



**PROCEEDINGS 2026-07**

Program on Political Economy

# **Building and Gaining National Capability in Science, Technology and Innovation**

**Moving Filippinnovation Forward:  
Proceedings of a Roundtable Discussion**

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27 February 2024 | 1:00 PM to 3:00 PM

National Engineering Center, University of the Philippines Diliman  
Diliman, Quezon City

*Edited by Fortunato de la Peña*



UNIVERSITY OF THE PHILIPPINES  
CENTER FOR  
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"The Makati City skyline at night, representing the financial hub of Metro Manila."

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PROCEEDINGS 2026-06  
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## Maximizing Benefits from Investments in Science, Technology and Innovation for Development

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Policy Brief  
2025-39

■ POLITICAL ECONOMY PROGRAM

## MODERN BIOLOGY FOR RURAL DEVELOPMENT

A policy framework for university innovation outputs to sustain higher economic returns for Filipino carabao dairy farmers

Joyce A. Banao<sup>1\*</sup>, John Aaron U. Aduan<sup>1,2</sup>, Paula Camille DC. Ingalla<sup>1</sup>, Josef J. Riva<sup>1</sup>, Micah M. Toran<sup>1</sup>, and Antonette R. Raquiza<sup>1,3</sup>

**ABSTRACT**

Carabao milk has remarkable potential as a raw material for developing high-value dairy products in the Philippines due to its rich nutritional profile and unique physicochemical properties. The Integrative Research Laboratory (IRL, Philippines), Institute of Biology, College of Science, University of the Philippines Diliman has developed methods for processing carabao milk using probiotic microorganisms to create NICEGUT™ functional food dairy products. These high-value products not only have a longer shelf life but also offer health benefits to consumers. In partnership with the Center for Integrative and Development Studies – Political Economy Program (CIDSS-PEP), we are studying how university-developed technologies like NICEGUT™ functional carabao cheese can significantly increase the income of small dairy farmers. Toward this end, we propose the following strategies: 1. Enhance government support for dairy farmers' cooperative training and support programs, 2. Implement a Geographical Indication (GI) protection for high-value products produced in specific communities in the Philippines, 3. Promote a community-centered profit-sharing arrangement between Philippine start-up companies or enterprises and farmer's cooperatives.

**INTRODUCTION**

The development of the Philippine dairy sector is a national priority, with local production of dairy products meeting only a small part of the domestic demand (Tringo et al., 2024; Mojica-Serrillo, 2023; Ang, 2017). The carabao or water buffalo that is usually used as a draft animal can, for instance, be a source for nutrient-rich milk, which may be used in high-value products (Ile-

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## POLICY BRIEF

Modern Biology For Rural Development: A policy framework for university innovation outputs to sustain higher economic returns for Filipino carabao dairy farmers



# Introduction

This second round of the roundtable discussion (RTD) series on “Moving Filipinnoation Forward” was led by Dr. Fortunato T. dela Peña, Senior Fellow of Political Economy Program (PEP) of the University of the Philippines Center for Integrative and Development Studies (UP CIDS). Dr. Antoinette Raquiza, PEP Convenor of the Political Economy Program opened the RTD and welcomed guests and speakers, namely: Mr. George T. Barcelon of the Philippine Chamber of Commerce and Industry (PCCI), Dr. Tirso A. Ronquillo of Batangas State University and the Philippine Association of State Colleges and Universities (PASUC), Dr. Gisela P. Concepcion of the National Academy of Science and Technology (NAST), Dr. Jonel P. Saludes of the University of San Agustin, Undersecretary Maridon O. Sahagun of the Department of Science and Technology (DOST), Dr. Deo Florence L. Onda of the UP Diliman College of Science and its Marine Science Institute, Atty. Jose Maria “Joey” Ochave of Unilab, Inc., Associate Dean Rowaldo R. Del Mundo and Dean Maria Antonia N. Tanchuling of the UPD College of Engineering. The UPD College of Engineering was the co-organizer of the said roundtable series on Filipinnoation.

The second RTD took off from the first session of the RTD on “Maximizing Benefits From the Public Investment in Science, Technology and Innovation (STI),” held on February 22, 2024. Action points raised during the first RTD to move Filipinnoation forward included going into the next generation technology, notably resource-based biotechnology, building on indigenous knowledge and community-based business models as well as ensuring technology development, transfer, and build-up across regions and sector. At the end of the first RTD, it became clear that the lynchpin of any strategy to raise the country’s regional profile and output in science, technology, and innovation (STI) is human capital development - the topic of the second RTD.



# Opening Message

**George T. Barcelon**

*Chairman, Philippine Chamber of Commerce and Industry (PCCI)*

Mr. Barcelon stated that the overarching theme of the previous administration was “Giant Step.”<sup>1</sup> The letter “G” stands for good governance, particularly referring to the ease of doing business. The second letter “I” stands for needed infrastructure, referring to land, sea, air, and digital infrastructure. The letter “A” stands for agriculture, an area where the Philippines is lagging behind other Southeast Asian countries. The letter “N” refers to the new period of manufacturing, and finally, “T” represents tourism, which is seen as the low-hanging fruit for the Philippines.

The next word, “STEP,” stands for Science, Technology, Education, and People Skills that, together with sources of financing, are the enablers at this stage of the country’s development. Industry, in particular, is really concerned about innovations in its various aspects and forms.

Mr. Barcelon then touched on a number of pressing national issues: food security, competitive energy, environment and climate change, and the urgent need to be competitive.

On food security, he highlighted the potential of soybean as a substitute for livestock protein and soy drink to which calcium can be added to become a milk substitute. He mentioned that local scientists are now seriously looking into growing soybeans in tropical countries such as the Philippines. Food cost is critical because it is a major component of the cost of living. It also affects inflation and exchange rates largely because of the country’s dependence on food and food-related imports, according to Mr. Barcelon.

Additionally, he discussed education, particularly the need to produce more Filipino scientists. He mentioned that, in his dialogue with government leaders

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<sup>1</sup> It was in April 2019, under the administration of former President Rodrigo Duterte, that the Philippine Innovation Act (Republic Act No. 11293) was enacted.

in the education sector, he suggested focusing on science and engineering degree programs.

Lastly, Mr. Barcelon dealt with the interlinked sectors of energy and new products, waste, and the environment. He cited the following:

1. The Department of Environment and Natural Resources (DENR) targets to reduce carbon emissions by 75 percent by 2030.<sup>2</sup>
2. The Philippines has one of the highest costs of energy (other countries are able to lower the cost by subsidizing its cost to end users).
3. The Philippine government in 2020 stopped issuing new permits for coal-based baseload generators.
4. India, with its big population and high energy requirements, still has an ongoing 24 gigawatts of coal-fired baseload power generation in operation and is moving towards a baseload capacity of 56 gigawatts. This shift is due not only to ensure energy availability but also to have competitive energy.
5. Renewable energy like wind and solar energy is much talked about, but its use by the common consumer has to be subsidized. While geothermal energy also helps, it is too expensive.
6. While carbon emission comes from the use of fossil fuel and charcoal, so too from rice planting and livestock raising. Additionally, if carbon emissions were taxed, the tax has to be applied across all sectors, making the situation more challenging.
7. The urban waste volume is high, and much of it is disposed of in landfills. Many of these wastes are also dangerous. Many, like lithium batteries, contain heavy metal. Thus, the electric vehicle (EV) car can pose problems to the environment because of lithium and some rare earth elements. Perhaps in the coming years, it will not be lithium but sodium ion. These

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2 "President Duterte Approves PHL Commitment of 75-Percent Emissions Reduction Target by 2030," Department of Finance, April 16, 2021, <https://www.dof.gov.ph/president-duterte-approves-phl-commitment-of-75-percent-emissions-reduction-target-by-2030/>.

issues pose concerns on the supply chain (as industrialized countries are not comfortable with relying on nickel and lithium).

8. Factories that were set up years ago in open ground areas are now forced to close due to rapid urbanization. Old factory sites are now high-density residential areas.

Considering all of what he discussed, Mr. Barcelon suggested that the country needs more people in the areas of science and engineering. A lot of them are needed for economic progress.



## KEYNOTE PRESENTATION

# Building and Gaining National Capability in Science, Technology and Innovation

*Fortunato T. de la Peña*

*Chair, Philippine Foundation for Science and Technology*

*Former Secretary, Department of Science and Technology*

*Former Vice President for Planning and Development, University of the Philippines*

Dr. Fortunato de la Peña began by stating that his presentation deals with the past and the present. He added that he will leave the discussion of the future to the discussants.

## **The Early Initiatives (1901-1950)**

Since 1901, Filipino pensionados have been sent to the United States of America (USA) to pursue degrees in various disciplines. He mentioned a photograph of early pensionados who managed the Philippines' booths at the 1904 International Exhibition in St. Louis, Missouri. The first Filipino faculty members of the University of the Philippines (UP) were pensionados who obtained their degrees at U.S. universities. The first scientists and researchers at the Bureau of Science and other government laboratories, along with many of the early national scientists in the Philippines, were also pensionados.

## **Cases on Science and Engineering Capability Building (1960s-1970s)**

Dr. de la Peña discussed the composition of the early science and engineering academic community, based on a document he obtained from UP Los

Baños (UPLB). The document contained the names of faculty members and researchers from the UP and the International Rice Research Institute (IRRI) who were sent for graduate studies in the US. Between 1964 to 1974, these scholars included nineteen who graduated from Cornell University, twelve from other U.S. universities, and thirty-six who received their PhDs from local universities. The United States Agency for International Development (USAID), the Rockefeller Foundation Fellowship, and the World Bank granted the largest scholarships. Other sponsors of these graduate scholarships were the Ford Foundation Fellowship, the British Council, the German Academic Exchange Service (DAAD), and Japan's Mombushu Scholarships.

From the 60s to 70s, mostly young faculty members from engineering were also sent abroad. A total of about twenty-five scholars took their advanced degrees in engineering at U.S. universities. Information about the program was provided by former DOST Secretary Filemon Uriarte, one of those who went to the US under this scholarship. Some of the universities they attended included Carnegie Mellon, Iowa State, and Rensselaer. There were five batches of scholars under this program. Upon returning, many of these scholars became department heads, college deans, and center directors at the UP College of Engineering. The program was implemented by Educational Programs Incorporated, based in Pittsburgh.

The Engineering Education Project was another program that sought to build capability in engineering from the late 1970s to the late 1980s. It was supported by the Asian Development Bank. The program benefitted thirty Philippine engineering schools, ten of which were called resource-based universities. These universities had better faculty profile and facilities, and good track record. The other engineering schools got limited benefits from the program, but many of these later grew into bigger universities.

The program was supervised by the Bureau of Higher Education under the Department of Education (DepEd), the predecessor of the Commission on Higher Education (CHED). It focused on faculty development, facilities improvement, and continuing education. A notable feature of the program was the institution of the Master of Engineering Education Program in UP. In this program, students pursuing master's degrees in their respective fields—whether chemical engineering, electrical engineering, etc.—had to take pedagogy courses at the UP College of Education.

## **The First Graduate Science Scholarship Consortium (1977-1992)**

The Advanced Manpower Development Program in Mathematics, Chemistry, and Physics is one of the country's first Graduate Science Scholarship Consortium. This was a consortium, involving UP Diliman and Ateneo de Manila University (ADMU) and ran from 1977 to 1992. The primary source of funding was mostly DOST (then NSDB, later NSTA before becoming DOST). The National Economic Development Authority (NEDA) also provided support during the earlier batches. In the later years, International Development Program (IDP) also provided funding. A total of fifty-nine scholars—many of whom became prominent figures in the fields of science, mathematics, chemistry, and physics in the Philippines—obtained their PhDs, with degrees granted by UP Diliman and ADMU.

Faculty members from UP Diliman, ADMU, Mindanao State University - Iligan Institute of Technology (IIT), Marawi, and General Santos, UP Visayas, UP Los Baños, UP Baguio, UP Science Education Center, Philippine Science High School, Visayas State College of Agriculture (ViSCA) (now known as the Visayas State University), Pangasinan State University, De La Salle University, Xavier University, University of San Carlos, and Notre Dame of Marbel University became scholars of the consortium from 1977 to 1992. This marked the beginning of UP Diliman College of Science offering graduate courses, particularly MS and PhD programs in science and mathematics.

## **The Engineering and Science Education Program (ESEP)**

Dr. de la Peña discussed the Engineering and Science Education Program (ESEP) as an important capability-building program funded by the World Bank in the 1990s. It produced academic leaders in the field of science, technology, engineering, and mathematics in the early twenty-first century.

In 1985, DOST created a Science Education Consortium, specifically to provide scholarships for science and mathematics education teachers. This was later renamed by the DOST Science Education Institute (SEI) as the National Consortium in Graduate Science and Mathematics Education (NCGSME) in 2014, with an expanded university membership.

In 2006 and 2007, two national consortia were formed: the Accelerated Science and Technology Human Resource Development Program (ASTHRDP), set up in 2006 for the basic or breeder sciences, and the Engineering Research and Development for Technology (ERDT) consortium, which was established in 2007.

Some statistics have been provided by DOST-SEI and they are shown below:

**Table 1. Graduate Consortia per number of HEI members and graduates per period**

DOST-SEI Graduate Scholarship Consortia	Year Started	No. of HEI Members	No. of Scholar-Graduates			
			Inception-2014		2015-2023	
			MS	PhD	MS	PhD
Accelerated Science and Technology Human Resource Development Program – National Science Consortium (ASTHRDP-NSC) (the NSC formalized in 2010)	2006	11	1,294	158	2,799	511
Capacity Building Program in Science and Mathematics Education – National Consortium in Graduate Science and Mathematics Education (CBPSME-NCGSME)	1986	16	36	159	676	203
Engineering Research and Development for Technology (ERDT) Consortium	2007	8	495	45	1,323	190

In 2019, the Science and Technology for Regional Advancement and Development (STRAND) consortium was formed, specifically with universities that were not part of previously established consortia. It covers all graduate programs in science, technology, engineering, and mathematics

(STEM), with the purpose of applying an inclusive development strategy in the area of S&T HRD. STRAND sources its scholarship funds from previously established consortia.

## **Institutions Created to Build Capacity in STI**

Dr. dela Peña then discussed the creation of the Philippine Science High School (PSHS) and the Science Education Institute (SEI) with mandates to build STI capability for the country:

The Philippine Science High School system was established through the following:

- RA 3661 or “An Act to Establish the Philippine High School” (23 June 1963)
- RA 8496 or “An Act to Establish the Philippine Science High School System and Providing Funds Therefore” (12 February 1998)
- RA 9036 or “An Act Strengthening the Governance and Defining the Scope of the Philippine Science High School System (PSHSS) Amending for the Purpose of Republic Act 8496 (12 March 2001), which required one campus per region”

PSHSS has produced 25,648 graduates from 1969 to 2023.

The DOST-SEI was created under Executive Order (EO) 128 of 1987, which evolved from the Education and Training Division of NSDB that was established under RA 2507 of 1958. SEI became the mandated agency to implement HRD Programs for the S&T community. It crafted the bill that became the Scholarship Act of 1994 or RA 7687, which increased scholarship slots from 270 to 3,500 per year (now close to 11,000 per year). DOST-SEI supports Science and Mathematics teachers through the Regional Science Teachers Training Centers. It also supports the development of digital learning and various graduate STEM Scholarship Consortia.

One of the features of the Scholarship Act of 1994, RA 7687, is the democratization principle, which requires supporting at least two scholars per municipality. Dr. dela Peña added that DOST-SEI also offers short-term

training programs for science and mathematics teachers, including those who teach specially-abled or differently-abled students. Such programs include the Science and Math Teachers Support Program through the Regional Science Teachers Training Centers that are based in partner universities. It also supports the development of digital learning, as well as innovative science and mathematics teaching tools and approaches.

## Capability-building through the R&D Councils

Dr. de la Peña also presented the initiatives of the DOST R&D councils in building national capability in STI. Some are special graduate scholarships within their sector, while others are training and innovation support programs towards technology-based enterprise creation, technology adoption and transfer, technology commercialization, and technology business incubation and acceleration.

**Table 2. Some special graduate scholarships, as part of the initiatives of the Philippine Council for Health Research and Development (PCHRD)**

Local Scholarships	Foreign Scholarships
<ul style="list-style-type: none"> <li>■ MD and PhD in Molecular Medicine with UP Manila</li> </ul>	<ul style="list-style-type: none"> <li>■ MS and PhD in Tropical Medicine with Mahidol University</li> </ul>
<ul style="list-style-type: none"> <li>■ MS in Molecular Medicine with St. Luke's College of Medicine</li> </ul>	<ul style="list-style-type: none"> <li>■ PhD in Molecular Biomedicine with the International Liver Foundation and University of Trieste, Italy</li> </ul>
<ul style="list-style-type: none"> <li>■ PhD in Health Research with University of Santo Tomas</li> </ul>	<ul style="list-style-type: none"> <li>■ Cohort Doctoral Studies Program with James Cook University, Australia</li> </ul>

The Philippine Council for Agriculture, Aquaculture, Forestry and Natural Resource R&D (PCAARRD) also has its Graduate Scholarship Program and Graduate Educational Assistance for Technology. PCAARRD also has the Reform Agri-Aqua Foundation Systems Enhancement (RAISE) Programs, consisting of six projects to support innovation generation, startup creation and technology transfer, and commercialization.

At the Philippine Council for Industry, Energy, and Emerging Technologies R&D (PCIEERD), these are their programs:

- Funding Assistance for Spin-off and Translation of Research in Advancing Commercialization (FASTRAC);
- Short-Term Program for Researchers on Innovation and Entrepreneurship (SPRINT);
- IP Management for Academic Institutions Commercializing Technologies (IMPACT);
- Startup Grant Fund Program;
- Higher Education Institution Readiness for Innovation and Technopreneurship (HeIRIT) Program;
- HEIRIT Regional Startup Enablers for EcoSystem Development (ReSEED) Program;
- Technology Business Incubator (TBI) Program;
- Women Helping Women: Innovating Social Enterprise (WHWise) Program; and,
- Smarter Philippines Through R&D, Training and Adoption (SPARTA) - an online training program aimed to produce expertise in data analytics and artificial intelligence (AI), which benefitted 30,000 trainees.

Additionally, the National Research Council of the Philippines (NRCP) has an R&D Grants Program, which encourages young researchers to carry out R&D projects under their division. The NRCP also has a program to assist thesis and dissertation work.

Lastly, Dr. de la Peña presented the situation on the “gaining” aspect of national capability for STI. He cited the Balik Scientist Program, the Science for Change Program, the DOST RDI-Industry-Academe Partnership Program, the Community Empowerment through Science and Technology Program, the Small Enterprise Technology Upgrading Program (SET-UP) and the Philippine Program on Bilateral and Multilateral Partnerships in STI. He shared the following information:

### **Balik Scientist Program**

The Balik Scientist Program, started as a NSDB program in 1975, was strengthened through a Presidential Executive Order in 1988, and further reinforced with the enactment of the Balik Scientist Act in 2018. This program is the government's initiative to reverse the effects of brain drain in the Philippines. It serves as a platform to encourage Filipino scientists, technologists, and experts abroad to return to the country and share their knowledge. It is also part of the solution to increase the number of S&T personnel doing R&D per million population. The program contributes to the implementation of research programs involving specialized expertise. Since it started, the Balik Scientist Program has achieved significant positive results.

### **The Science for Change Program**

Launched in 2017, this program has four components:

- The Niche Centers in the Regions for R&D (NICER)
- The Collaborative R&D to Leverage the Economy (CRADLE)
- The R&D Leadership (RD Lead) Program
- The Business Innovation through Science and Technology (BIST) for Industry.

Forty-six NICERs were established from 2018–2022, while seventy-eight R&D leaders were fielded in the regions during the same period.

### **DOST Research and Development Institute-Industry-Academe Partnership Program**

Recent examples under this program include the setting up of the following: the Philippine Nuclear Research Institute, which collaborates with the private sector for irradiation services for products and materials as well as the setting up of a private facility in Tanay, Rizal; the Metals Industry Research and Development Center (MIRDC) that is involved in advanced manufacturing, 3D printing, training and services; the Industrial Technology Development Institute (ITDI) that has the largest number of R&D contracts with industry and implements a PhD by research in material science in partnership with Mapua University; and, the Food and Nutrition Research Institute (FNRI) addresses malnutrition.

Other examples of RDI-Industry-Academe partnerships: the Philippine Textile Research Institute (PTRI)'s Regional Yarn Production and Innovation Centers (RYPIC), the Forest Products Research and Development Institute (FPRDI)'s Flavors and Fragrances from the Forests Technology Program (F3TP), and the Philippine Bamboo Musical Instruments Innovation R&D Program.

### **Small Enterprise Technology Upgrading Program (SET-UP)**

The Small Enterprise Technology Upgrading Program assisted 9,707 firms from 2002 to 2023. This program has led to the creation of new jobs, adoption of production technologies adopted, increased gross sales, and improved productivity. Total investment in this program, as of 2023, amounted to 8.68 billion pesos, and had a target productivity improvement per firm of 5 to 10 percent.

### **Community Empowerment through Science and Technology (CEST)**

The Community Empowerment through Science and Technology (CEST) introduces different science and technology approaches to help marginalized communities.

### **Government to Government Partnerships**

Government R&D institutes, such as the DOST RDIs, partner with local government units (LGUs), national government agencies (NGAs), and industries to provide much-needed technical services. Examples include agricultural product R&D and commercialization, packaging R&D, advanced manufacturing R&D and services (such as irradiation services), textile energy conservation, clean production, and production technologies.

### **Capability-building through bilateral and multilateral agreements**

Bilateral agreements in S&T, particularly for capability building and R&D, have been signed by the Philippines with selected countries. Examples include those with France, United Kingdom, USA, Australia, and Chinese Taipei. One notable example is the Memorandum of Agreement (MOA) with France, which resulted in the availability of free tuition for academic programs in their public universities for Filipino scholars in S&T. Taiwan has also recently offered work-study programs in STEM courses at what is called "talent cultivation base universities" for specific industry sectors.



## DISCUSSIONS

# Discussion 1

### ***Dr. Tirso A. Ronquillo***

*President, Batangas State University (BatSU)*

*President, Philippine Association of State Colleges and Universities (PASUC)*

Dr. Ronquillo began by expressing his gratitude for being a beneficiary of DOST's program during the incumbency of Dr. de la Peña, the keynote presenter, as Secretary of DOST. He then proceeded with his presentation, entitled "Advancing Engineering Education Development through the AIST Park and NIT Program to Build National Capacity for Science, Technology, and Innovation (STI).

The following programs, projects, and activities are examples of the initiatives of the Batangas State University (BatSU) as the National Engineering University by virtue of Republic Act No. 11694<sup>3</sup>:

### **The BatSU Engineering Hub**

The BatSU Engineering Hub is a center for excellence on engineering, expected to deliver or shape graduates across various engineering disciplines. In light of a Commission on Higher Education (CHED) ruling that BatSU cannot offer new programs that are not allied to engineering and technology, the university today has expanded into the following new programs, both at the undergraduate and graduate levels: aerospace engineering, biomedical engineering, transportation engineering, advanced manufacturing, and automotive engineering, among others. As of now, 43 percent of BatSU's enrolment is in engineering and technology. Although there is only one BatSU campus in Batangas province, students come from over fifty provinces across the country. It is expected that within the next few years, students from all provinces will enroll at the university. This target aligns with BatSU's mandate to reserve 50 percent of its slots to engineering and technology, according to law. Notably, BatSU is the only state university in the country with an international accreditation for

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3 BatSU was established in 2001 with the passage of RA. 9045. RA 11694 was enacted in 2022.

engineering through Accreditation Board for Engineering and Technology (ABET)<sup>4</sup>, under the Washington Accord.

### The STEER Research Hub

BatSU has established and is now operating the Science, Technology, Engineering, and Environment Research Hub (STEER).<sup>5</sup> The hub is expected to do R&D, product development, and start up incubation in engineering and technology-related areas. The Regional Development Council of CALABARZON<sup>6</sup> has recognized STEER as the CALABARZON center for science, technology, and engineering research. It hosts six centers: 1) Center for Technopreneurship and Innovation, 2) Electronic Systems Research Center (ESRC), 3) GIS Applications Development Center, 4) Digital Transformation Center on SMART Cities, 5) Material Testing and Calibration Center, and 6) Manufacturing Research Center and LIKHA FabLab<sup>7</sup>. These centers are now conducting research in the STEER Hub. They are specifically mandated by law to produce more research on science, technology, and engineering. In particular, BatSU's Center for Technology and Innovation (CTI) has received numerous grants from DOST in support of its goals and targets. It trains more than 2,000 students in technology entrepreneurship, and more than 100 startup incubatees have already graduated from this center. Additionally, there are several research cells within each center of BatSU's Steer Hub.

### Knowledge and Innovation in Science and Technology (KIST) Park

BatSU, in partnership with the Philippine Economic Zone Authority (PEZA) and DOST, also established a KIST Park. It is still in its development stage, although infrastructure is already in place. Today, the park already has locators, such as Phytos Corporation, which is producing graphene-based face masks.

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4 To know more about ABET, visit <https://www.abet.org/>.

5 To know more, kindly visit <https://batstateu.edu.ph/research-and-extension/support-system/steerhub/>.

6 CALABARZON, comprising of Cavite, Laguna, Batangas, Rizal, Quezon, is an administrative region in the Philippines.

7 LIKHA FabLab stands for Labspace for Innovation Knowledge Honing and Application Fabrication Laboratory (LIKHA FabLab). To know more, visit <https://batstateu.edu.ph/research-and-extension/support-system/likha-fablab/>.

According to Dr. Ronquillo, in all its initiatives, BatSU is motivated by a Philippine Institute for Development Studies (PIDS) report in 2021 that the supply-demand gap in STEM human resources, and in engineers, in particular, would reach an estimated 570,000 by 2025.<sup>8</sup>

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8 See <https://www.pids.gov.ph/details/philippines-facing-oversupply-in-it-graduates-stem-shortage>.



# Discussion 2

## **Dr. Gisela P. Concepcion**

*Professor Emeritus, Marine Science Institute, UP Diliman*

*Former Vice President for Academic Affairs, University of the Philippines  
Academician, National Academy of Science and Technology (NAST)*

Dr. Concepcion began by emphasizing that the UP leadership, led by President Angelo Jimenez, is committed to support innovation, particularly social innovation with a social return on investment. These innovations must make an impact on the ground in communities, which would need the following: a new innovation policy, innovation hubs, revised intellectual property policy, advice on national innovation and industry policies, specific modes of implementing and managing UP innovations, support for research and creative projects in the pre-incubation or incubation stage, and linkages to create innovation and entrepreneurship for the different constituencies in the university.

She then pointed out the importance of serving the communities. For this, she cited an example of a DOST-academe-local government unit (LGU) collaboration under the program called Innovation through Science and Technology to Advance Regional Technology-Based Development (iSTART). Under iSTART, Leyte Province, led by the governor, identifies the priorities, statistics, and profiles, which are shared with DOST-designated experts who then help in creating a provincial plan using science and technology as a tool. In Leyte, the following were identified as priorities: delivery of basic goods and services, governance, and identifying areas of progressive development in the province. She quoted the provincial governor as saying: “You cannot have wafers being manufactured without using coal-fired energy until now because you are not going to have the stable or continuous energy. *“Pag merong brownout diyay, tapon lahat ng wafers* [When there is power outage, all the wafers will be wasted].” This shows the importance of having a reliable energy source and of coming up with an efficient approach to designing and developing sustainable, integrated, and social circular economies. The priority is to begin with waste recycling.

Dr. Concepcion then discussed how the National Innovation Act can help address future needs. She enumerated areas of development that should be given attention, including education, health and well-being, food and

agribusiness, finance, manufacturing and trade, transportation and logistics, public administration, security and defense, governance, energy, the blue economy, and water. She added that human resources are needed to take care of all of these.

## Learning and Education

Dr. Concepcion mentioned the Versatile Instrumentation System for Science Education and Research (VISSER) as an example of how researchers can contribute in the area of learning and education. This instrumentation system, developed by a group led by Dean Giovanni Tapang from the UP Diliman College of Science, can help a lot in learning through experimental science.<sup>9</sup>

## Energy

She then presented the research on batteries by the chemical engineering laboratory, then headed by Dr. Joey Ocon. The laboratory, then the largest in UP, had forty researchers working on sodium ion batteries. It also produced a publication on hybrid systems of renewables and fossil fuels in different parts of the country, taking into account the socio-economic status of various regions.

## Health Products

Dr. Concepcion presented two examples of R&D in health, highlighting their different statuses and situations related to commercialization. The first example is the Relief Vent Ginhawa Project of UP Manila, which focuses on developing a local ventilator in response to the high demand for ventilators during the height of the COVID-19 pandemic. It is still undergoing trials and seeking a manufacturer. The second example is the RT-PCR test kit for COVID-19, which proved effective during the pandemic. This kit was developed by an R&D group led by UP Manila faculty member Dr. Raul Destura. He also developed the Dengue test kit. Unfortunately, the Department of Health (DOH) did not purchase the COVID-19 test kits because the imported kit

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9 To learn more about the VISSER, visit: <https://tapitechtransfer.dost.gov.ph/technologies/it-development/versatile-instrumentation-system-science-education-and-research-visser>.

from China is cheaper. Dr. Concepcion refers to these as challenges in the R&D commercialization journey.

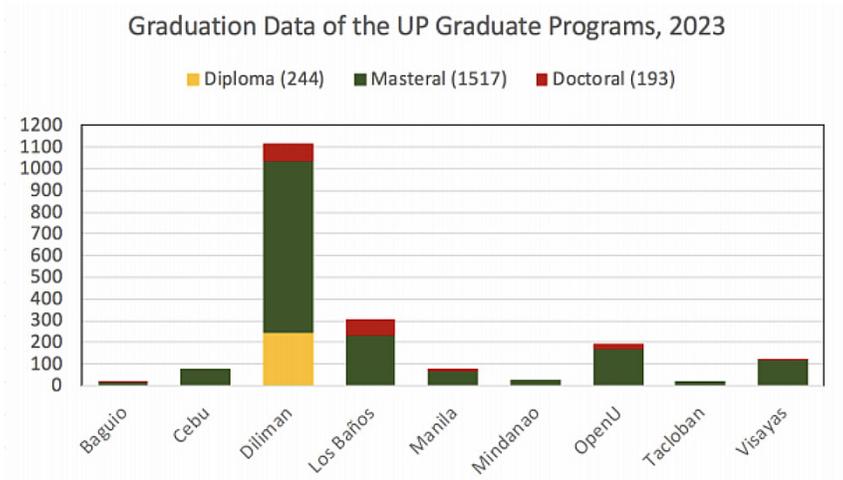
## Human Capital Development

Dr. Concepcion highlighted the very low figures that the Philippines has on the UNESCO Science and Technology Indicators, which links investment in R&D and the number of S&T researchers to a country's economic development and GDP per capita. The Philippines still has a GERD (Government Expenditures for Research and Development) over GDP (Gross Domestic Product) of 0.32 percent, as compared to the world average of 1% for developing countries.

She then benchmarked the Philippine figures with those of Indonesia, Thailand, and Vietnam. While the Philippines has a higher percentage of college graduates in science and engineering compared to Indonesia, Thailand's figure is ten times that of, and Vietnam's figure is four times higher than the Philippines. Still, according to her, there is hope if baccalaureate graduates can be directed to graduate programs to pursue MS and PhD degrees.

Dr. Concepcion also emphasized the need for qualified people to focus on research, instruction and technical services in agri-technology, aqua-technology, biotechnology, food technology, health technologies, social innovation, etc. She cited an on-the-ground estimate that an employee working in a micro, small, or medium enterprise (MSME) makes an average of Php15,000 per month. Meanwhile, farmers and fisherfolks, who are part of the poorest communities, make about Php 5,000 per month. According to her, the quality and quantity of products in these farming and fisherfolk communities could be significantly improved with advanced innovative technologies.

The performance indicators on human capital development, as evidenced by the number of MS and PhD graduates in S&T, have to be improved. The graduation data of the UP graduate programs in 2023 shows the need for much higher investment in human capital development.

**Figure 1.** Graduation Data of the UP Graduate Programs, 2023.<sup>10</sup>

Emphasizing the gravity of the situation, Dr. Concepcion calculated that the Philippines needs 37,490 full-time equivalent researchers at the MS and PhD levels for a population of 115 million.

Concluding her discussion, she proposed the following regarding advanced education in S&T:

### **Massive Postgraduate Master’s and PhD Study-Abroad Program**

- a. Massive investment in Master’s and PhD education and training programs for teams of Filipino researchers in leading universities and RDI centers of the world, particularly in the US.
- b. Competitive selection of the best tertiary level graduates from top SUCs in the regions, focusing in the priority areas of development as previously mentioned.
- c. A rational plan for providing scholarships to teams of postgraduate students rather than to individual students, to specialize in complementary disciplines required in the priority areas of development of a region or province.

<sup>10</sup> “Pagtatapos 2023,” University of the Philippines, July 24, 2023, <https://up.edu.ph/pagtatapos-2023/>.

- d. Attractive scholarship packages with incentives and a guarantee of employment in universities, research institutes, and private industry upon return to the region of origin.
- e. Completion of studies, with return and reintegration secured through the foreign mentors, the Department of Foreign Affairs (DFA), and S&T education and training agreements between the Philippine government and foreign countries.

Dr. Concepcion also provided a list of information that should be considered, including questions, guidelines, and incentives related to the implementation of a massive postgraduate foreign studies program. These include the following:

### **Feasibility of a Postgraduate Foreign Studies Program**

- a. US: Full PhD programs usually take four and a half to five years; Europe, Australia, Japan: Full MS programs take two years, while full PhD programs by research take three years and require an MS degree.
- b. Is it feasible to equally allocate slots among the seventeen regions?
- c. SUCs with MS programs can participate in this Foreign Studies Program.
- d. Industry-focused MS and PhD studies for thesis/dissertations.
- e. Industry representative should be involved in scholar recruitment, thesis proposal, and thesis defense stages.
- f. Implement of industry contract research, wherein industry partners provide scholarship and ensure employment.
- g. MS and PhD sandwich programs reduce both foreign study time and cost. For MS, the foreign study period is limited to one year, and for PhD, it is limited to two years, with the time primarily used for thesis.
- h. Appropriate incentives and assurance of employment to ensure completion of studies and return to regions should be put into place.

Dr. Concepcion clarified that the proposals and suggestions mentioned above are based on the assumption that these programs will get funding from the Philippine government and will not just depend on the financial assistance from external sources.

Finally, she recommended the establishment of a Philippine Advanced Technology Innovation Institute for Industry (PAT-III or PATI-CUBE). The models she envisions for the Philippines could be like the Max Planck Institute in Germany, the Rikken Research Center in Japan, and the Academia Sinica in Taiwan, along with some features of the Small Business Innovation Research (SBIR) in the US, in terms of providing research grants that have yielded numerous commercialization successes, including the explosive growth of the biotechnology industry over the last past decades.

The infrastructure for PAT-III or PATI-Cube would initially resemble a special economic zone, centrally located in an area where local and foreign industry locators are concentrated. The policy environment would include enabling procurement terms, tax exemptions, expert incentives under the Philippine Economic Zone Authority (PEZA) and Board of Investments (BOI), a new intellectual property regime, with world-renowned scientists—not just Filipino expatriates but foreign scientists—leading research teams. The institute would also offer MS and PhD programs in partnership with UP.

# Discussion 3

## **Dr. Jonel P. Saludes**

*Vice President for Research and Global Relations (VPRGR)*

*Professor of Chemistry and Director of the Center for Natural Drug Discovery and Development, University of San Agustin, Iloilo City*

Dr. Jonel Saludes, a 2015 Balik Scientist known for his work in small protein structure, small protein design, and drug delivery agent development for cancer cells, began his discussion by noting that he was only speaker in the RTD from a private higher education institution (HEI) and from the Visayas and thus will be speaking from this distinct perspective.

He first introduced the University of San Agustin (USA) as a university known for its flagship degrees in science and health, such as pharmacy and medical technology, due to its strong performance in the board examinations for these programs. USA, which is in Iloilo City, has a strong track record as a primarily undergraduate teaching university and celebrated its 120th anniversary in 2024.

He recalled that prior to 2015 the university was not known for research. USA was not the go-to university for expert consultation and collaboration, even in its hometown, in Iloilo City in Western Visayas. When he arrived in 2015, the university's only institutional research collaboration was with the Southeast Asian Fisheries Development Center (SEAFDEC).

Dr. Saludes said that within a few years, after the establishment of the Office of Research and Global Relations in 2015, the university forged ninety functional and productive partnerships, certified by memoranda of agreement and memoranda of understanding. These partnerships were not only with domestic academic centers but also with international industry firms and renowned universities. According to him, it is okay to start with nothing as long as you have the following:

This is the vision. This is the guiding principle. Just have the guts, have the vision, have the team of experts. As articulated earlier, human capital is very important. Even if you have the infrastructure, if you don't have the human capital, that infrastructure is nothing—it is useless. No people will

use that infrastructure. And administration is very important. Sec. de la Peña has been a personal witness [to] the commitment of the University President in transforming the University of San Agustin into what it is now, [than] it was in 2015.

He went further, stating:

When I was given the task in 2015, returning as a Balik Scientist, my first job was as the laboratory supervisor of what was supposed to be a research laboratory. Then, after a few months, the President mandated the creation of a research program. At that time, I had no idea what the university had looked like for the past 110 years. I was away for more than a decade. I had to start from scratch. The first questions were: what were the gaps in the university? Why had it remained a primarily teaching university for more than a century? These were just ideas that came about, and I showed to the University President the numbers.

Take note that the university is a private university. It does not benefit from the annual General Appropriations Act (GAA) of the Philippine government. Every single peso that is invested in something must have a Return of Investment (ROI). It is reliant on tuitions and fees. It does not receive support from the Department of Budget and Management (DBM) for the salaries of its employees. So, we have to set numbers.

We set up a timeline. We said we need to build an airport for the airplanes to land. This came from the idea on how Iloilo City was transformed from a laid-back, forgotten city of the past to what it is now. That airport, [and] the seaport, was instrumental in the transformation of the city into a business city that it is now.

Phase one, we needed to do something with the infrastructure. There was a research lab but there was no budget for research. Here's where the commitment of the administration to transform the university from a teaching to a research university. We needed to build a program even if the university would have to borrow funds to support it.

Dr. Saludes then talked the following experiences and lessons learned from the time he returned up to the present, when the University he serves now has several R&D Technical Services Centers with state-of-the-art facilities and equipment:

1. A small starting reward grant can attract more funding support if good financial stewardship is demonstrated.

2. Grantsmanship, a key skill in attracting external support, is learned through mentorship. It cannot be taught in the classroom.
3. One cannot work by himself; a team is needed. Teams also need to work in an inter-end cross-disciplinary manner.
4. Human resource development takes time. Persons cannot be transformed overnight.
5. Original and innovative ideas are important. In many cases, innovations produced are increment in nature. An institution can have hundreds of utility models, yet they may only contribute to incremental progress. Innovation is necessary, and not just incremental progress, to produce innovative products that are beneficial to the Filipino people.
6. Innovation research that leads to the production of tangible products need preliminary data. Additionally, preliminary ideas are important to demonstrate feasibility. These help ensure the success of a project.

Dr. Saludes also shared about their work that led to the creation of the Universtiy of San Agustin's centers. These include the following:

1. USA's Tuklas Lunas Development Center. First, they were able to get the support of the National Research Council of the Philippines (NRCP) for the first and only national survey on marine, sediment-derived actinobacteria (*bacteria sa buhangin*), which produce antibiotics that live in sands under the ocean. The survey was conducted from as far north as Batanes to as far south as Davao. The entire country was mapped for this bio-resource, which now contains more than 3,000 sources of potential antibiotics housed at the university. It will take several lifetimes to study the entire collection. Ultimately, this effort led to the selection of USA by DOST as a Tuklas Lunas Development Center for Western Visayas.
2. In 2019, USA's Center for Information was established after six months of work on bio informatics, health informatics, hospital informatics, and neuroscience. It was timely to set up this center that year because, by the following year, the COVID-19 pandemic hit the country and the rest of the world.

3. In May 24, 2022, the first and only mass spectrometry imaging laboratory was established at USA, with the support of DOST. This facility aims to help drug-discovery researchers identify in which organ drugs settle. Images, from brain to toe—whether in an animal or human sample—can now be easily obtained. This facility usually comes with a surgery room, as it can be used by doctors or surgeons for real-time monitoring during cancer surgery, particularly for the removal of cancer cells or cancer mass.
4. Also in May 2022, the first and only Nuclear Magnetic Resonance (NMR) laboratory with a cryoprobe NMR in the Philippines was established at USA, with the support again of DOST. The Philippines later became the fourth country in Southeast Asia to have this facility, following Singapore, Thailand, and Malaysia.
5. In March 1, 2022, the Center for Sustainable Smart Nanomaterials was established at USA, with support from DOST-PCHRD. This became a reality because a Balik Scientist expert in nanomaterials decided to join USA, demonstrating that where there is human capital, infrastructure will follow.
6. Realizing the importance of socially relevant research, USA created the Center for Heritage and Indigenous Cultures in 2017.

Finally, Dr. Saludes discussed the importance of gaining the buy-in of industry and the local government to ensure the utilization and commercialization of products and technologies derived from R&D. He again used specific examples from their experience at USA to illustrate this:

■ **Example 1: The Commercialization of Hanel and Skivios**

Hanel and Skivios are products developed at USA. They are skin antibiotics that use Philippine natural products. Hanel is produced from Philippine honey, and Skivios is produced from the Ilonggo legume called *kadyos*. The R&D for Hanel was sponsored by USAID<sup>11</sup>, while the R&D for Skivios

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11 USAID stands for U.S. Agency for International Development. To know more about the agency, visit: <https://www.usaid.gov/>.

was sponsored by DOST<sup>12</sup>. At the start of the research conceptualization stage, the industry partner was already engaged. Since they have a stake in the success of the products, they see to it that the ideas become a reality and are translated into products that can reach the people who need them. Both Hanel and Skibios are now Food and Drug Administration (FDA) and Intellectual Property Office (IPO) field-registered and commercially available nationwide at Rose Pharmacy, Mercury Drug, and for those fond of online shopping, on Shopee and Lazada.

■ **Example 2: Tawa-tawa, Turmeric, and a Nanomaterial**

Tawa-tawa, turmeric, and a nanomaterial to be used for portable water desalination are in the works. The portable desalination will enable people in the geographically-isolated and disadvantaged areas (GIDAs) to source their own water from seawater. The LGU of Iloilo province already has a buy-in and is supporting the mass production of this product<sup>13</sup>.

■ **Example 3: Peri-health for Remote Consultation**

Peri-health for remote consultation is a project supported by the Asian Development Bank that is now operational. For indigenous peoples living in GIDAs, this service is just one call away. The community health workers have been trained, and consultations are provided 24/7. Currently, the service is now serving 6,000 residents.

In summary, Dr. Saludes' recommendations are as follows: 1) continued human capital acquisition and development, 2) a direct link between scientists and industry, 3) continuous innovation and R&D, 4) continuous learning, whether incrementally and by leapfrogging, and 5) keeping service to the people in mind.

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12 To know more about Skivios, visit this link: [https://usa.edu.ph/celebrating-the-success-of-skivios-a-significant-milestone-for-usa-highlighted-during-the-42nd-dost-pchrd-anniversary-at-picc/?utm\\_source=chatgpt.com](https://usa.edu.ph/celebrating-the-success-of-skivios-a-significant-milestone-for-usa-highlighted-during-the-42nd-dost-pchrd-anniversary-at-picc/?utm_source=chatgpt.com).

13 Retrieved from <https://www.iloilo.gov.ph/en/education-news/iloilo-provincial-government-awards-top-researches-innovations-science-technology>.



# Reactions

## Maridon O. Sahagun

### *Reactor 1*

*Undersecretary, Office of the Undersecretary for Scientific and Technical Services (OUSEC-STS)*

*Department of Science and Technology (DOST)*

Undersecretary Maridon O. Sahagun began by quoting the mandate of DOST in building capacity in science and technology:

DOST is a key player in the Philippine innovation system in moving the building and gaining of national capability in STI. This is a given in the mandate to direct, lead, and coordinate the country's scientific and technological efforts towards maximum economic and social benefit for the people.

She said that, in the latest DOST strategic plan, under the leadership of Secretary Renato U. Solidum Jr., this mandate is incorporated into DOST's vision of being the leading enabler and provider of STI-driven solutions towards national development. Innovation is part of this vision in order to emphasize that science and technology are valuable inputs in coming up with new knowledge, products, services, and processes that can be offered to end users. Nevertheless, while excellence in science and technology is important, she emphasized that it is not enough. This must be communicated and widely applied to continuously create positive changes the country needs.

Undersecretary Sahagun also emphasized that building and gaining national capability will continue through the four pillars or aspirations of the DOST. These pillars are the following: promotion of human well-being, creation of wealth, protection of wealth, and sustainability.

In order to build and gain national capability, there must be a balance between developing national competence in science and technology and producing a sizable number of STI products and services that can address present and future needs of industry and the country. Necessary feeders, in terms of human capital, infrastructure, and financial resources, must be ensured to create an impact on the country's innovation ecosystem. According to Undersecretary Sahagun, this means continued support to scholarship programs, from

secondary specialized science high schools to the Philippine Science High School System, as well as the undergraduate and graduate scholarship programs and the sending of graduate scholars abroad.

In relation to sending graduate scholars abroad, 492 scholars were sent to twenty-five countries from 2018 to 2023. Undersecretary Sahagun stressed that the country no longer relies on outside funding or grants to send scholars abroad. It is now a purposive action on the part of DOST.

Additionally, Undersecretary Sahagun shared that there is now a deliberate program to improve the business acumen of the scientific community. Technopreneurship is now being taught to science and technology students, including Philippine science high school or PSHS students. Senior high school students are already producing significant R&D outputs that are publishable, patentable, and marketable. She added that the expanded technology business incubation program of DOST includes a “super accelerator program.”<sup>14</sup>

### *Other Developments*

Undersecretary Sahagun concluded her remarks by enumerating the following DOST programs for STI capability building:

1. The National Youth Festival of Science, Technology, and Innovation
2. Expanded Technology Transfer and Commercialization Program
3. The establishment of Knowledge and Innovation Parks for Science and Technology (KIST Parks) in universities, in partnership with PEZA

The first KIST park was established at BatSU. A company in a KIST Park signifies that there is already an engagement between the university and industry.

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14 DOST launched “Super Accelerator Program” to boost the growth and competitiveness of the technology industry in the Philippines. It is a holistic platform aims to provide a diverse array of services and resources to eligible science and technology start-ups and other enterprises enabling them to innovate, grow, and compete in the global market. Retrieved from: <http://www.tapi.dost.gov.ph/443-entering-the-international-tech-space-what-s-next-for-dost>.

#### 4. Smart and Sustainable Cities and Communities Program

This program, in partnership with LGUs, aims to showcase the development of cities into smart, resilient, and inclusive communities. This also includes a stronger STI ecosystem, as LGUs are assured of a larger income share (Mandanas Ruling), and digitalization is adopted as a strategy among smart and sustainable communities.

#### 5. An Expanded Balik Scientist Program and Sustainable Cities and Communities Program

#### 6. International Cooperation and Linkages

This program is a major contributor to building national capability in STI.

Lastly, Undersecretary Sahagun highlighted the constraints encountered in the STI system. These include limited government funding, outdated laws that present tremendous bottlenecks for researchers, and limited private sector support.

## **Dr. Deo Florence L. Onda**

### ***Reactor 2***

*Associate Dean for Research, Development, Innovation, and Enterprise  
College of Science, UP Diliman  
Associate Professor of Marine Science*

For Dr. Onda, building and gaining capability for STI in the country requires including the younger generation in the conversation for they are the future of the country and key to sustainability. The younger generation will be responsible for further developing and enhancing S&T. He emphasized that, at the end of the day, the progress of S&T in the country ultimately depends on human resource and its development.

Dr. Onda mentioned that, in UP Diliman, around 63 percent of research personnel are REPs (Research and Extension Personnel), project staff, administration staff, and non-UP contractual employees. He stated:

The REPs, together with graduate students, are actually the biggest pool of recruits available. We want to make sure that the environment, the training,

and the mentoring of this pool of researchers continue. Thus, looking at the situation of the REPs, as well as the researchers at the university, is very, very important.

Dr. Onda then discussed two things that are needed, in addition to building and gaining capability in STI. First, he asked how trained manpower can be retained, as not all recruits stay. The primary concern, he said, is getting them to stay and retaining them. In reality, many young people who graduate with advanced degrees are given so much administrative workload, which takes away their time for research.

Second, he cited limited research grants as another concern. In relation to this, he stated:

There is not much research grant available for early-career and mid-career researchers. Whereas, [when] you go to DOST, at [the] national level, as a young researcher, you actually compete with more seasoned researchers. There is an ongoing joke [among] the young cohort of scientists right now that to actually get funding in the Philippines as a young researcher, it's not about what you know; it's who you know. You need to put a name that is very popular or a more senior scientist in your proposal to increase the chances of it being funded. This limits the opportunities for the younger scientists to do their own research. It is something that needs to be looked into. Young scientists relatively do not have much experience, and so to look for experience for them to be given a research grant is, I think, a futile exercise.

Additionally, Dr. Onda emphasized the following points:

1. The ability to do research is different from the ability to manage research. There are many graduate researchers, but not many good research managers. Managing research entails managing people, managing funds, communicating research results, and communicating science. Not all scientist can do that. To address this, the UP Diliman College of Science has developed a training program that will allow Masters and PhDs to be familiar with the research landscape in the Philippines, particularly at UP, enabling them to package their research into research proposals. When they graduate, they will not just be bringing their theses and those of their mentors, but also research proposals, along with a strong network of

other scientists who can help them implement their projects. These little initiatives can help further develop the young pool of scientists.

2. The country not only needs to create researchers, but also to deploy them to different parts of the country where there are very relevant areas of and adequate facilities for research. However, Dr. Onda said that young researchers do not seem to be interested to go to these places for various reasons. An example is the case of Mindanao State University (MSU) Tawi-Tawi, where research on seaweeds is underway and laboratories with up-to-date equipment have been set up. Yet, young researchers do not find it interesting to go there. The pool of experts and researchers are mostly in Mega Manila and other metropolitan cities, although there are still many things that need to be done in the countryside. According to Dr. Onda, other state universities and colleges are invited to the UP Diliman College of Science to inform and to offer opportunities in their localities to the graduating batch.
3. The perception that scientists are not assured of a good life in the country is a problem. Parents often dissuade their children from pursuing a career as a scientist. Dr. Onda attributes this to the fact that scientists are not as visible to the public as other professions. According to him, the work of a scientist needs to be showcased on television and other platforms to increase public appreciation of the profession. In the case of UP Diliman College of Science, they conduct more outreach programs to ensure greater visibility for scientists. Dr. Onda also pointed out what needs to happen to ensure that scientists can live a good life: scientists must be heard. They should hold government positions so they can participate in the decision-making process. He added that scientists must be treated with dignity, and become part of the decision-making process. We need to do that so that we can also tell the younger generation that we are important.

Dr. Onda concluded his remarks by stating that, in all of these plans and dreams, there should be policy support. To emphasize this point, he cited a concrete example:

For example, the country has 82 percent of its territory underwater. The Philippines is a maritime country, and yet has less than 50 oceanographers. When we talk about the blue economy, we talk about exploring the waters and exploring the resources we have underwater, but how many vessels do we have to actually do expeditions? We need policies for this. We need

enabling policies that will support not just the manpower but also the resources, facilities, equipment, and everything else that scientists actually need.

Dr. Onda emphasized the need to create a more enabling environment and ensure that all policies are aligned toward making UP a research university. He ended his discussion by highlighting the term “consciencia”<sup>15</sup> to stress the importance of creating and generating the tools that serve the Filipino people through science.

## **Atty. Jose Maria "Joey" Ochave**

### ***Reactor 3***

*Senior Vice President, United Laboratories (UniLab, Inc.)*

Atty. Jose Maria "Joey" Ochave started his discussion by stating that his views are personal and not, in any way, the view of the companies to which he belongs, and that his views on STI are limited to the prism of health care. He mentioned that his background is in chemical engineering and law, both degrees earned at UP. He also cited his involvement at DOST as a governing council member of the PCHR.D.

He then described the company he belongs to, UniLab, Inc., as having ten manufacturing facilities in the Philippines, three in Indonesia, one in Thailand, and one in Vietnam. According to him, these facilities are affiliates, but they are basically in one group.

He also mentioned that he has visited numerous pharmaceutical manufacturing plants around the world. Serving as a technical inspector, negotiator, and signatory to agreements, his plant visits spanned Latin America, Europe, Japan, Korea, and India, which he noted has now become a pharmaceutical powerhouse.

Atty. Ochave then discussed the development of Bangladesh, where he recently visited eight manufacturing facilities. According to him, while Bangladesh

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15 “Consciencia” is Dr. Onda’s term that takes off from the English word, “conscience,” and the Filipino translation, “konsensiya.”

is seen as a poor country, it is actually rapidly growing. As an indicator, 98 percent of the drugs used in Bangladesh are manufactured domestically, and those manufacturers are certified by the European Union (EU) and Good Manufacturing Practices (GMP) for their facilities. He reviewed the organizational charts of these manufacturing facilities and noted that, in one company alone, there were 650 pharmacists out of a total of 2,500 employees. He then asked: why do they have so many pharmacists and engineers?

By way of answer, he shared lessons from other countries' experiences and recommendations for the Philippine STEM community, especially industry.

### **Lesson 1**

Many of the companies that set up pharmaceutical operations in Bangladesh were large garment companies that later branched out and diversified their investments in the country, initially adopting a global mindset towards competition. For him, Philippine-based companies should adopt this mindset. In his opinion local companies are so secure that there is no incentive for them to go out and compete elsewhere. Some exceptions include the International Container Terminal Services, Inc. (ICTSI) in port operations, UniLab, Inc. in pharmaceuticals, and Oishi and Jollibee in food. The reason for this phenomenon, he said, is the attitude of seeking a safe return of investment (ROI), which usually means building shopping malls. This, however, has resulted in making the country a nation of shopkeepers.

### **Lesson 2**

Atty. Ochave said that industry-academe linkaging has mainly been token efforts. Industry initiatives with universities are usually limited to their corporate social responsibility (CSR) program, which is not sustainable. For industry-academe linkages to work in a developing country, he then recommended for companies to integrate CSR as an integral part of its business model, and not treat these as an external affair.

### **Lesson 3**

Start-up companies that conduct R&D or adopt technologies from R&D often fail to scale up because they usually go into production without a complete understanding of regulatory requirements. This is particularly true for health care products. He stated: "If you have a pharmaceutical product and you cannot register with the FDA, that is money thrown away."

#### Lesson 4

The need for ROI on investments in innovation, particularly product innovations, makes big private universities and colleges better candidates for sustainability. In contrast, state universities and colleges, according to observation, do not have an ROI objective when conducting R&D. In their proposals, most SUCs allocate budget for laboratory equipment, which is primarily intended for student use in their courses.

#### Lesson 5

Many Filipinos do not fully understand the meaning of innovation. When they think of innovation, all they can think of are iPads, iPhones, and other related technologies. Innovation involves painstaking work, iterations, and much more.

#### Lesson 6

Atty. Ochave emphasized the importance of fully understanding patents in order to succeed in conducting R&D and innovations. Knowing how patents work is a fundamental concept that should be taught to students.

### ***Recommendations***

#### **Understand and Use Patents**

First step, we'll give a prize to anyone who will do a patent search. Focus on a patent and put that into practice. *Yun lang yun* [That's it]. So, I will ask you: *Sige nga, gawin mo yan, as described in the patent* [Go ahead, do what is described in the patent]. Now, if you can do that, I will then ask you, what are the other patents relevant to that particular invention?

I am fully in agreement with Dr. Saludes when he mentioned the utility model patents. *Utility models ay sa mga nag-uumpisa pa lang* [Utility models are for those who are just starting out]. Those are not real innovations. Innovation patents are different from utility model patents. *So, yun muna.* [That's the first step.] We'll give a prize to the best person who can copy a patent. *But, alam din niya dapat what are the relevant patent literature* [They should also know the relevant patent literature]. So, they should come up with the relevant patent literature for that invention. And that's a global search. You can go to the US Patent and Trademark Office (USPTO) and European Patent Office (EPO).

*Doon ang punta noon, hindi dito sa IPO lang. Kasi normally, yung isang na-submit dito, na-submit na doon* [That’s where you should go, not just the IPO here. Because normally, something that’s been submitted here has already been submitted there].

### **Make Improvements and Reduce Costs**

After the initial innovation, the next step is to make improvements and reduce costs in order to make the product or technology superior. According to Atty. Ochave, patent searches can teach the fundamentals.

### **Reinvent STEM Education**

Atty. Ochave recommended the reinvention of STEM education. Private industry sector must engage with schools and universities through real partnerships—from curriculum design to faculty development and compensation, all while ensuring inclusivity, proper branding, and aligned standards. With this strategy, it will no longer matter where the school or university is located; learning outcomes, diagnostic tests, and the quality of graduates will be assured. This approach democratizes quality education, supported with state-of-the-art laboratories built by industry partners.

### **Break Barriers**

Atty. Ochave stressed the need to break barriers, particularly geographical barriers, in order to attract the best minds to teach STEM courses. According to him, this can be achieved by having adjunct professors from around the world, including Balik Scientists, with instruction delivered virtually. Students at multiple locations would be able to listen, interact, and learn simultaneously from these global adjunct professors, who will share their knowledge and expertise. Additionally, part of reinventing STEM programs involves universities continuing to support students even after graduation.

### **Make the STEM Profession “Sexy”**

Atty. Ochave advocated making the STEM profession “sexy.” He posed the question: in basketball, they sought potential varsity players even while the prospects are still in senior high school. Why isn’t the same happening for future scientists? According to him, many bright STEM students do not have scholarships because they do not know how to access them. He added that organizations, firms, and institutions that will need and benefit from scientists

in the future should take the initiative to look for promising individuals and support them not only through scholarships but with other forms of development assistance. He expressed hope that the private sector will engage in this manner, making it part of their business model and moving beyond the usual tokenism.

### **Proactively Collaborate with Industry and Government**

Atty. Ochave said that private universities and colleges seem better at marketing their programs that are industry- or sector-focused for collaboration with both industry and government. He cited the creation of the Center for Excellence in Drug Research, Evaluation and Studies, Inc. (CEDRESS)<sup>16</sup> as an example. It went to the University of Santo Tomas (UST) because the university was willing to invest around 20 percent in the center.

To end, Atty. Ochave summarized his discussion into the following points:

1. Innovation can be any solution, and not just product innovation.
2. The more sustainable and impactful innovations are business and social innovations.
3. Innovations happen when financial resources are limited, and yet there is still demand for ROI.
4. When ROI targets are imposed, costs are carefully monitored and controlled, and more conscious effort is exerted in the attainment of expected results.
5. The true test of any innovation is its success in the market. Once in the market, another test is whether it will be utilized or not.
6. He warned of innovations—both products and devices—that are created only for conferences or resume-building, with no real demand.

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<sup>16</sup> Before changing its name in 2014, The Center of Excellence in Drug Research, Evaluation and Studies, Inc. (CEDRES) used to be the University of Santo Tomas Center for Drug Research Evaluation and Studies (UST CeDRES). UST CeDRES was established in 2004 as a joint venture between UST and Chemfields, Inc. To know more about the center, visit: <https://www.cedres.ph/>.

## Closing Remarks

Dean Maria Antonia Tanchuling of the UP College of Engineering delivered the closing remarks. As previously-mentioned, the UP College of Engineering is a co-organizer of the RTD series on “Moving Filipinnovation Forward.”

Dean Tanchuling remarked that everyone in the RTD has learned from the different perspectives and insights from the speakers. She noted that there was a broad representation among the discussants, reactors, and participants, including those from universities (both state and private)—industry, young and promising researchers, and the government. She also mentioned that there were many problems, realities, and challenges presented during the RTD. Nevertheless, it ended on a positive note.

Dean Tanchuling shared that the UP College of Engineering is deeply committed to building the capacities of the Science and Technology sector. She recognized that UP cannot do it alone; there is a need to build a network of universities that will produce more graduate degree holders, both MS and PhD, so that the country can meet its targets—particularly in terms of the research density needed for sustainable industrialization. This will involve collaboration with other state universities and colleges (SUCs) and higher education institutions (HEIs), different industries, and government agencies. Dean Tanchuling mentioned that she would initiate discussions with Atty. Ochoa on how to combine ideas, such as integrating private universities with SUCs.

In closing, she announced that the UP College of Engineering will also conduct a RTD and focus group discussion (FGD) to explore a grand plan that PCCI Chairman Barcelon referred to as “GIANT STEPS” in the coming years. She ended by saying, “Hopefully we will see ourselves industrialized and we will realize that dream.”

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# **Center for Integrative and Development Studies**

Established in 1985 by University of the Philippines (UP) President Edgardo J. Angara, the UP Center for Integrative and Development Studies (UP CIDS) is the policy research unit of the University that connects disciplines and scholars across the several units of the UP System. It is mandated to encourage collaborative and rigorous research addressing issues of national significance by supporting scholars and securing funding, enabling them to produce outputs and recommendations for public policy.

The UP CIDS currently has twelve research programs that are clustered under the areas of education and capacity building, development, and social, political, and cultural studies. It publishes policy briefs, monographs, webinar/conference/forum proceedings, and the Philippine Journal for Public Policy, all of which can be downloaded free from the UP CIDS website.

## **The Program**

The Political Economy Program (PEP) seeks to advance innovation-driven and equitable development through the conduct of problem-solving research on development policies and practice; the promotion of collaboration among the academe, government, industry, and other stakeholders in pursuit of inclusive technology and sustainable industrial policy; and the popularization of the political economy framework in the national conversations on policy options.

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