal Weekends
  Hosts Erwin Temperante and Sofia Okut
  Resource Person Dr. Rowena Cristina L. Guevara, Topic PSHS Online Reviewer

- DZRB 738 kHz,
  June 29, 2013, 11:30 AM
  Program Journey to Discovery
  Host Mely Tenorio
  Resource Person Ryan CP Viado
  Topic PCIEERD Program on Climate Change

- DZRH 666 kHz,
  June 29, 2013, 4:00 PM
  Program Radyo Henyo
  Hosts Angelo Palmones and Ruby Cristobal
  Resource Person Dr. Rowena Cristina L. Guevara, Topic PSHS Scholarship Online Reviewer

- DZRB 738 kHz,
  September 8, 2013
  Program Journey to Discovery,
  Host Mely Tenorio
  Resource Person Ma. Elena A. Talingdan,
  Topic SEI Online Reviewer

- DZRB 738 kHz,
  November 10, 2013
  Program Journey to Discovery
  Host Mely Tenorio
  Resource Person Albert G. Mariño,
  Topic PCIEERD Call for Proposals

- DZRB 738 kHz,
  November 12, 2013,
  9:00 pm Program Pambansang Paaralan sa Himpapawid Host Mely Tenorio Resource Person Dr. Rowena Cristina L. Guevara,
  Topic CFP, NBW, PCIEERD Competitions

- DZEC 1062 kHz,
  November 16, 2013, 6:30 AM Program Pambansang Almusal Weekends
  Hosts Annabelle Surara and Sofia Okut
  Resource Person Dr. Rowena Cristina L. Guevara, Topic NBW, Nowcasting

- DZRH 666 kHz,
  November 17, 2013, 4:00 PM
  Program Radyo Henyo
  Host Ruby Cristobal
  Resource Person Dr. Rowena Cristina L. Guevara, Topic NBW

(Note: Interviews aired live and after press conferences are not listed)

TV Interviews

- Studio 23,
  July 25, 2013, 1:00 PM
  [telecast August 3, 9:00 AM]
  Program Thumbs Up
  Host Lorraine
  Topic LEAP Project

- ANC,
  August 7, 2013, 7:00 PM
  Program Future Perfect
  Host Anthony Velasquez
  Topic LEAP Project

- Net 25,
  November 28, 2013, 7:00am
  Program Pambansang Almusal
  Topic PCIEERD Projects

II. Publications

- PCIEERD 2012 Annual Report
  Went off the press May 15, 2013 in time for DBM requirement, and PCIEERD 3rd Anniversary

- PCIEERD 2013 Annual Report

- PCIEERD Pinoy Innovations (Quarterly Newsletter)

- Nanotechnology: Prospects and Priorities--a PCIEERD-sponsored publication that features articles on the fundamentals of nanotechnology and its impact on global economy, along with the Philippine Nanotechnology Roadmap

- Posters & Brochures for:
  - ❖ Call for Proposals
  - ❖ Electronics Design Competition
  - ❖ Nowcasting Competition
  - ❖ LEAP brochure
  - ❖ DOST Tablet brochure
  - ❖ PIIC and EPDC [content and design of poster and flyer]
  - ❖ PCIEERD Ad for the MAPUA Celebration
  - ❖ Design and layout of launching and press conference programs
  - ❖ Design and layout of GAD flyer
  - ❖ 2013 PCIEERD Calendar

III. National S&T Week Exhibits, SMX Convention Center July 22-26, 2013

PCIEERD projects went on exhibits in various clusters:

- ❖ Climate Change Adaptation and Disaster Risk Reduction [5 booths]
  - DREAM-LiDAR, NOAH, DRMS, Hydromet, KAMANAVA
- ❖ Industry
  - State-of-the-art Facility
    - ADMATEL
    - LEAP
  - Cutting Edge Technology
    - Nanotechnology
    - Genomics
  - Maharlikang Sasakyan na Gawang Pinoy: Datu Hybrid Car
  - Education
    - VISSER
    - DOST Tablet
    - LEAP

IV. Regional Science and Technology Fairs

- Souther Luzon Cluster (Tagaytay City), Aug 22 – 24, 2013
- Northern Luzon Cluster (La Trinidad), Benguet, Sept 30 – Oct 5, 2013
- Visayasa Cluster (Iloilo City), Oct 16 – 18, 2013
- Mindanao Cluster (Butuan City), Nov 6 – 10, 2013

V. Biotechnology Exhibits and Seminar

Conducted on January 21, 2013 at the House of Representatives conducted alongside the Department of Agriculture, AGHAM Party-list, Butil Party-list, International Service for the Acquisition of Agri-biotech Applications, National Academy of Science and Technology, the Philippine Science Journalists Association, Inc., Program for Biosafety Systems Philippines, and UPLB

VI. Evaluation of Customer Feedback for:

- 3rd PCIEERD Anniversary on June 28,2013
- 2013 NSTW
- KABISIG Expo
- Regional S&T Fairs (Tagaytay, Benguet, Iloilo, Butuan City)
- New Era University S&T Fair, Sept 4-7, 2013

VII. Speechwriting

- Speeches and messages for DOST/PCIEERD officials

VIII. Institutional

- Corporate Branding
- Corporate Identity Manual [first draft]
- Corporate Envelope
- PowerPoint Template

- In-House PCIEERD Christmas Card

Information Dissemination and Promotion Projects

New Projects

OYSI Training Workshops for Writing Proposals and Logical Frameworks Towards Developing Science Culture in the Regions

The Outstanding Young Scientists Inc. (OYSI) is a collegial body of scientists committed to excellence and innovation in research and development. It is composed of recipients of NAST's annual Outstanding Young Scientist Award.

OYSI has recently focused on activities or topics concerning S&T-related issues such as climate change mitigation, air pollution, wastewater treatment, and agricultural biotechnology, among others.

Through this activity, OYSI aims to provide forums for the exchange of scientific ideas and forging of research collaboration among researches from the regions and OYSI members through training workshops on writing research proposals, logical frameworks, and scientific articles addressing national and regional R&D concerns and priorities involving different disciplines, enhance research activities of researchers in the regions to address local concerns, current scientific and technical issues and challenges, and promote awareness and appreciation of science towards developing a science culture, and provide opportunities for initiating research networking and mentoring of researchers from the regions by OYSI members through writing of research proposals, and scientific articles for publication.

Capability building and sustainable biotechnology Information, Education, and Communication (IEC) for DOST and LGU key personnel

The project will develop a sustainable biotechnology IEC program among key DOST officials and personnel, and local government units through capability building and engagement of qualified personnel in the different regions. The mechanisms to implement the project include communication campaign planning to be joined by key stakeholders to identify communication strategies for specific audience, development of a lecturers' network for biotechnology communication activities, development and production of IEC materials appropriate for specific audience, biotech IEC activities for key LGUs and DOST regional offices personnel, and biotech advocacy through mass media such as TV, radio, etc.

Development and fabrication of interactive science exhibit on environment for display at PCS's Earth Science Gallery

The Philippine Science Centrum's Earth Science Gallery will be upgraded to provide better substance and information for visitors' appreciation and understanding.

The project will develop and fabricate eight interactive exhibits such as Battle of the Bulbs, Biodegredation, Biogas Generator, Dual Flush, E Waste, Let's Recycle, Standby Power, and Surface Run-off

Teachers and students of the Quezon National High School, Quezon, Palawan try the DOST Starbooks, the first Philippine Science Digital Library during the Launching on June 6, 2013.

On-going Projects

S&T Academic and Research-based Openly Operated Kiosks (STARBOOKS)

STARBOOKS project plans to provide public access to S&T information materials maintained at the STII library, install kiosks in selected public libraries in the Philippines for more accessibility, and train library staff and kiosk administrators in selected sites on the use and maintenance of STARBOOKS facilities. Targeting an increased number of library subscriptions, STARBOOKS users, and S&T information accessed/downloaded, the team will also produce printed promotional materials, update STARBOOKS servers monthly, and conduct promotions in target areas.

Digitization of publications and other media available at the specialist library of the National Academy of Science and Technology

The project aims to put up an online NAST specialized library in sync with the Philippine E-Lib. Its specific objectives are to digitize NAST library materials, develop database of NAST library materials, and upload database and digitized materials online.

Essentially, this project is expected to allow easier and online access to NAST's valuable library collection in digital format.

Strengthening linkages in S&T development programs in telecommunication/ICT sector through Regional Cooperation with ASEAN

The ASEAN 12th Telecom/IT Ministers (TELMIN) and 13th Telecommunications/IT Senior Officials Meeting (TELSOM), along with Dialogue Partners, were held November 12-16, 2012 in Cebu City.

The expected gains from this effort include approved 'Mactan-Cebu Declaration" as the official statement of ASEAN TELMIN Leaders, joint press statement, conference report and proceedings to contain Joint Working Group and TELSOM - TELMIN Leaders' decision on projects and activities discussed in relation to the implementation of the ASEAN ICT Master Plan 2015.

The project's objectives are to promote Philippine interest in telecom/ICT sector by hosting international and regional conferences, and bilateral meetings, strengthen linkages with regional counterparts and R&D organizations in telecom/ICT sector, develop, strengthen, and enhance the competitiveness of the ASEAN ICT sector in general and Philippine ICT sector in particular.

Strategic communication intervention for the Nationwide Operational Assessment of Hazards (NOAH) Program

The Nationwide Operational Assessment of Hazards (NOAH) Program of the Department of Science and Technology aims to collate/consolidate information to be generated from projects involving flood mitigation specifically targeting 6-hour flood early warning system for communities along 18 major river systems, enhancement of geohazard maps, and enhancement of storm surge vulnerability maps. The information will be processed into useful data and make them available to those who need these. The seven DOST projects included in the NOAH Program are [1] Smart Sensors

for Disasters (SSD), [2] FLOODNET, [3] Disaster Risk Exposure Assessment for Mitigation (DREAM), [4] Enhanced Landslide and Geohazards Project (ELAG), [5] Coastal Hazards and Storm Surge Assessment and Mitigation (CHASSAM), [6] Local Development of Doppler Radar Systems (LaDDeRS), and [7] Weather and Hazards Information Project (WHIP).

This project shall process and package relevant and up-to-date information from NOAH projects for public use, conduct information, education, and communication activities on the NOAH projects among target users and beneficiaries, and learn about/ benchmark other existing initiatives/technologies related to disaster risk reduction and management.

This multiplatform awareness project is expected to lead to the development and production of communication resources like web portal, videos, bulletins, brochures, posters, and development and implementation of information, education and communication activities such as project launch, press conferences, seminars, workshops, and local consultations.

Second Strategic Planning Workshop for NOAH, June 20, 2013


Support for Technology
Transfer and Commercialization

DOST Secretary Mario G. Montejo as Guest Speaker during the 9th National Biotechnology Week

The 9th National Biotechnology Week

In 2013, DOST was one of the agencies that participated in the 9th National Biotechnology Week which was spearheaded by the Department of Education. With the theme " EdukasyonsaBiotecknolohiyaparasaKalikasan, Kalusugan, Kagandahan, Kabuhayan, at Kaunlaran! EdukasyonsaBioteknolohiya: Ok sa 5k," the celebration was held last November 25 – 29, 2013 at Universidad de Manila Palma Hall and Arroceros Forest Park, Manila.

The PCIEERD was the DOST's Focal Agency for the 9th NBW celebration. To ensure the successful participation of DOST, the DOST Committee for 9th NBW was constituted, composed of representatives from the three Councils (PCIEERD, PCAARRD and PCHRD) as well as FNRI, SEI, PSHS, STII, TAPI, DOST Region 4A, NAST, NRCP and the DOST Biosafety Committee.

As Build-up Activity for the celebration of 9th NBW, PCIEERD conducted a guided tour of facilities and lecture at BIOTECH-UPLB and IRRI last November 13, 2013. Same activity was also held at the National Institute of Molecular Biology and Biotechnology (NIMBB-UP Diliman) last November 18, 2013.

In addition, PCIEERD also hosted an Industry Visit at Absolut Chemical Plant in LianBatangas on November 29, 2013. On the same day, a Technology Demonstration on Microbial Rennet for Cheese Making, a technology from BIOTECH-UPLB, was also conducted by PCIEERD.

Other NBW activities initiated by DOST were the following:

- Guided Tour of Facilities and Lecture at the National Institute of Molecular Biology and Biotechnology (NIMBB-UP Manila) – also one of DOST's Build-Up Activity
  - Date: November 18, 2013
  - Venue: NIMBB-UP Manila
- Students' Biotech Forum and Exhibit on Select Investigatory Projects of PSHS students – aimed to increase awareness and appreciation of high school students on the products and application of Biotechnology.
  - Date: November 27, 2013
  - Venue: PSHS Diliman Lecture Hall
- Science and Technology (S&T) Forum – highlighted the issues on genetically modified crops in the Philippines, and applications of biotechnology in the fields of genomics and forensic science
  - Date: November 28, 2013
  - Venue: Universidad de Manila Palma Hall
- NBW Exhibit – featured 9 DOST-funded r&D projects on the application of Biotechnology in genomics/health, agriculture, environment, and industry
  - Date: November 25 – 29, 2013
  - Venue: Arroceros Forest Park

Technology Transfer Projects

Field deployment and effectiveness testing of LEAP software

A two-year project, LEAP is developing a stand-alone, computer-based training program for English language skill improvement of Filipinos. This one year field deployment and effectiveness testing of LEAP program is a follow up to the LEAP project. This involves training in the use of LEAP, and development and effectiveness assessment of LEAP training modules.

ON3 Technology Entrepreneurship Acceleration Program

The ON3 Technology Entrepreneurship Program is an acceleration program aimed at helping Philippine-based technology startups in the IT, Electronics and Biotechnology sectors speed up commercialization of their ideas into the worldwide marketplace. The ON3 project features an Immersion Program in Silicon Valley wherein participants will be provided an opportunity to participate in mentoring, coaching and training programs (financial analysis, sales and marketing, competitive analysis, and communication and presentation skills).

The Immersion Program will train start-up companies on how to present to an international investor audience to help secure additional funding necessary for their companies to establish a global presence.

Further, the project seeks to improve the human resource talent pool in the IT-BPO sector through cross-border training and mentoring; shorten the time to market of commercialization of university R&D and SMEs ideas; provide technical assistance to technology startups engaged in consumer Web, Internet, mobile, wireless, social media, gaming, software, clean technology, and biotechnology; and provide technology startups access to available venture capital and angel funds.

Scaling Up Rice Fortification Program through Techno-Transfer: A Strategy towards Nutrition Security

Project 1: Technology Transfer to Private Mills

The project will enable private mills to acquire and adopt Food and Nutrition Research Institute (FNRI) technology in the production of iron premix rice (IPR) and iron fortified rice (IFR). The millers from Region 11 (Davao del Norte, Davao del Sur, Davao Oriental, and Compostela Valley) are targeted to become producers of IPR and/or suppliers of IFR. By establishing linkages and partnerships with them they will be assisted in the preparation of proposals and other documents to be submitted to DOST SET-UP and/or DA-NABCOR for possible funding on the purchase of either a complete IPR line facility or only a blending facility for IFR.

The target beneficiaries are rice millers, rice retailers, and Filipino consumers.

Project 2: Monitoring and Evaluation of Impact of Iron Fortified Rice and Program Sustainability

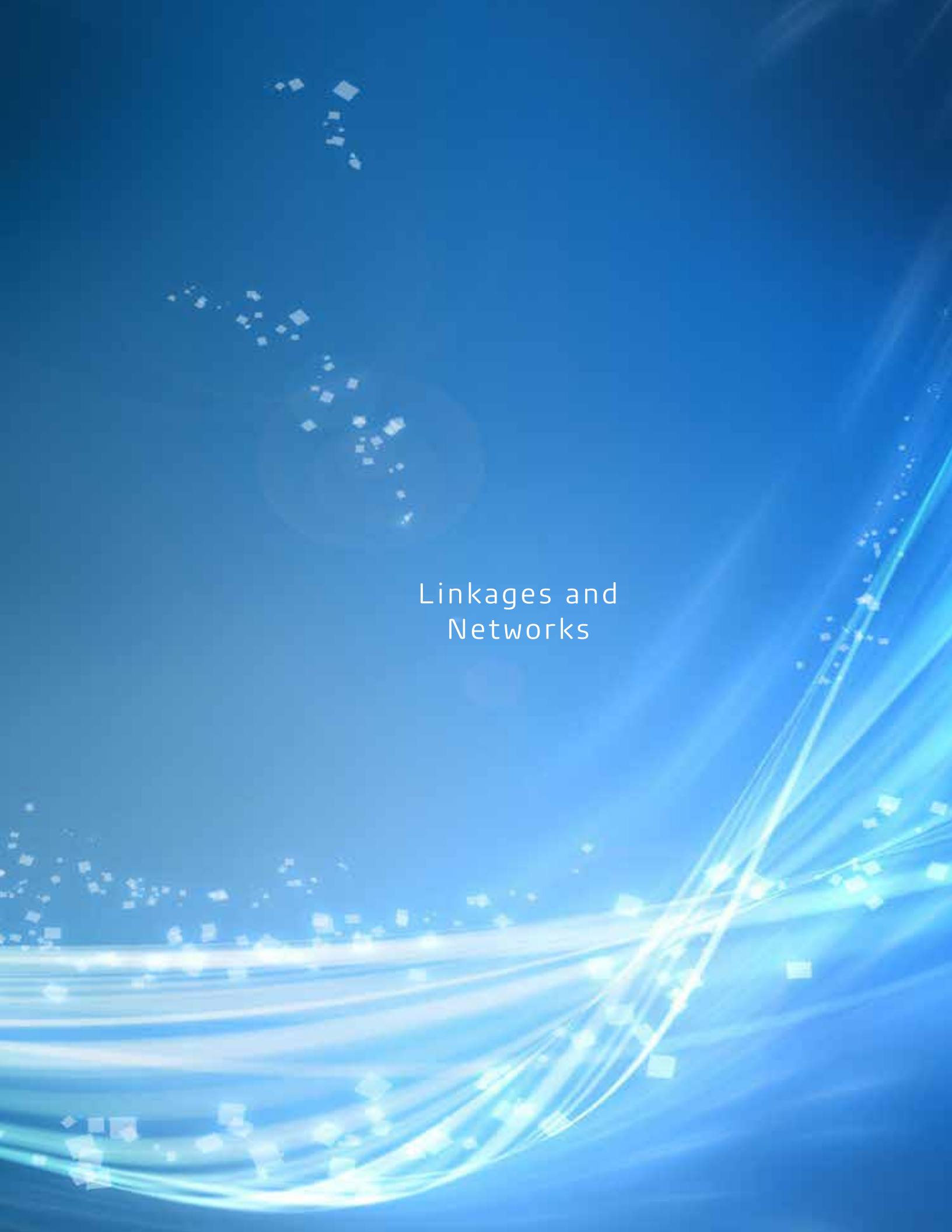
The project will make IFR available, affordable, and accessible to all Filipinos.

The project aims to evaluate program implementation and the effects of consuming IFR on the prevalence of anemia among targeted school children. Specifically, it seeks to conduct coordination activities with Local Government Units (LGUs) in Region XI, establish partnership with National Food Authority (NFA) and other Government Organizations (GOs) in project implementation, document the processes, and enhancing and hindering factors in project implementation, evaluate the impact of consuming IFR among targeted schoolchildren through determination of hemoglobin levels, weight and height measures, evaluate the KAP of parents of targeted children regarding program implementation, organize local inter-agency management team to sustain project implementation and continuously enlist technology adopters, and monitor program sustainability in current and previous study sites: Orion, Bataan; Zambales Province and Davao Region

Systems Enhancement and Market Testing of Automated Broadcast Monitoring (ORCHESTRACK)

ORCHESTRACK offers automated broadcast monitoring of content being aired 24/7 from various sources such as radio and TV. It automatically ingests broadcast feeds, auto-identify content such as commercials or music, collate data and publish reports on real-time. It generates data such as title, source, owner, duration, airplay date and time from captured broadcasts, and then aggregates data into various outputs such as feeds, dashboard and reports. This project will enhance and develop the market readiness and features/ functionalities of Automated Broadcast Monitoring (ORCHESTRACK) and increase its marketability by tapping into the networks of company. It will also establish/develop historical data on advertising placement of running candidates for future references.

The ORCHESTRAK Equipment


Linkages and
Networks

The PCIEERD is able accomplish its tasks and activities from research and development to information dissemination and technology transfer to human resource development through its dynamic linkage and collaboration with its networks here and abroad. Its linkages and networks ensure a supportive system for the sharing of information, services and resources. PCIEERD continues to maintain and establish collaborations and meaningful formal relationships with international and local agencies to be part of its network.

ASEAN-COST and ASEAN-SCMST, May 15-20, 2013, Tagaytay City

The Philippines hosted the ASEAN Committee on Science and Technology (COST) Meetings in 2013. One of the Sub-Committees was on Materials Science and Technology (SCMST). The SCMST Meeting on May 22, 2013 discussed follow-up activities to the ASEAN-India Surface Engineering project which earned for the Philippines two research attachments in India and Malaysia; as well as collaborative research to be undertaken under the ASEAN-Pakistan Cooperation Program. PCIEERD's Engr. Ermie M. Bacarra is the Philippine Focal Person for the SCMST.

24th Meeting of the ASEAN Sub-Committee on Space Technology and Applications (SCOSA-24), May 20-21, 2013, Tagaytay City, Philippines

The meeting was hosted by the Philippines through the Department of Science and Technology (DOST). It was attended by delegates from Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam as well as a representative from the ASEAN Secretariat, China Centre for Earth Resource Satellite Data & Application (CRESDA), Ministry of Economic, Trade and Industry (METI) of Japan and Indian Space Research Organisation (ISRO). Engr. Raul C. Sabularse,

ASEAN COST Chairman, Permanent Secretary (Technical & Professional) at the Ministry of Development, Dato Paduka Hj Suhaimi Hj Gafar, (3rd from right) Brunei Darussalam and his delegation during the 5th ASEAN COST Meetings in Tagaytay City. Also in photo, (rightmost) Alexander A. Lim, ASEAN Secretariat, and Maria Elena A. Talingdan, DOST-PCIEERD(leftmost)

PCIEERD Deputy Executive Director and Chair, Philippine SCOSA participated together with Ms. Clarinda G. Reyes, PCIEERD.

Sub-Committee on Sustainable Energy Research (SCSER)

The Council continues to sustain its S&T network in the ASEAN Region in the field of energy international cooperation through the ASEAN-SCSER. In 2013, among the regional collaborations and activities conducted and participated by the PCIEERD, DOST and S&T network technical personnel were regional workshops on biofuels and landfill gas utilization.

The ASEAN Training-of-Trainers Workshop on Biofuels Life Cycle Assessment (LCA) and Greenhouse Gas Profiling was conducted in Malaysia on 26-29 November 2013 under the ASEAN Biofuel Flagship Programme. The workshop aimed to address the gaps in understanding and practices on LCA among ASEAN member countries to contribute towards harmonizing the LCA methodology for quantifying environmental impacts of biofuels in the ASEAN region.

Under the ASEAN-Japan cooperation, the 2nd and 3rd Regional Training Workshops were held in Indonesia on 04-08 March 2013 and Thailand on 17-19 December 2013, respectively. The workshops provide a venue for ASEAN participants to share experiences and best practices in municipal solid landfill gas model estimation, extraction techniques and energy utilization.

Global Methane Initiative (GMI) Partnerships

In March 2013, PCIEERD as network partner of GMI, participated in the GMI Sub-Committee Meeting and the Methane Expo 2013 in Vancouver, Canada. In this meeting, the GMI network partners initiated to combine the efforts of GMI, Climate and Clean Air Coalition (CCAC) and the Center for Clean Air Policy (CCAP), synchronize activities and projects for funding support to avoid duplication of activities.
Considering majority of the GMI network countries are formulating the Nationally Appropriate Mitigation Actions (NAMAs) under the UNFCCC Framework, it was agreed that the NAMAs development will be included in the future discussion to address concerns on determining the scope and components of NAMAs, common tools for developing NAMA appropriate for municipal solid waste, and defining the measurable, reportable and verifiable (MRV) process and elements.

At the Methane Expo, methane reduction initiatives were presented by the GMI network partners that highlight biogas refining technology, high efficient biogas engine, municipal solid waste organic processing, biogas co-digestion tool kit among others.

Committee on Space Technology Applications (COSTA) Regional/ International Networks

The PCIEERD as the Philippines' Focal Institution of the Regional Space Applications Programme (RESAP)

The RESAP is one of the programs of the United Nations Economic and Social Commission for Asia and the Pacific (UN-ESCAP). The ESCAP is the regional development arm of the United Nations for the Asia-Pacific region with 53 Member States, including the Philippines.

The RESAP aims to promote and coordinate regional space cooperation for development, as well as organize and implement space application projects of regional interests. It also provides technical assistance, such as advisory body on national policies and programmes and planning related to the establishment of space agencies, and other related space applications requirement in general.
PCIEERD's Deputy Executive Director, Engr Raul C. Sabularse, is the RESAP Focal Person for the Philippines.

High Level Decision Maker Meeting on Implementing the Asia-Pacific Years of Action for Applications of Space Technology and the Geographic Information System for Disaster Risk Reduction and Sustainable Development 2012-2017, November 27-28, 2013, Bangkok, Thailand
In the meeting, policymakers discussed better utilization of space technologies and Geographic Information Systems (GIS) for disaster risk reduction and management and sustainable development. There was sharing of knowledge and good practices at both the regional and national levels; and identified needs, gaps and challenges on practical and technical issues in implementing the Asia-Pacific Plan of Action.

The 17th Session of the Intergovernmental Consultative Committee (ICC) on the Regional Space Applications Programme (RESAP), November 26-27, 2013, Bangkok, Thailand

The Meeting provided a brief overview of the key activities and achievements as well as the opportunity to review and discuss the future plan under the RESAP. It also presented critical elements of the regional cooperative mechanism for drought monitoring and early warning. Furthermore, it outlined the secretariat's efforts in the implementation of the Asia-Pacific Plan of Action for Applications of Space Technology and GIS for Disaster Risk Reduction and Sustainable Development 2012-2017 (Asia-Pacific Plan of Action). This led to discussions regarding the work plan for RESAP in 2014-2015, and other relevant discussions.

UN-ESCAP Provision of Free Satellite Images after Typhoon Haiyan

The United Nations Operational Satellite Applications Programme (UNOSAT) is a technology-intensive programme delivering imagery analysis and satellite solutions to relief and development organisations within and outside the UN system. It intends to help make a difference in critical areas such as humanitarian relief, human security, strategic territorial and development planning. UNOSAT thru UN-ESCAP provided free satellite image maps and analysis after the devastating hit of Super Typhoon Haiyan in the Philippines. UN-ESCAP member countries including India and Singapore likewise provided free satellite imageries for the post-disaster assessment in the country.

Stakeholders Meeting on Regional Cooperative Mechanism on Space Applications in Asia-Pacific Region, August 8, 2013, China

Participants committed to support ESCAP's continuing efforts in promoting space and GIS applications and enhancing the capacity of member states in the use of innovative technology for the disaster risk reduction and sustainable development. The Stakeholders Meeting on "Regional Cooperative Mechanism on Space Applications in Asia-Pacific Region" was participated in by representatives from Bangladesh, China, Hong Kong, China, Malaysia, Mongolia, Nepal, Pakistan, Philippines, Sri Lanka, Vanuatu and Viet Nam. PCIEERDs Senior Science Research Specialist and Coordinator of Space Technology Applications Programme of PCIEERD, Ms. Clarinda G. Reyes, represented RESAP-Philippines during the stakeholders meeting.

Microsatellite and SATREP Projects Development with Hokkaido University

The PCIEERD invited Dr. Yokihiro Takahashi of Hokkaido University to the Philippines on July 30 and September 26 to discuss the possible development of microsatellite and SATREPS projects. Microsatellite offers a wide variety of possible applications including disaster risk management, hazard risk assessment, and environmental monitoring. It is more affordable and practical for the Philippines than that of the small satellites. SATREPS project on the other hand is for PAGASA's severe weather monitoring and prediction based on thunderstorm observation and real-time monitoring. Through this network, PAGASA was encouraged to submit a proposal to JICA through the National Economic Development Authority (NEDA) in October 2013.

Asian Association on Remote Sensing

The Philippines renewed its membership in the Asian Association on Remote Sensing (PhilRSS). PCIEERD through the Committee on Space Technology Applications and its affiliated Philippine Remote Sensing Society supported this endeavor to revive the participation of the country in this prestigious association. The PhilRSS has been granted the opportunity to host the 2015 ASIAN Conference on Remote Sensing in the Philippines.

Teleconference of DOST NOAH Project and the Pacific Disaster Center

The teleconference meeting co-organized by PCIEERD and the US Embassy in Manila aimed to find synergies between the Pacific Disaster Center's (PDC) based in Hawaii and the Philippine Department of Science and Technology's (DOST) Project NOAH (Nationwide Operational Assessment of Hazards). The meeting reached a consensus to determine first the needs Philippine disaster management decision-makers -

primarily the Office of Civil Defense (OCD) and how the PDC's Early Warning Decision Support System (EW-DSS) and NOAH Project can work together for OCD. Said meeting was held at the Advanced Science and Technology Institute (ASTI) on March 15, 2013.

International Networks for PCIEERD's Fellowships in Advanced S&T (FAST) and Visiting Professorship

The FAST program is intended for the conduct of research for scholars via sandwich program and PhD programs. For this, PCIEERD maintains its international linkages with universities abroad. In 2013, two scholars pursued their PhD in Remote Sensing at the Asian Institute of Technology (AIT), Bangkok, Thailand. Also, PCIEERD approved the conduct of the research work of 1 scholar at the Osaka University under the UNESCO Biotechnology School in Asia. This is covered by an agreement between the DOST, though PCIEERD, and the International Center for Biotechnology (ICBiotech) for the implementation of the UNESCO International Postgraduate Biotechnology Program.

The National Science Consortium (NSC) The Engineering R&D for Technology (ERDT) Consortium

In 2013, PCIEERD organized the NSC and the ERDT Consortium to present the BCDA-funded project, "Bridging the Human Resource Competency Gaps in Support of the National R&D Agenda". Under R.A. 7227 and 7917, funds are allocated for the S&T scholarships and trainings of young Filipino scientists and researchers in areas supportive of the National R&D Agenda where there are competency gaps. The project covers grants for short-term trainings, sandwich program for ERDT and ASTHRDP scholars, post-doctoral programs and group trainings (for SEI and the DOST RDIs).

The NSC and ERDT Consortiums Meeting for the BCDA-Funded Project entitled "Bridging the Human Resource Competency Gaps in Support of the National R&D Agenda, January 10, 2013, Richmonde Hotel, Ortigas

S&T Governance and Management

An essential component for a nation to achieve competitiveness is an effective and dynamic S&T governance system that is anchored on innovation. Such system should support activities that promote a science culture and deepen involvement and understanding of science related programs.

The PCIEERD carefully looks into this matter and supports the growth of personnel in terms of their exposure to S&T related trainings as well as in taking further studies in areas that would allow them to actively participate in the programs of the Council.

PCIEERD Personnel on Scholarships in 2013

The PCIEERD continually encourages and supports its employees in taking up graduate studies or move up to BS courses. For 2013, there were seven employees on scholarship in different fields:

Ruby Raterta
Ph.D. in Biological Science
University of Santo Tomas

Carminda Tandelcarmen
Masters in Public Management
Univ. of Makati

May-Rose B. Pariñas
Masters in Technology Management
UP-Diliman

Meraida D. Reyes
Masters in Technology Management
UP-Diliman

Mary Jane S. Dabela
Masters in Information Technology
UP-Los Baños

Marivic A. Legista
Masters in Information Technology
UP-Los Baños

Rolando A. Yanquiling
BS in Information Technology
Polytechnic University of the Phils.

Records and Information Management Seminar

Records management is one of the identified core competencies of PCIEERD. To upgrade the competencies of its personnel, the PCIEERD conducted a seminar on Records and Information Management for thirty (30) of its personnel handling, managing, and disposing office records and documents last October 23-24, 2013 at the NAST Conference Room. The topics and hands-on exercises were on the life cycle of a record from the creation to disposition, methods for records creation and control, proper procedures in records retention and disposition, among others. Resource Persons came from the Philippine Records Management Association, Inc.(PRMA).

Project Management Competencies for DOST agencies

In 2012, PCIEERD was able to get funding for the conduct of training programs on project management not only for its personnel but also for other DOST agencies. The first batch was conducted exclusively for PCIEERD personnel while the second and third batches were for agencies in Bicutan, Quezon City and Los Baños science communities.

The second batch was held last June 18-21, 2013 at the TAPI Training Room where participants came from FNRI, ITDI, PTRI, TAPI, NRCP and Special Projects Division (SPD) of the DOST Central Office (CO). Each agency was allotted 5 participants in order to create a critical mass of personnel with common understanding on the framework of project management within the agencies.

The third and last batch was conducted on July 9-12, 2013 also at the TAPI Training Room. Participants were from ASTI, FPRDI, PNRI, PCAARRD and PCHRD. Both training programs were conducted in cooperation with the Holistic Training Solutions.

The third batch of participants for the Training on Project Management from ASTI, FPRDI, PNRI, PCAARRD PCHRD and PCIEERD with the Resource Speaker Mr. Marvin I. Noroña, MBA, PIE, Associate Consultant, Holistic Learning (middle). Also in photo are Ms. Maridon O. Sahagun, FAD Chief, PCIEERD (leftmost) and Ms. Mildred F. Cabradilla, Personnel Officer, PCIEERD (rightmost).

PCIEERD Staff Complement for 2013

The PCIEERD has a total personnel complement of 112, broken down as follows:

Status	Female	Male	Total
Permanent	40	24	64
Contractual	31	15	46
Detailed	1	1	2
Total	72	40	112

PCIEERD's ICT Advantage

The Council never stops to look at ICTs as still the most potentially powerful tools in getting inter-connected anytime, anywhere with its partners, stakeholders, networks and publics. ICT is becoming more and more ubiquitous that almost all economic activities are now ICT-based.

Thus, PCIEERD continues to enhance its services using to full advantage its ICTs. It is guided by its 2012-2014 Information Systems Strategic Plan (ISSP) which was endorsed by the National Computer Center (NCC). Notably, the PCIEERD has instituted and benefitting from its e-Proposals for the submission of project proposals and has developed a new intranet site and continues to make its PMIS (Project Monitoring Information System) more user friendly. In 2013, the following were the ICT activities and initiatives of the Council:

- Development of MITHI Program Proposal: "Network and Systems Development and Upgrading"
  - Project 1: Private Cloud Computing: A Consolidation of Network Infrastructure
  - Project 2: Development and Enhancement of Strategic Information systems (SISs)
- Development of HRDP Proposal on "Training Program on the Adoption of PCIEERD's Document-Tracking System (DTS)"
- Launching of New e-Proposals with integrated GAD checklist – 13 November 2013 @ DOST Executive Lounge
- Training on the use of the PCIEERD Project Management Information System (PMIS) – 5 June 2013 @ PCIEERD Conference Room and 17 September @ RITTD area

- Enhancement of the Document-Tracking System (DTS)
- Implementation of Human Resource Management Information System – 8 March 2013, (Presentation/Demonstration of HRMIS) @ OED Meeting Room and 3 May 2013, Training on the use of the HRMIS @ OED Meeting Room
- Adoption of DOST's Cashier Reporting System
- Preventive Maintenance of ICT Equipment– 12 August – 3 October 2013
- Posting of the Performance-Based Bonus requirements in Transparency Seal
- Continuous upgrade of computer equipment
- Consultative Meetings on the Implementation of Administrative Order No. 39, s. 2013: Mandating Government Agencies to Migrate to the Government Web Hosting Service (GWHS) of the Department of Science and Technology-Information and Communications Technology Office (DOST-ICTO)

PCIEERD's Gender and Development (GAD) Initiatives

Gender and development activities are actively pursued and participated in by PCIEERD personnel with the underlying principle that development is for everyone and in whatever activity whether in R&D, information dissemination, technology transfer, or human resource development. The PCIEERD also participated in various activities to enhance GAD information and activities for the Council. The PCIEERD GAD Nook was established which serves as a venue for GAD activities or other meetings of the PCIEERD personnel. Following are the other GAD activities conducted in 2013:

1. PCIEERD GAD Mainstreaming: Strengthening GAD Sensitivity and Creating an Environment for Gender Responsive R&D Programs and Projects-Phase 1
   - April 10, 2013 Day 1: Training Workshop on Harmonized GAD Guidelines (HGG) for R&D Projects at the PCIEERD Conference Room, Participants: M-13; F-30
   - Post Activity Evaluation Result: 3-Fulfilled the expectations of the participants
   - April 11-12, 2013 Day 2&3: Scenario Building and Fun-Filled Activities to Strengthen GAD Sensitivity at the Estrella De Mendoza Resort, Participants: M-34; F-54

Opening of the PCIEERD GAD Nook

PCIEERD GAD Mainstreaming

2. Sustained systematic collection of gender-oriented information of PCIEERD programs/projects/activities
3. Gender-related statistics and database on PCIEERD programs/projects/activities
4. Enhancement of Information systems to capture sex disaggregated data February 2013, The Project Management Information System (PMIS) was enhanced to include gender fields on the following information:

Project Proposal Stage: Project Proponent
Project Implementation Stage: Project Leader
Project Monitoring and Evaluation Stage: PCIEERD Technical Monitors

5. The "PCIEERD GAD Briefs" was developed and distributed during the Launching of Call for Proposals and eProposals with GAD Checklists
6. DOST Celebration of Women's Month – Aerobics, GAD Seminar, PCIEERD Staff, March 11, 2013
7. Provision of MS/PhD scholarships, and thesis/dissertation grants, post-graduate fellowship, visiting professorship

Usapang PCIEERD

Internal dialogue encourages accountability, understanding, and camaraderie among colleagues whose individual attention stretches beyond the in/out bundy clock.

Usapang PCIEERD, a continuing forum, allows staff to share their knowledge and experiences from domestic and foreign seminars, conferences, and similar activities. The forum is an intra-agency process to ensure everyone is up to speed with issues and developments that may have direct and indirect impact to the agency and individual staff.

Aside from technical reports and updates on administrative matters, the forum is also a venue for external resource speakers who in 2013 amplified on insurance and healthcare benefits for PCIEERD employees. Presentations during the year include:

Updates by PCIEERD Delegates to International Conferences

Status & Prospects of Renewable Energy in the ASEAN Region and India
Engr. Loreto C. Carasi,
Sr. SRS (EUSTDD)

Summer School on Ambient Intelligence and E-health (Hungary)
Engr. Ermie Bacarra, Chief SRS (HRIDD)

Earth Observation Satellite Network (Japan)
Engr. Raul C. Sabularse,
Deputy Executive Director

Land Gas Application Workshop: Capacity Building in Landfill Gas Utilization in ASEAN (Thailand)
Rachel Habana, SRS (EUSTDD)

Strengthening South-South Cooperation on Science and Technology to Address Climate Change (China)
Ryan Christopher Viado,
SRS what [division]

ISO Updates and Other Administrative Matters

1. Updates on PCIEERD preparations for ISO 9001:2008 Certification
2. Call for 2014 Project Proposals
   Albert Mariño, Chief SRS [PCMD]

The PCIEERD's 2013 Budget
Maridon Sahagun, Chief SRS [FAD]

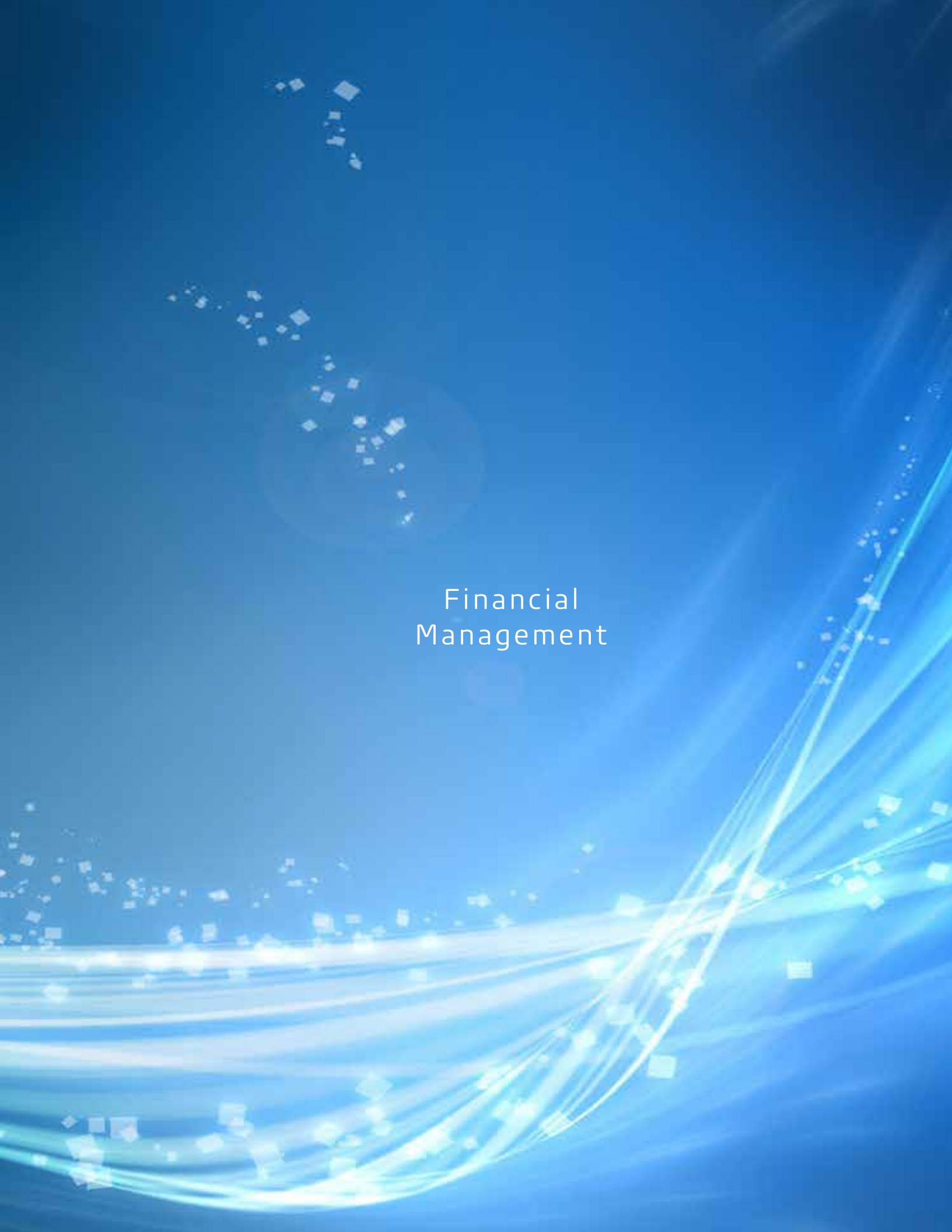
Performance Evaluation System
Engr. Darwin Rosales, Chief SRS (EUSTDD)
Sonia Cabangon, Administrative Officer V (FAD)
Mildred Cabradilla, Personnel Officer, FAD

Utilities Expenses Calculator
Engr. Loreto Carasi
Engr. Patrick Montero
Engr. Lucky John Florido
Engr. Daryll Malabanan

Basic Records and Information Management Training
Ena r. Conde, Records Officer (FAD)

Review and Assessment of GAD Activities: Gender Mainstreaming
Arlene a. Romasanta, Sr. SRS (PCMD)

PAG-IBIG and PHILHEALTH Updates
Monette Domingo
Annabelle Llanto


Financial
Management

Financial Management

For CY 2013, the PCIEERD approved budget in the General Appropriations Act (R.A. 10352) amounted to P447,203M distributed as follows: Personnel Services - 11%; Operations – 3%; and Grants-In-Aid (GIA) – 86%. In addition, the Council received Supplemental Budget in the amount of P10,792 M from the Miscellaneous Personnel Benefits Fund and Pension Gratuity Fund. The Council utilized 99.9% of the total budget allocated for the year.

The bulk of the PCIEERD Budget was allocated for the GIA to support and implement strategic programs and projects that are aligned with the DOST 8 Outcomes, specifically in industry, energy and emerging technology sectors.

In 2013, the Council also received P110,080 M from DOST and other agencies for the implementation of various programs and projects and to cover project monitoring and management cost. 65% of the resources generated from other Agencies was intended for the implementation of the program on Bridging the Human Resource Capacity Gaps in Support of the National R&D Agenda and 8.7% was released for the implementation of the Balik-Scientist Program.

2013 BUDGET UTILIZATION BY MAJOR FINAL OUTPUT (MFO)

(in thousand pesos)

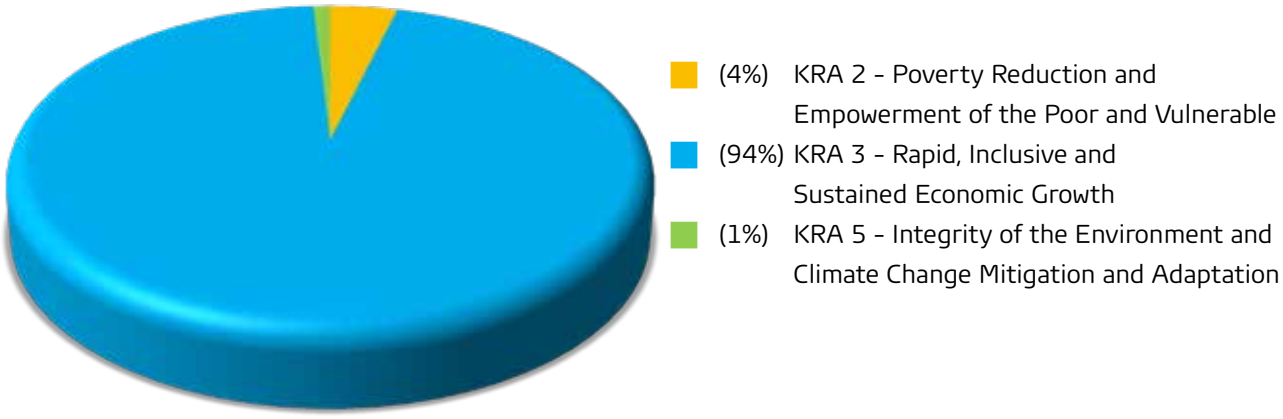
MFO	UTILIZATION	%
MFO 1 - R&D Policy and Planning Service	16,358.69	4%
MFO 2 - R&D Management Service	412,801.76	90%
MFO 3 - Technology Commercialization Service	28,328.61	6%
	457,489.06	

2013 Budget Utilization by major Final Output (MFO)

2013 BUDGET UTILIZATION BY KEY RESULT AREAS (KRAs)

KRA 2 - Poverty Reduction and Empowerment of the Poor and Vulnerable	19,245.45	4%
KRA 3 - Rapid, Inclusive and Sustained Economic Growth	431,395.41	94%
KRA 5 - Integrity of the Environment and Climate Change Mitigation and Adaptation	6,848.20	1%
	457,489.06	

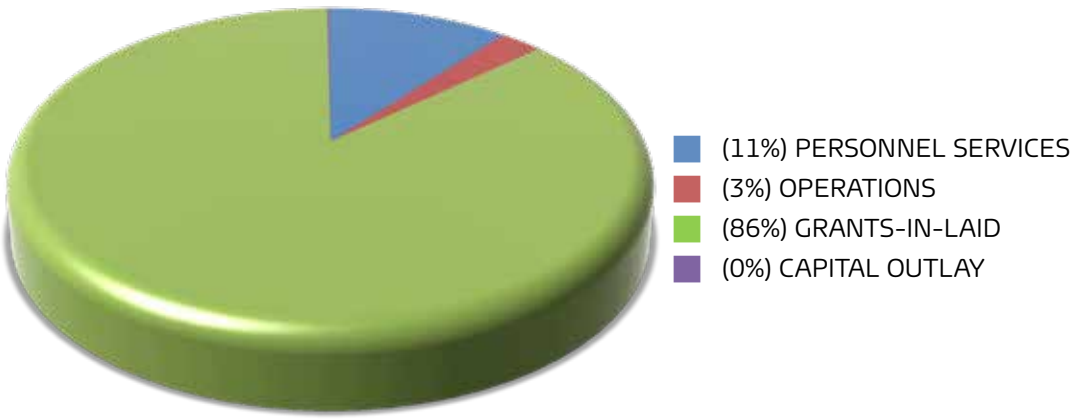
2013 Budget Utilization by Key Result Areas (KRAs)



2013 BUDGET UTILIZATION BY EXPENSE CLASS

PERSONNEL SERVICES	49,657.19	11%
OPERATIONS	11,800.22	3%
GRANTS-IN-AID	395,000.00	86%
CAPITAL OUTLAY	1,031.66	0%
	457,489.07	

2013 Budget Utilization by Expense Class



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ENGR. NONILO A. PEÑA
Chief
Energy and Utilities Systems Technology
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MS. MARIDON O. SAHAGUN
Chief Administrative Officer
Finance and Administrative Division (FAD)

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