



7 March 2024

**Dear Researchers and Partners:**

The Philippine Council for Industry, Energy and Emerging Technology Research and Development (DOST PCIEERD) is joining the Call for Concept Proposals of the Department of Science and Technology (DOST). Submission of concept proposals for the said Call will start by 8:00 a.m. on 1 March 2024 until 5:00 p.m. of 15 March 2024. More specific details about the Call themes are attached as Annexes A and B. This can also be viewed at the PCIEERD website <http://pcieerd.dost.gov.ph>.

For those who are interested to submit proposals, below is the evaluation timeline for the 2024 Call

Submission of Concept Proposals to the Councils	March 1-15, 2024
Councils Evaluation of Submitted Concept Proposals and Notification of Approved Concept Proposals	March 16-31, 2024
Inter-Council Deliberation of Submitted Concept Proposals	March 22, 2024
Preparation of Full-blown Proposals	April 1-30, 2024
Submission of Full-blown Proposals through	May 1-31, 2024
Evaluation of Full-blown Proposals	June 3 - July 30, 2024
Governing Council schedule	July 8-12, 2024
DOST-GIA EXECOM Marathon	July 31 - August 02, 2024

Should you need clarification or further information, please do not hesitate to send email to Ms. Carlota P. Sancho or Ms. Jillfell Faith SD. Pardilla at [cpsancho@pcieerd.dost.gov.ph](mailto:cpsancho@pcieerd.dost.gov.ph) and [jillfell.pardilla@pcieerd.dost.gov.ph](mailto:jillfell.pardilla@pcieerd.dost.gov.ph), respectively.

Thank you for your usual support and we hope to collaborate with you through the R&D funding support and other programs being offered by the Council.

Thank you.

Very truly yours,

  
**DR. ENRICO C. PARANGIT**  
 Executive Director

/PCMD

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

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## Funding opportunity title

DOST and PCIEERD Grants-in-Aid (GIA) Program Call for Concept Proposals for CY2026 Funding

## Key information

Type of funding	Grant
Funding Agency	DOST-Philippine Council for Industry, Energy and Emerging Technology (DOST-PCIEERD)
Co-funder(s) <i>External agencies</i>	Department of Science and Technology of the Philippines (DOST)
Add link to start the application	<a href="https://capsuleproposals.pcieerd.dost.gov.ph/auth/login">https://capsuleproposals.pcieerd.dost.gov.ph/auth/login</a>

## Timeline

Event	Date	Time
Opening date	March 1, 2024	8:00 A.M.
Closing date	March 15, 2024	5:00 P.M.
Evaluation Period of Submitted Concept Proposals and Notification of Approved Concept Proposals	March 16-31, 2024	
Preparation of Full-blown Proposals	1- 30 April 2024	
Submission of Full-blown Proposals through the DPMIS	1-31 May 2024	
Evaluation of Full-blown Proposals	3-30 July 2024	
DOSTGIA EXECOM Marathon Meetings	31 July 02 August	

## Overview

The Department of Science and Technology (DOST) and the DOST-Philippine Council for Industry, Energy and Emerging Technology Research and Development (DOST-PCIEERD) are ready to accept research and development (R&D)/Science and Technology (S&T) Concept proposals for 2024 for CY 2026 funding. This Call for Concept Proposals is aligned with AmBisyon Natin 2040, from which the DOST Strategy Framework for 2023-2028 is derived. It also aligns with the Harmonized National R&D Agenda (HNRDA) for 2022-2028 and PCIEERD's Roadmap and Action Plan (2021-2028) which is clustered into a program agenda called NEXUS or Nurturing Exemplars of Unified Scientific Solutions.

## Opportunity summary

This funding opportunity encourages S&T collaboration and applied research among Higher Education Institutes (HEIs), government Research and Development Institutes (RDIs), and non-profit S&T networks and organizations seeking funding for their R&D/S&T initiatives.

## Who can apply

Any public and private universities and colleges, Research and Development Institutes (RDIs), R&D Consortia, non-profit laboratories, other public or private non-profit S&T institutions located in the Philippines with proven competence may apply for GIA support of DOST and DOST-PCIEERD and its grant-giving units, provided that projects fall under the specific research areas with overall goal to benefit Filipinos. Non-profit S&T organizations are those, which: (1) are operated primarily for scientific, educational, service, or similar purposes in the public interest; and (2) are not organized primarily for profit. Non-profit organizations engaged in lobbying activities are not eligible to apply.

## What we're looking for

Proposals to be submitted and or funded under this announcement must demonstrate the advancement of Science and Technology, alignment to government's economic policy direction and fall under at least one of the DOST-PCIEERD Priority Programs identified in **Annex B**.

### **Eligible costs**

Except for projects involving public good, the applicant's organization shall provide at least 15% counterpart funding, in cash or in kind, while the remaining cost shall be covered under the Grant. Only eligible and allowable costs may be used for counterpart fund and/or in-kind contribution (ex. utility costs, office space rental, etc.), as determined by DOST-PCIEERD. The proposal must describe how the applicant will provide the counterpart fund/in-kind contribution and the role that the Grant will play in the overall project.

The requested budget shall be itemized following the DOST Form 4-Project Line-Item Budget. The grant may cover the partial or full cost of the project, both direct and indirect costs which shall include personnel services, maintenance and other operating expenses, and capital outlay that are an integral part of the project. All expenditure items shall be in accordance with the Unified Account Code Structure (UACS) and relevant provisions as shown in Section IX, B. Line Item Budget Preparation of AO 011 series of 2020 Revised Guidelines for the [Grants-in-aid Program of the Department of Science and Technology and its Agencies](#).

Capital or infrastructure expenditure is not an eligible cost under the Grant as well as fees and/or stipends associated with Master and PhD studentships.

## How to apply

Applications should be submitted through the DOST PCIEERD Concept Proposal System (eProposal System) <https://capsuleproposals.pcieerd.dost.gov.ph/auth/login> from 8:00 am of March 1, 2024 to 5:00 pm of March 15, 2024.

Proposals submitted after the deadline will not be considered. Applicants are encouraged to leave enough time for proposal inputting in the eProposal System before this date.

When submitting your application, please follow these steps:

1. Log-in to PCIEERD E-Proposal System
2. Input Registered and Verified Email and Password
3. Fill out required fields
4. Submit

The following will automatically be disapproved:

- 1) Proposals from organizations that are not qualified to submit during this Call;
- 2) Proposals outside the priority areas of the Council; and
- 3) Proposals not submitted through the DOST PCIEERD eProposal System

### Documents Required

As a summary, your application should include the following documents.

- 1) DOST Program Concept Proposal Form
- 2) DOST Project Concept Proposal Form

## Document Summaries

### 1) DOST Program Concept or DOST Project Proposal Format

Applicants shall follow the DOST Concept Program Proposal Format which will be accomplished in the PCIEERD eProposal system:

<https://capsuleproposals.pcieerd.dost.gov.ph/auth/login>

The manual for submission is accessible through the link:

<http://tinyurl.com/PCIEERDeProposalSystemManual>

### **Example of a DOST Concept Program Proposal Format:**

#### **I. Concept Program Proposal Summary Information**

1. Program Title
2. Program Duration
3. Estimated Budgetary Requirement
4. Principal Research (Question to be Addressed by the Program (maximum of 100 words))
5. Program Leader

#### **II Program Proposal**

<b>1. Title of Component Projects</b>	<b>2. Project Leader/Designation and Institutions</b>	<b>3. Estimated Budgetary Requirement</b>
Project 1.		
Project 2.		

**4. Program Summary** (Please briefly describe your proposed research project ensuring the clarity of the scientific rationale; the deficit, needs, gaps or problems to be addressed; significance of the research and the solutions/benefits that it will offer; and relevance to the Philippine context. Include basis of problem identification (i.e., roadmap, value chain, industry request, etc.). Explicitly identify the objectives of the project and its target accomplishments and outputs. (Maximum of 1,500 words).

<b>5.</b>	<b>Submitted by: (Program Leader)</b>
Signature	
Printed Name	
Designation/Title	
Date	

### **Example of a DOST Concept Project Proposal Format:**

**I. Concept Project Proposal Summary Information**

1. Project Title
2. Project Duration (in months)
3. Estimated Budgetary Requirement
4. Principal Research Question to be Addressed

**II. Project Leader Profile**

1) Name	2) Position	3) Organization	4) Department/ Division	5) Contact Details (telephone number, email)
6) Other Ongoing Projects Being Handled by the Project Leader: ____ (number)				
Title of the Project		Funding Agency		Involvement in the Project

**III. Project Profile**

1. Cooperating Agency/ies (indicate role/responsibility of cooperating agency)		
2. Site (s) of Implementation (Municipality/District/Province/ Region)	Base Station:	
	Other implementation sites:	
3. R&D Program	Basic	Applied
a) Agriculture, Aquatic and Natural Resources		
b) Health		
c) Industry, Energy and Emerging Technology		
d) Disaster Risk Reduction and Climate Change Adaptation		
4. DOST Pillars Pursued (Check all that apply)  <input type="checkbox"/> Human Wellbeing <input type="checkbox"/> Wealth Creation <input type="checkbox"/> Wealth Protection <input type="checkbox"/> Sustainability	(5) DOST Thematic Areas Covered (Check all that apply) <input type="checkbox"/> Learning, Education, and Culture <input type="checkbox"/> Health and Wellbeing <input type="checkbox"/> Food and Agriculture <input type="checkbox"/> Industrial Solutions and Competitiveness Development <input type="checkbox"/> Transport and Mobility <input type="checkbox"/> Energy and Utilities System <input type="checkbox"/> Environment & Natural Resources <input type="checkbox"/> Climate, Disaster Resilience, and Human Security <input type="checkbox"/> Governance <input type="checkbox"/> Others (please specify): _____	

**(6) Project Summary-** (Please briefly describe your proposed research project ensuring the clarity of the scientific rationale; the deficit, needs, gaps or problems to be addressed; significance of the research and the solutions/benefits that it will offer; and relevance to the Philippine context. Include basis of problem identification (i.e., roadmap, value chain, industry request, etc.). Explicitly identify the objectives of the project and its target accomplishments and outputs. (maximum of 1,500 words)

<b>7) Submitted By</b>	(Project Leader)
Signature	
Printed Name	
Designation/Title	
Date	

## How we will assess your application

### A. Review and Selection Process

The Capsule proposals shall be evaluated according to the following:

Eligibility Criteria	Yes	No	Remarks
Is the proposal aligned with the roadmap/call for proposal?	/		
Are the sectoral needs identified? (N)	/		
Does the proposal solve or partially solve the identified problem? (S)	/		
Does the proposal identify how it is different from existing technologies? (D)	/		
Are the benefits identified? (B)	/		
with pending liquidation (until EO donation, if applicable)		/	

**Needs** - State the research problem and significance of the project to the current needs of the country

**Solutions:** The research must also include compelling solutions. (What is the proposed solution? Would it satisfy important needs? How would it satisfy the needs?)

**Differentiation:** Technologies from the research proposal must make differentiation from the current/available technologies. (Compare with competitive or substitute solutions/technology, what is the differentiation of what is being proposed? What are its advantages? Its Unique features?)

**Benefits** - The benefits from the research proposal must be taken into consideration. (What are the benefits that can be perceive/receive after using the solution?)

## Contact

DOST-PCIEERD Project Managers are available to provide appropriate assistance to potential applicants interested in competing for this Call for Concept Proposals. This may include assistance to potential applicants in determining eligibility of the applicant or the applicant's proposed concept proposal for funding, questions about administrative issues relating to the submission of a concept proposal, and clarifications on the announcement.

Contacts:

**Energy and Utilities Systems Sectors:**

Engr. Nonilo A. Peña, [napena@pcieerd.dost.gov.ph](mailto:napena@pcieerd.dost.gov.ph)

**Industry Sectors:**

Ms. Mary Grace Buenavides [mgbuenavides@pcieerd.dost.gov.ph](mailto:mgbuenavides@pcieerd.dost.gov.ph)

**Emerging Technologies Sectors:**

Ms. Edna C. Nacienceno, [ecnacienceno@pcieerd.dost.gov.ph](mailto:ecnacienceno@pcieerd.dost.gov.ph)

**Special Concerns:**

Environment; Creative- Footwear, Furniture, Jewelry, Heritage Innovation Program

Ms. Mary Grace G. Buenavides

Creative-animation, game, and film

Ms. Edna C. Nacienceno

DRR-CCA

Engr. Nonilo A. Peña

Science Communication Sector

Mr. Mark Ivan Roblas [markivan.robblas@pcieerd.dost.gov.ph](mailto:markivan.robblas@pcieerd.dost.gov.ph)

For **general inquiries related to the Call Guidelines**, the applicant may contact:

Ms. Grace F. Estillore, Policy Coordination Division

[gfestillore@pcieerd.dost.gov.ph](mailto:gfestillore@pcieerd.dost.gov.ph)

## Additional information for the submission of Full-Blown Proposals

[PCIEERD Eligibility Criteria Checklist](#)

[PCIEERD Management Team \(PMT\) Evaluation Criteria/Score sheet](#)

[PCIEERD Technical Panel \(TP\) Evaluation Criteria/Score sheet](#)

[PCIEERD Governing Council \(GC\) Evaluation Criteria/Score sheet](#)

## List any supporting documents you will provide

References for PCIEERD-supported projects:

<http://projects.pcieerd.dost.gov.ph/>

<https://pcieerd.dost.gov.ph/library/annual-reports>

<https://pcieerd.dost.gov.ph/supported-programs-projects/supported-programs-and-projects/on-going-projects>

<https://pcieerd.dost.gov.ph/supported-programs-projects/supported-programs-and-projects/completed-projects>

## List any related content links

[AO 011 series of 2020] [Revised Guidelines for the Grants-in-aid Program of the Department of Science and Technology and its Agencies](#)

[AO 13 S. 2021] [Amendment to DOST Administrative Order No. 011, Series of 2020, otherwise known as the "Guidelines for the Grant-in-Aid \(GIA\) Program of the Department of Science and Technology \(DOST\) and its Agencies"](#)

[AO 17 S. 2021] [Amendment to DOST Administrative Order No. 011, Series of 2020, otherwise known as the "Guidelines for the Grant-in-Aid \(GIA\) Program of the Department of Science and Technology \(DOST\) and its Agencies"](#)

[DPMIS – Proposal Submission Guide](#)

PCIEERD Sectoral Roadmaps: <https://pcieerd.dost.gov.ph/library/road-maps>



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DEPARTMENT OF SCIENCE AND TECHNOLOGY  
**PHILIPPINE COUNCIL FOR INDUSTRY, ENERGY AND  
EMERGING TECHNOLOGY RESEARCH AND DEVELOPMENT**

# 2024 CALL FOR PROPOSALS FOR CY2026 FUNDING





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## OVERVIEW

The Call for Proposals by DOST-PCIEERD is aligned with *AmBisyon Natin 2040*, from which the DOST Strategy Framework for 2023-2028 is derived. It also aligns with the Harmonized National R&D Agenda (HNRDA) for 2022-2028 and PCIEERD's Roadmap and Action Plan (2021-2028) which is clustered into a program agenda called NEXUS or Nurturing Exemplars of Unified Scientific Solutions.



Innovation ecosystems require specific attention especially when faced with fast-developing emerging industries that closely link science, technology, and business. Therefore, innovation capacities of a multi-layered innovation ecosystem that involves science, technology, and business ecosystems, contribute to the creation of new knowledge, and then utilization of that knowledge to boost the prosperity of the people, society and to provide solutions to the various issues facing the country.

Further, it is also important that policies are in place to support the creation of vibrant and productive science and technology (S&T) knowledge hubs, anticipating that such value-adding discoveries will be converted into the mainstream of the business economy or in being utilized by the community or other intended beneficiaries.

The NEXUS consists of three essential pillars, *i.e.*, Harnessing S&T Capabilities, Fusing Technologies and Business, and Establishing an Enabling Policy Environment. There are complementing components driven by S&T initiatives which contribute to the rationale and aspirations of the program. These are:

1. Providing S&T Interventions for Resilient and Sustainable Communities- This program provides for the development of scientific and technological interventions that contribute to resilient and



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sustainable communities by considering and addressing multiple human needs, reflecting the interdependence of economic, environmental, security and social issues.

2. Providing S&T Interventions for Industry Productivity and Competitiveness - This program provides for the development of scientific and technological interventions that contribute to the industries' productivity and competitive advantage
3. Enabling/Development of Core Technologies - To spur innovation and transformation in the country, PCIEERD provides support and S&T interventions for the development of enabling core technologies and solutions for the emerging industries, energy, and infrastructure sectors to solve the challenges of today and tomorrow. PCIEERD will continuously harness and develop new and emerging technologies on the horizon.
4. Science Communication for Innovation - Communication of scientific information with potential users and the public is an important aspect of science and technology. Only until results of science are communicated and shared accordingly will research be deemed complete. As Science Communication (Scicom) is a rapidly expanding discipline, having both practical and theoretical features that are critical to today's developmental challenges, PCIEERD provides support for undertakings towards an integrated, inclusive, and innovative approach of the said discipline in the country. Interventions and activities in communicating science will cut across the whole R&D process of PCIEERD-funded projects to include the relative pillar of science communication in accordance with its nature.
5. Impact Assessment- This program provides for the determination of the effectiveness and success of the significant investments made by the Council on research and development (R&D), information dissemination and technology transfer activities and initiatives, and assessing the significance of changes brought about by those activities. Impact assessment studies on PCIEERD-funded or monitored projects are conducted to determine and measure the changes, both intended and unintended, that result from research, development, and extension.

The 2024 Call is also aligned with the 4 Pillars of DOST which goal is to strengthen and advance science, technology, and innovation (STI) in the Philippines, ensuring responsive, people-centered, and technology-enabled public services and governance. This year's R&D call prioritizes nine thematic areas under the DOST's 4 Pillars: Human Wellbeing, Wealth Creation, Wealth Protection, and Sustainability.





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For each of the DOST four pillars, DOST-PCIEERD intends to support R&D programs that will contribute to the attainment of the following:

- On Human well-being - DOST PCIEERD will be supporting programs on food security, water security and environmental protection, energy security, and human resource development.
- For wealth creation - increase economic development, job creation, and industry competitiveness.
- For wealth protection - R&D programs on climate and disaster resilience will ensure that minimal resources are shielded from calamities.
- On sustainability - R&D programs will be geared towards facilities upgrading, digital transformation, and smart and sustainable communities.



## Call Themes

### I. Providing S&T Interventions for Resilient and Sustainable Communities

#### 1.1 Energy and Utilities Systems Technology

##### 1.1.1 Energy Sector (Sustainability: Energy and Utilities System)

#### Call Rationale

According to the Department of Energy, the 2022 Philippine economy experienced a growth of 7.6 percent, surpassing the government target. Given the high rate, driven by ease in restrictions on mobility and related activities, the total final energy consumption showed a modest growth of 2.4% from 35million tons of oil equivalent (MTOE) in 2021 to 35.9MTOE in 2022. Sectors such as industry, residential, and transport provided increasing energy utilization during the final quarter of 2022. The transport's demand for energy remained in an increasing trend due to restoration of full transport capacity. Energy is a fundamental part of human activities and is an essential need of the industry and services sectors. With these, the response to utilize alternative fuels for the transportation need is identified by the Council, which includes biofuels for land transport and sustainable aviation fuel for the aviation industry.

The Council has established energy related roadmaps to support the development of new energy resources, efficient energy use, technology development, and human capacitation. This was made possible through the conduct of several stakeholders' consultation, environmental scanning, and exploration of emerging technology abroad. This roadmap serves as guidance in detailing R&D activities in specific timeframe to meet the plans, program and projects intended to improve energy development in the next years. The roadmap is also aligned with the Philippine Energy Plan in attaining energy independence, through accelerating and demonstrating renewable energy (RE) R&D technologies.

#### Call Objective

The objective of this call is to provide S&T intervention in the development of clean and effective energy resources. This involves localization and development of innovative technologies and equipment, supply chain profiling, and technology applications/demonstration activities aimed at providing energy to unserved and unelectrified communities.

#### *Renewal Energy (RE), Waste to Energy (WTE) and Hydrogen Systems and Technology*

##### a) Green Hydrogen Production and Hydrogen Energy Applications

- Production of green hydrogen utilizing local resources, with actual hydrogen utilization for energy generation and various applications
- Cost effective technologies for hydrogen production, separation, and purification
- Hydrogen Carriers, storage, handling, transport, and utilization

##### b) Biofuels

- Biodiesel Oil Palm & Empty fruit bunch (EPB) viability assessment
- Sustainable Aviation fuel



The call is expected to develop and introduce cost-competitive, innovative, and effective energy technologies that address gaps and deficiencies in the existing supply chain and incorporate the best available technologies. These technologies should be able to provide solutions and benefits such as improved energy security, resilience, cost effectiveness, and social and economic impacts. Techno-economic viability studies are required for demonstration sites and applications. Outputs derived from the project must lead to new, or improvement of, existing standards/policies & energy regulations and codes. To distinguish/differentiate the proposed technology and method/technique, emphasize aspects such as cost-competitiveness, productivity enhancement, efficiency, and materials performance improvement when compared to existing technologies and applications.

### **Additional Call Document Requirements**

- ✓ The implementing agency and proponent should have a record of accomplishment and established expertise in implementing projects, specifically in the energy sector.
- ✓ Endorsed by the Head of Implementing Agency. Proposals submitted by the consortium must also include an endorsement from the Regional Consortium Chair.
- ✓ Sound scientific basis for the proposed technology includes:
  - Relevant data and literature to provide a situationer for the pressing national problems to be addressed
  - Appropriate experimental design and statistical analyses when applicable
  - Advantages and differentiation over existing similar technologies
- ✓ Letter of Commitment from an industry partner or end user. Specific involvement must be identified in the letter (e.g. investor in technology development, adopter of the R&D output) as well as their counterpart support in project implementation (e.g., funding, or in-kind donation such as equipment, personnel technical support, provisions for service facility)

The proposal must include the following details:

Clearly presented value or opportunity cost of the proposed technology including:

- Socio-economic impact (projected increase in productivity of risk managers or additional income of industry)
- Current demand for the proposed technology
- Environmental impact and waste management plans
- Initial Feasibility Study (FS) that describes the current need/situation of the target community
- Detailed Risk Management Plan
- Detailed Sustainability Plan after the Project Completion (institutional, financial, and human resources) for the host institution and partner industry.
- Counterpart funding from the partner agencies to be involved in the project.
- Counterpart resources (e.g., facilities, equipment) available in each implementing agency



## 1.1.2 Utilities Sector (Sustainability: Energy and Utilities System)

### 1.1.2.1 SMART Approach for the Construction Industry

#### Call Rationale

The construction industry played a key role in accelerating the Philippine economic recovery in 2022 despite a challenging 2020 and 2021 due to global pandemic. Based on the data of the Philippine Statistics Authority and Philippine Construction Authority, the Philippine construction industry registered an annual growth of 10.6% in 2021 following an annual decline of 30.3% in 2020, with an expected growth of 21.8% in 2022. This progress was supported by the investment of the government under the Build Build Build Program amounting to P1.2 trillion in 2022. It is expected to register an annual average growth rate of 7.5% from 2023 to 2026, which includes an investment of PHP4.7 trillion (\$95.4 billion) on 112 Infrastructure Flagship Projects (IFPs) under the Build Better More Program. In addition, public and private sector investments in residential, commercial, and educational infrastructure construction projects are expected to support growth in the industry over the forecast period.

Despite this investment from the government and private firms, construction is still widely known to be one of the slowest adopters of technology, ranking second from the bottom, ahead of only agriculture. However, for the last two years of pandemic, the industry has recognized the benefits of construction technology to mitigate challenges of productivity, efficiency, cost, labor and safety.

Thus, DOST increased its efforts to support the technological needs of the industry in 2020-2022 with 58 research projects amounting to more than 500 million pesos which are implemented by Research and Development Institutions (RDIs) and HEIs nationwide in partnership with private construction firm, DPWH, PPA, NHA and other relevant NGAs/LGUs. To sustain these efforts and to continuously help the industry, DOST initiated collaboration agreement with the DPWH under the Climate Resilient Infrastructure Initiative Program, participated in government-led working group such as NHA AITECH, DTI-CIAP, DOTR Philippine Road Safety TWG, etc, and conducted various stakeholders meetings with DTI Construction Industry Association of the Philippines members, DPWH, NHA, DILG from September to December 2022 resulting to the updating of the Construction S&T Roadmap and re-prioritization of research topics for possible 2026 funding.

The DOST Construction S&T Roadmap with the theme “Smart Approach for the Construction Industry Program” is formulated, aligned with the NEDA Ambisyon 2040 - The Life of All Filipinos: Matatag, Maginhawa at Panatag na Buhay by 2040, the Philippine Construction Industry Roadmap 2020-2030 with the themed "TATAG at TAPAT", and the DPWH KONKRETO Program. The Smart Approach is the transition from conventional construction techniques and methods to digital and modern/advanced technologies. DOST is hoping that the roadmap and its effort to harmonize the various program and initiatives aim to provide the necessary technological support in the implementation of the Build Better More program through providing sustainable construction materials, innovative construction techniques including provision of human resources program and advance testing laboratories.



### Call Objective

The objective of this call is to develop and deploy indigenous construction materials and innovative techniques/tools in support of the construction industry towards a climate-adaptive and resilient infrastructure.

### Call Scope

The R&D initiatives should address the following identified research areas.

#### A. Construction industry digitalization

- Localized and cost-effective construction assessment, monitoring, or surveying equipment (e.g., wearable, robotics)
- Utilization of generated science-based data for design and analysis of critical infrastructures (BIM, data digitization visualization and analysis, etc.)
- Innovative cost-effective design/methods/techniques
- Utilization of generated science-based data for design and analysis of critical infrastructures

#### B. Competitive sustainable construction indigenous materials

- a. Value adding and innovative use and application of recycled concrete, debris or any construction demolished materials
- b. Localization of commonly used chemicals by the construction industry using indigenous or agro-industrial waste (superplasticizer, adhesive, hardener, etc)
- c. Use of sustainable agro-industrial waste or indigenous materials for green building/housing - ease of construction, cost-effective, improved physical and mechanical properties, and climate-adaptive features

#### C. Earthquake engineering system and technologies

### Specific Features Sought in this Call

The proposed projects should be able to develop and introduce innovative and more efficient construction technologies through the use of indigenous and sustainable **materials**, or innovative and cost-effective **techniques**. These technologies should be able to provide solutions and benefits such as reduced costs, improved processes (testing and monitoring), green construction, recycling decommissioned materials, multifunctional and environment-friendly materials, quality and longevity of buildings, and improved quality of life for users. The proponent should be able to differentiate the proposed technology and method/technique by elaborating on cost-competitiveness, productivity enhancement, and efficiency and materials performance improvement with existing technologies and applications.

Output derived from the project must lead to new, or improvement of, existing standards/policies & building regulations and codes. Proponents must partner and secure a commitment letter with possible technology adoptors, construction companies, relevant government agencies and end-users with provision of counterpart funding support in the project implementation especially for pilot demonstration.

	DOST-GIA	PCIEERD-GIA
Target no. of projects to be funded	5	3
Budget	45M	15M



### 1.1.2.2 SMART and Innovative Water Management and Infrastructure

#### Call Rationale

The Philippines has an abundant freshwater resource obtained mainly from rainfall, surface water, and groundwater. The average annual rainfall amounts to 2,440 mm, rivers, lakes and reservoirs constitute to 125.4 billion cubic meters with groundwater potential of 20.2 billion cubic meters and reservoir aggregate area of 50,000 sq km. Theoretically, it is expected that the Philippines should have sufficient water supply. However, due to the geographical location, changing environmental conditions, high-economic growth, and water balance (difference between the amount of water resources potential and the water demand), the country is experiencing both flood and drought issues.

Forecast suggests that in 2025, Philippines will not be able to meet the demand for water supply. More so, the World Resources Institute (WRI) predicted a high degree of water shortage that will be experienced in 2040 with agriculture as the most stressed sector, and Mindanao as the most stressed region. In 2015-2016 alone, the country was driven with severe El Nino event ever recorded which caused damage across 16 out of 18 regions. This event led to the drying of nine (9) dams, with six (6) being critical and ten (10) below normal levels. Recent typhoons in 2022 once again brought severe flooding, demonstrating that current water infrastructures and disaster management systems are inadequate to cope with extreme climate conditions, significantly affecting the lives of the Filipino. These phenomena inflict impact on streamflow, dam operation and water allocation, domestic water supply, irrigation, hydro power generation, depth and recharge of aquifers, water quality, and watershed.

In an effort to deliver science-based services towards effective water management of irrigation and in the management of water resources in the Country, DOST partnered with the National Irrigation Administration (NIA) and the National Water resources Board. Consequently, various stakeholders' meetings, water summits were conducted in 2023 with the NIA, NWRB, Department of Interior and Local Government (DILG), the National Economic and Development Authority, and LGU-owned Water Districts that led to the updating of the Water Resources S&T Roadmap with identified new research topics as well as re-prioritization considering the current state of the country in managing its water. Water security and management, limited water infrastructure and unavailable/centralized data are identified to be challenging issues to the stakeholders that needs immediate intervention.

The current roadmap is in accordance with the objectives of the Philippine Development Plan (PDP) 2017-2022, National Climate Change Action Plan (NCCAP) 2011-2028, and aligned with the initiatives of NIA, NWRB, priority of DILG on water management and with the goals of the pending establishment of national framework for water resource management, department of water resources, and water regulatory commission.

#### Call Objective

The objective of this call is to provide S&T interventions that are not yet applied/used locally for effective management of the country's water resources through the development and introduction of innovative tools, methodologies, and technologies to ensure safe, adequate, and sustainable water supply.

#### Call Scope



The R&D initiatives should address/cover the following identified research areas:

1. Automated water monitoring and control systems for dams/reservoir/watershed/utilities
2. Hydrological model updating with monitoring and visualization system in major river basin surface and underground water supply
3. Sustainable water management for island communities

### Specific Features Sought in this Call

DOST is looking for proposals on the development of cost-effective, advanced, and localized tools, methodologies, and technologies in managing the country's water sources: surface water, & groundwater, and in addressing water-related hazards: flooding & drought.

Through this intervention, the program will provide solution to limited water resources, water efficiency and conservation, water demand management, aquifer depletion, mitigation of water related hazards and climate change adaptation strategies. The projects should be able to differentiate the proposed interventions by elaborating the cost-comparative assessment, monitoring and management improvement, efficiency, and sustainability.

Further, the output of the project should contribute to the development and/or improvement of new and existing water policy and management decisions, codes, benchmarks, sanitary, irrigation, flood control, assessment and allocation tools, and operating rules of all existing and future water infrastructure. Proponents must partner and secure commitment letter with possible technology adaptors, water companies, relevant government agencies and end-users with provision of counterpart funding support in the project implementation.

	DOST-GIA	PCIEERD-GIA
Target no. of projects	3	2
Budget	30M	20M

## 1.2 Environment Sector (Solid, Air, Water Quality) (Wealth Protection: Environment & Natural Resources)

### *Innovative Green Technologies for Sustainable Environment and Circular Economy*

#### Call Overview

The 2024 Call for Proposals for CY2026 Funding under the Environment Sector focuses on the three sub-sectors, namely: (1) water quality/wastewater treatment and management, (2) air quality, and (3) solid waste management. These topics would like to address pressing national problems by providing solutions through programs for the prevention and control of water pollution, air pollution and innovative solutions to plastic wastes, respectively.

In addition, the three (3) roadmaps of the Environment sector of PCIEERD namely, S&T Water Environment Roadmap, S&T Clean Air Roadmap, and Sustainable S&T Solid Waste Management Roadmap which were developed with collaborative efforts among National Government Agencies (NGAs), academe, non-government organization and other stakeholders, will serve as basis for the development of new programs and projects to be included in the Call. The updated roadmap (2022-2040) sets the direction of each sub-sector which is also aligned with the different national programs



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such as the DOST's Harmonized National Research and Development Agenda (HNRDA 2017-2022) and the Philippine Development Plan (PDP) to complement the SDG 2030 Agenda and Ambisyon Natin 2040.

### Additional Call Document Requirements

- Letter of Commitment from an industry/government partner or end user. Specific involvement must be identified in the letter (e.g. investor in technology development, adopter of the R&D output) as well as their counterpart support in project implementation (e.g. funding, or in-kind donation – equipment, personnel technical support, provisions for service facility)
  - If their counterpart is the use of the facility, estimated amount should be reflected in the LIB and the schedule on the use of the facility is shown in the workplan
  - If their counterpart is the personnel technical support, the number and the estimated salary for their period of participation is shown in the LIB and in the workplan
  - If they plan to adopt the technology, initial plan on the adoption should be reflected in the detailed sustainability plan after project completion
- Detailed Sustainability Plan after the Project Completion
- Technology Roadmap. A clear roadmap of project activities and outputs
- Data on how the project can contribute to the improvement of environmental conditions by including any possible environmental impact from the proposal
- Incorporate the socio-cultural, political, health and economic implications of managing pollution, impact to the industry and its target outcome
- For project leaders with on-going projects, updated reports for their respective projects should be submitted (i.e. technical progress and terminal and audited financial report). For completed projects, clearance from the funding agency from any obligations under the project.
- Research outputs must lead to S&T policy formulations and decision support systems for sustainability

### 1.2.1 Program 1: National Research and Development Program for the Prevention and Control of Water Pollution

#### Call Rationale

The Philippine **Clean Water Act** of 2004 (**Republic Act No. 9275**) aims to protect the country's **water** bodies from pollution from land-based sources (industries and commercial establishments, agriculture and community/household activities). It provides for a comprehensive and integrated strategy to prevent and minimize pollution through a multi-sectoral and participatory approach involving all the stakeholders. Under **Section 24** of the Philippine Clean Water Act, **Pollution Research and Development Programs**, it states that, the DENR in coordination with the Department of Science and Technology (DOST), other concerned agencies and academic research institutions, shall establish a **“National Research and Development Program for the Prevention and Control of Water Pollution.”** As part of the said program, the DOST shall conduct and promote the coordination and acceleration of research, investigation, experiments, training, survey, and studies relating to the causes, extent, prevention, and control of pollution among concerned government agencies and research institutions.

#### Call Scope

The R&D initiatives should address/cover the following identified research areas:



1. Development of Rapid Test Kits for detection of pathogens and other emerging contaminants in WW, etc.)
2. Development of Cost-effective Technologies on Water/Wastewater Reuse, Water recycling for industries and communities
3. Development/ Application of scalable treatment and/or removal of heavy metals (HM), micropollutants and other emerging pollutants in wastewater
4. Pilot scale/industry scale application for AI-based water treatment and/or resource recovery, desalination, deionization, etc.
5. Development of microplastic capturing technology and treatment for industries and/or waterbodies
6. Cost-effective and portable treatment for nitrate, phosphate, oil and grease and ammonia in accordance with DENR Administrative Order 2016-08 Water Quality Guidelines and General Effluent Standards

### Call Objectives

This call's main objective is to emphasize research and development of improved methods and innovative technologies with industry-wide application for water quality management and pollution control. It is important to note that the program/project should be holistic in approach, closed loop technological interventions that are low-cost/cost effective and innovative, multi-disciplinary or transdisciplinary to foster collaborative learning and inclusive solutions development with all stakeholders.

PCIEERD will fund/endorse maximum of 5-6 projects not to exceed PhP150M budget covering all projects. The maximum duration for each project is 3 years.

### 1.2.2 Program 2: National Research and Development Program for the Prevention and Control of Air Pollution

#### Call Rationale

The Philippine Clean Air Act of 1999 (Republic Act No. 8749) outlines the government's measures to reduce air pollution and incorporate environmental protection into its development plans. Under the 'Implementing Rules and Regulations for Philippine Clean Air Act, the Air Pollution Research and Development Program, Section 1 states that a "**National Research and Development Program for the Prevention and Control of Air Pollution**, the DENR through its bureau, in coordination with the Department of Science and Technology (DOST), other agencies, the private sector, the academe, NGOs and POs shall, establish a National Research and Development Program for the Prevention and Control of Air Pollution."

These agencies should align their efforts to come up with the national R&D program for air pollution prevention and control. Studies on the prevention and control of air pollution should be backed-up with scientific data gathered by the said institutions. There is an immediate need to monitor the effects and impacts of particulate matter at high time resolution, especially those with small diameters (e.g., PM<sub>2.5</sub>, ultrafine particles, UFPs) that significantly influence human health and the environment. Thus, development of real-time PM assessment tools/ devices is also a recommendation to help reduce the health impacts of PM. Additionally, mobile sources remain the largest source of emissions in the country (2018). Emissions from mobile sources increased from 65% in 2015 to 74% in 2018. Managing mobile sources for emerging megacities are also becoming a challenge, due to the dependence on motorized modes of transportation, and availability of more affordable motor-vehicles which enhanced substantially the traffic volume. Based on the National



Air Quality Status Report (2016-2018), the monitoring capacity remains to be ~100 stations nationwide, and a major challenge is the nearing obsolescence of some of the equipment. Thus, it will be imperative to develop more monitoring stations together with DENR, particularly roadside measurement cabins, to fully capture the variability of pollutants generated from vehicular activities. Overall, despite the consolidated efforts to improve air quality status, there are still remaining challenges and needed actions in air quality management.

### Call Scope

The R&D initiatives should address/cover the following identified research areas:

1. Development of GHG emission monitoring & assessment tools and protocols
2. Development of GHG capture & mitigation technologies
3. Establishment of locally developed emission factors and standards
4. Cost-effective air pollution treatment technologies focusing on control and abatement from natural and/or anthropogenic sources
5. Development of real-time spatio-temporal emission inventory, monitoring, and ambient air quality forecasting

### Call Objectives

The proposals to be submitted should be able to develop technologies that will support new interdisciplinary research and innovation that will tackle Sec. 15. Air Pollution Research and Development Program i.e., establish a National Research and Development Program for the prevention and control of air pollution. Proposals should emphasize research and development of improved methods and innovative technologies with industry-wide application for the prevention and control of air pollution.

PCIEERD will fund/endorse maximum of 5-6 projects not to exceed PhP180M budget covering all projects. The maximum duration for each project is 3 years.

### 1.2.3 Program 3: Innovative Solutions to Solid Waste Management

#### Call Rationale

The Philippines' generation of solid wastes has been increasing directly proportional to the country's population and economic activity with infrastructure development and modernization among other factors. In the **National Solid Waste Management Status Report for CY 2008-2018**, based on the per capita rate of 0.40 and annual projected population, the projected amount of waste generated in the year **2020 is 16,628,026 metric tons**. It must be noted that the data projection was pre-COVID-19 Pandemic and before the surge of consumer's shift to online purchase. DENR reports that the Philippines has endeavored to improve its management of solid waste through the passage of **RA 9003** or the **Ecological Solid Waste Management Act of 2000** which *provides for a systematic, comprehensive, and ecological waste management program to ensure the protection of the public health and the environment*.

To address solid waste management concerns, the **National Solid Waste Management Committee (NSWMC)** initiates food waste management program, development of composting guidelines and energy recovery for the biodegradable wastes; Increase recovery for recycling wastes and promotion of recycling for recyclable wastes; initiatives for arts and crafts, alternative technologies (i.e., construction materials like hollow blocks, eco-bricks, lumber, roads) and energy

recovery (RDF, Fuel, Electricity) for residual wastes; hazardous wastes management at City/Municipal Centers (DENR), medical waste management program of DOH and lastly, proper Sanitary Landfill disposal for special wastes.



However, despite the efforts and 21 years after RA 9003 was passed into law, solid waste management remains a major problem in the country especially in urban areas like megacities (e.g., Metro Manila, Cebu, Davao). In the current DENR Solid Waste Management Division website, ***the Philippines' projected waste generation from 2020-2025 will increase from 21.4M metric tons/year to 23.6M metric tons/year having NCR and Region4A both with the highest generation of about 22M metric tons/year.***

In 2015, a report was published by Ocean Conservancy and McKinsey Center for Business and Environment, where the **Philippines was ranked 3<sup>rd</sup> as the biggest source of plastics leaking into the oceans**; This study should be validated by local research with actual sampling and analysis. Plastic per se has its many advantages and is cheap and easy to produce compared to other materials. Sadly, these same features are the same reasons for the mismanagement of this material. Single-use plastics from products sold by conglomerates, such as bags, bottle labels, and straws end up not being recycled and worse, sometimes end up mismanaged. Every year, our country contributes 1.88 million tons of "mismanaged plastic waste". The majority of the mismanaged plastic wastes are made of Polypropylene or PP. It is a heat-resistant plastic commonly used in food and beverage packaging. When it is dumped in the sea, over time it breaks down into small plastic particles or "**microplastics**". Microplastics are plastic particles less than 5 mm in length. They occur in the environment due to plastic pollution and weathering. Due to their small size, they can be easily ingested by filter-feeding marine organisms and accumulated through the food web.

### Call Objective

The objective of this call is to support inter-disciplinary research to understand the risks that solid waste pollution poses and provide technological interventions. Therefore, this call requires the proposals to address the key gaps and to incorporate the socio-cultural, political, health and economic implications of managing pollution while providing scientific data that will support and lead to formulations of policies.

### Call Scope

The R&D initiatives may include the following potential study areas:

1. Establishment of a Life Cycle Analysis Certification Protocol/Standards for plastic packaging products, styrofoam products, single use plastics, other materials/products and its alternatives
2. Development of technologies/strategies for marine litter prevention and reduction from point & non-point sources
3. Value-adding of Solid Wastes/By-products from ship recycling, plastic materials and other conventional sources
4. Integrated solutions following Bio-Circular-Green Economy (BCG) model for solid waste reduction, prevention, and control
5. Establishment of Recyclability Testing Facility and development of database of Recyclables including Plastics
6. Establishment of Demo/Model Facility for Waste Infrastructure: Strengthening of the Waste Management Flow

PCIEERD will fund/endorse maximum of 5-6 projects not to exceed PhP240M budget covering all projects. The maximum duration for each project is 3 years.



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### **1.3 Disaster Risk Reduction and Climate Change Adaptation (DRR-CCA) (Wealth Protection: Climate, Disaster Resilience, and Human Security)**

#### **Call Rationale**

The Philippines, because of its location, is vulnerable to numerous natural disasters and climate change resulting to catastrophic loss of lives and property each year. The Philippines ranks 1st in the World Risk Index for Natural Disasters according to a study done by the United Nations University Institute for Environment and Human Security (UNU-EHS) in 2022 and 2nd in the Global Climate Risk Index as of 2018. Lessening the impact and/or reducing different communities' vulnerability to the harmful effects of natural disasters and climate change over the years has remained one of DOST's primary goals over the years. These threats have ranged from multi-natural hazard such as tsunamis, earthquakes, volcanic activity, landslides, typhoons, thunderstorms, severe wind, heavy rains, and floods as well as climate-induced hazard such as extreme weather phenomena (heatwaves, droughts, frost, hail, intense storms, etc.), temperature rise, changes in precipitation patterns and sea level rise.

Disaster Mitigation (DM) is a priority of DOST-PCIEERD and is aligned with the Harmonized National R&D Agenda for DRR and CCA. The DOST, in consultation with government and private research and development institutions, the academe, industry and other concerned agencies, prepared the Harmonized National R&D Agenda (HNRDA) 2022-2028 to ensure that results of S&T endeavors are geared towards and are utilized in areas of maximum economic and social benefit for the people. It is divided into five (5) sectors: Basic Research; Health; Agriculture Aquatic and Natural Resources; Industry, Energy and Emerging Technology; and Disaster Risk Reduction and Climate Change Adaptation. The formulation of the HNRDA is in line with the DOST's mandate of providing central direction, leadership, and coordination of the scientific and technological efforts in the country. The priority programs also aim to help contribute to the attainment of the following Sustainable Development Goals as part of the 2030 Agenda for Sustainable Development, specifically:

Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Goal 11: Make cities and human settlements inclusive, safe, resilient, and sustainable.

Goal 13: Take urgent action to combat climate change and its impacts.

#### **Program Description and Roadmap Creation**

The DRR-CCA program has three (3) Sub-Programs as follows:

**1. Multi-Hazard Assessment Tools and Systems** | Various multi-natural hazard and exposure maps have been created such as Tsunami Susceptibility Maps, Earthquake Hazard Maps, Seismicity Maps, Philippine Fault Zones, Volcano Hazard Maps, Rainfall-induced and Earthquake-induced Landslide Maps, Typhoon Tracks Map, Heavy Rains, Severe Wind, Flood Maps and Drought Maps. Due to these outputs, it is also now possible to generate near-real-time multi-hazard reports for tsunamis, earthquakes, volcanic activity, landslides, typhoons, severe wind, heavy rains and floods. These maps can be used for further research and other applications to DRR-CCA.

**2. Vulnerability Assessment, Risk and Warning Communication Systems** | With the generation of reference maps mentioned above, addressing and assessing local vulnerabilities to help



planners and managers mitigate the impacts of natural hazards and disasters are easier. Mandated agencies, through developers and programmers, are also able to create warning communication systems through integrated web-based and mobile phone-based warning and information systems. In this way, there is an enhancement of the capabilities of high and moderately vulnerable communities to assess, and national and local risks to mitigate and quantify the impacts, and damages due to natural hazards.

**3. Localization of observation and Forecasting Tools & Monitoring Networks** | Across several projects, locally developed/manufactured, cost-effective sensors and prototype instruments for effective monitoring of Disaster Risk Reduction- Climate Change Adaptation (DRR-CCA) related events have also been made.

In consideration of the above, the following has already been accomplished:

- a. Enhanced capacity of the high and moderately vulnerable communities to assess and address local risks to mitigate and quantify the impacts, and damages due to natural hazards.
- b. Developed/fabricated an improved and enhanced all-hazards monitoring and forecasting through an accessible and reliable, real-time to near-real time end-to-end risk communication systems.
- c. Locally developed/manufactured, cost-effective sensors and instruments prototype for effective monitoring of DRR-CCA related events.
- d. Locally fabricated and upgraded monitoring system, tools & techniques for risk assessment.
- e. Established and reliable observation and operating systems for disaster management

### Call Objectives

For this call, the objective is to alleviate the effects of disaster and climate change through enhancing the current methodologies, technologies, and capabilities of the mandated agencies such as DOST-PAGASA, DOST-PHIVOLCS and DENR-MGB. Specifically, the call should address concerns and research gaps relating to seismic, hydrometeorologic, and climate- related hazards.

Total Allocation for 2024–2026: **Total PhP450,000.000.00 (DOST-GIA)**

### Call Scope

The R&D initiatives should address/cover the following identified research areas.

#### Disaster Risk Reduction (Total: 65M)

##### A. Geological Hazards (25,000,000.00)

**Target number of projects: 4 (DOST-GIA)**

1. Development and deployment of alternative localized early warning system (EWS) for Tsunami (low-cost, locally fabricated and developed detection systems)
2. Modeling Earthquake Hazards from new and historical data
3. Mapping and modeling of Active Volcanoes
4. Subsidence hazards - Engineering geology and geotechnical applications and monitoring system for karst subsidence

##### B. Hydrometeorological Hazards (40,000,000.00)

**Target number of projects: 5 (DOST-GIA)**



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1. Sectoral impacts and risk assessment of possible changes in rainfall, temperature, wind, humidity, and other meteorological elements
2. Ocean Forecast System for Marine Activities and Related Disasters
3. Impacts of climate change-driven droughts and extreme rainfall events in the development of related hazards
4. Flood Forecasting & Early Warning using Advance Technology (Radar, Satellite, High Resolution Modelling and others)
5. Mapping, modeling/projections and instrumentation for extreme phenomena (drought, marine heatwaves, etc)

## 1.4 Convergence of Emerging Technologies (Smart Cities)

### 1.4.1 SMART City (Wealth Creation: Industrial Solutions and Competitiveness Development)

#### SMART CITY CHALLENGE PH: Sustainability through Innovation in Cities in the Philippines

##### Call Rationale

The DOST aims to address challenges of urban and regional life in cities using science, technology, and innovation to enhance opportunities and address challenges relating to sustainable urban development against disasters.

The priority topics were based on the stakeholders' consultations conducted with relevant LGUs, academe, and government agencies with the main goal of integrating the Smart City initiatives of the Council and developing novel digital solutions.

##### Call Objectives

The DOST Smart and Sustainable Communities and Cities Framework aims to enhance research collaboration and to fund excellent research with lasting impact. The specific objective is to fully exploit the potential of the regions talent pool and maximize the benefits of an innovation-led economy with the following perspectives.

- Integration of different dimensions of urban sustainability in the framework of the UN Sustainable Development Goals.
- Co-production - a way to extend research activities to bridge gaps between knowledge, understanding, and action

##### Call Scope

Proposals to be submitted must be aligned to the following priority topics/applications.

**A. Collaborative Diagnostics with Prescriptive Analytics** | Collaborative diagnostics with prescriptive analytics in smart cities involve a synergistic approach to problem-solving and decision-making through the combined use of diagnostic tools and prescriptive analytics. This will imply a collective effort to identify urban challenges and apply advanced analytics to provide optimized solutions.

In the context of smart cities, prescriptive analytics can be incredibly powerful in traffic management, energy consumption, waste and water management, emergency response, public safety, and urban planning.

**B. Decision Intelligence for Priority Applications of the LGUs** | Smart cities leverage advanced technologies and data-driven insights to enhance the quality of life for residents, improve



sustainability, and optimize various urban processes. Decision intelligence, which combines artificial intelligence, machine learning, data analytics, and human expertise, can significantly contribute to the success of smart city initiatives in data-driven decision making, predictive analytics, resource optimization, citizen engagement, public safety, urban planning, sustainability, and governance.

**C. Integrated Simulation and Synthesis** | Integrated simulation and synthesis are often associated with hardware and software development, where simulation and synthesis play crucial roles in creating and optimizing complex systems. In the context of smart cities, integrated simulation and synthesis play a crucial role in the planning, development, and optimization of various systems and technologies.

**D. Remote Management and Smart Surveillance** | Remote Management and Smart Surveillance involves leveraging advanced technologies to monitor, control, and manage urban environments more efficiently. This integration might contribute to smart city initiatives to actively manage and respond to events in real-time.

**E. Internet of Things** | The Internet of Things (IoT) plays a vital role in the development and functionality of smart cities. IoT refers to the interconnected network of physical devices embedded with sensors, actuators, and communication capabilities that enable them to collect and exchange data.

The following must be considered in the proposal:

- It should be based on standard sets of data LGUs produce to report in different offices (DILG mainly). These include financial report, PSA data, land use cover, infrastructure utilities, facilities, and amenities.
- Level of reliance, access, and availability of data to make local leaders' decisions and plans, and for people to be aware and partake in the process.
- Should include the development of a web system or dashboard to curate/manage and visualize input data and assessment of results.
- Assessment of readiness should make references to technology in terms of 1) need of LGUs, 2) current level of use or access, 3) availability.
- Interoperability of cities

### Requirements

- Endorsement from the Local Government Unit (LGU) is required.
- Present a novel concept or mechanism.
- Case of immediate application must be presented.
- Collaboration with an industry or government partner committed to provide counterpart funding is an advantage.
- Provide details on the technologies to be used. There is no limit to the number of technologies that may be used.
- PCIEERD is interested in understanding the range of technologies that communities are considering as part of their applications to achieve perceived outcome(s). Cite available DOST technologies that can complement with the project.

The DOST/DOST-PCIEERD will fund maximum of three (3) projects with a budget allocation of PHP20M per project.



## 1.5 Human Security (Wealth Protection: Climate, Disaster Resilience, and Human Security)

### Human Security and Defense

#### Call Rationale

In the midst of intensifying advancements in communication technology, the development of a responsive communication link system and secure network for the exchange and dissemination of valuable data, alerts, and sensitive information is imperative for world-class government and private organizations. The role of communication link system and network in an organization is vital as it addresses communication requirements for dissemination of information during times of disaster or crisis, it allows collaboration between organizations to effectively communicate changes, updates, or crisis management plans.

Moreover, a designated communication system is responsible for facilitating quick identification and resolution of issues to better navigate challenges, maintain stability and ensures that decision-makers have the necessary information when making important choices which leads to more informed decisions and prevents delays caused by a lack of critical information.

Ultimately, a distinct communication link system and network in accordance with public security and defense organization operational requirement is essential in securing efficiency,

interoperability, collaboration, customer satisfaction, adaptability, effective decision-making, increased productivity, engagement, and maintaining a competitive edge.

#### Call Objectives

Under the belt of Human Security and Defense Research and Development (R&D) Program, this Call seeks to address the communication link and network requirements of local and national defense and security organization for an improved conduct of their missions and operations through the development an indigenous communication system and establishment of a secure network.

Total allocation for 2024-2026: **PhP75,000,000.00**

#### Call Scope

The R&D initiatives should undertake the following actions with specific requirements.

**A. Development of an Indigenous Communication Link system (25,000,000.00)**

**Target number of projects: 1 (DOST-GIA)**

1. Constitute a positioning, navigation, and identification component.
2. Integrates secured data communication with cryptography, steganography, and transmission security.
3. Incorporates up-to-date radio technology.
4. Allows near-real time data exchange.
5. Innovative and cost-effective design/methods/techniques.
6. Robust device enclosure and meet environmental compatibility.

**B. Development of Human Security User Program and Common Platform (25,000,000.00)**

**Target number of projects: 1 (DOST-GIA)**

1. Constitute unit tracks, positioning, navigation and other system information.



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2. Enables common operational picture.
3. Enables messaging function.
4. Implements appropriate symbology.
5. Compact, adaptable and user-friendly interface.

**C. Establishment of Secure Network and Enhanced Secured Communications  
(25,000,000.00)**

**Target number of projects: 1 (DOST-GIA)**

1. Allows several network participating units using Time-Division Multiple Access (TDMA) or other network scheme.
2. Reliable network coverage.

## II. Providing S&T Interventions for Industry Productivity and Competitiveness

### 2.1 Food Sector (Human Well Being: Health and Wellbeing and Wealth Creations: Food and Agriculture)

#### Call Rationale

The Philippines dropped from rank 64 down to 67 out of 113 countries in the 2022 Global Food Security Index measured in terms of its four dimensions: availability, quality, and safety, affordability, and sustainability and adaptation. The global pandemic in 2020 led to limited movement and transport restrictions that magnified the vulnerabilities in the agri-food sector as availability and access to food affected the population regardless of socioeconomic status. For the period 2020-22, 44.7% of the total Philippine population has moderate or severe food insecurity, with 84.3M people unable to afford a healthy diet (FAO State of Food Security and Nutrition in the World, 2023). Food inflation also rose to 8.0% in 2023 from 6.1% in 2022 (Department of Finance, 2024). As the most climate-vulnerable country in the world (World Risk Index, 2023), natural disasters and the impacts of climate change causes several disruptions in achieving a sustainable food supply. More than 40% of food losses occur during the production, postharvest, and processing stages (Mopera, 2016) while hunger and the triple burden of malnutrition continues to be a challenge.

Prioritizing food security, the Philippines reaffirms the need for resilience of the agri-food sector amidst the imminent risks from the prevailing effects of the pandemic, emerging market tensions and global trends, and the impacts of climate change. The *Pagtanaw 2050* Philippine Foresight on Science, Technology, and Innovation recognizes the shift towards a science-based **food system** paradigm to achieve the desired transformation into a more sustainable future with sufficient, safe, accessible, and affordable nutritious food supply that have positive or neutral impact on the environment. A food system is defined as *all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to the production, processing, distribution, preparation and consumption of food, and the outputs of these activities, including socio-economic and environmental outcomes* (High Level Panel of Experts on Food Security and Nutrition, 2017).

With this, PCIEERD continuously supports R&D and S&T initiatives for the food sector as specified in the Harmonized National R&D Agenda 2022-2028 for Industry, Energy, and Emerging Technologies, and in support of the UN Sustainable Development Goals No. 2 on Zero Hunger and No. 12 on Responsible Production and Consumption. This is aligned with efforts towards the



following food security and nutrition outcomes identified in Chapter 3 of the Philippine Development Plan 2023-2028 and the Philippine Food Systems Transformation Pathway:

- Improved access to safe and nutritious food
- Shift to healthy and sustainable consumption patterns
- Boosted nature-positive production at scale
- Advanced equitable livelihood and value distribution
- Built resilience to vulnerabilities, shocks, and stresses

### Call Objectives

This Call aims to support effective programs and strategies for (1) ensuring product safety and quality, (2) utilizing local products to reduce imports of raw materials for food processing, (3) developing technologies for the conversion of "waste-materials" into value-added products, (4) development of human resources for the food sector, (5) optimizing digital platforms for the food value chain, and (5) conduct of joint research on new processing technologies and systems in response to global trends for a more sustainable and resilient agri-food sector.

### Call Scope

This Call covers the following programs of the Food Sector with specific priorities presented in the next sections and as validated with stakeholders:

1. Food Innovation Program
2. Innovation for Philippine Food Systems Transformation (*Solicited*)
3. DOST Smart Food Value Chain Program
4. DOST Integrated Food Safety Program
5. DOST Halal S&T Program

### Specific Features Sought for all Food Sector Programs

1. The implementing agency and proponent should have a record of accomplishment and established expertise on the proposed project.
2. A collaborative undertaking among institutions is encouraged. Institutions from other region/s working on similar or related research areas may also be engaged given their capability and commitment.
3. The proposal must include the following details:
  - a. Detailed Review of Literature by including previous works and/or relevant studies where the proposal will take off.
  - b. Sound scientific basis including:
    - Relevant data and literature to provide situationer for the pressing national problems to be addressed
    - Appropriate experimental design and statistical analyses
    - Advantages and differentiation over existing similar technologies/studies
  - c. Information on potential socio-economic impact and marketability:
    - Projected employment generation after the completion of the project. Identify the possible specific jobs to be involved and estimated number of personnel needed.
    - Estimated increase in income/productivity
    - Current demand and potential market expansion
  - d. Advantages of the proposed studies and its target cost over the existing/commercially available/similar studies
  - e. Potential impacts to the identified industry partner or partner institution.



- f. Data on how the project can contribute to the improvement of environmental conditions by including any possible environmental impact from the proposal and waste management plan
  - g. Adequate counterpart funding from the implementing and partner agencies
  - h. Counterpart resources (e.g. facilities, equipment) available in implementing and partner agencies
  - i. Letter of commitment from identified cooperating agencies willing to test and/or adopt the project output.
  - j. Risk Management Plan
    - Identify the risks on the implementation of the project. Develop and submit an action/contingency plan for identified risks and prepare alternative activities to avoid delays in the conduct of the project's activities.
  - k. Technology Roadmap
4. Clear plans for utilization of project results:
    - a. Specify mechanisms for the sustainability of operations
    - b. Strategies for wider adoption by indicating how the project results can be scaled up to be widely used or available
    - c. Details on how the target beneficiaries will participate or benefit from the project
    - d. Plans for promotion and transfer of technology to end-users
  5. Sustainability plan including established mechanisms in terms of institutional, financial, and human resources capability after project completion

### **2.1.1 Food Innovation Program**

The following challenges identified relative to the ASEAN integration in 2015 continue to affect the local industries: 1) Continued dependence on imported raw materials; 2) Need for improvement or innovation in local technology; 3) Ability to consistently deliver the required level of quality and food safety. To address these concerns, an array of possibilities exists for innovation - from the sourcing of raw materials, processing, packaging, including marketing and distribution systems. With these priorities, the Food Innovation Program was conceptualized with the vision to make local industries more sustainable and geared towards innovative food products with better quality and improved safety that responds to the population's nutritional and health requirements.

From 2018-2023, there are 28 projects implemented under the Food Innovation Program. In terms of 6Ps output as of 2023, there are 202 IP filed for products of the DOST Food Innovation Centers (FICs) for Patents/IP, 32 new products launched for Products, 36 licensing agreements forged for Partnerships, and for People Services, 49 trained on technology valuation and profitability, and 37 on Technology Needs Assessment (TNA) process.

The priorities under the Food Innovation Program were revisited in 2023 and early 2024 with consultation from the academy, government, and industry stakeholders. Matching industry needs with the expertise of researchers was done in coordination with the Department of Industry – Export Marketing Bureau (DTI-EMB).



### Priorities

1. *Enabling Systems for Food Innovation* - these include projects on establishment or upgrading of processing centers and other facilities, building capabilities, and enhancing systems that impact the food sector as a whole:
  - New Processing and Packaging Technologies for Local Food Industries
    - Nutrition-sensitive food processing technologies
      - Freeze Concentration Technology (for calamansi & other juices, coconut water)
      - Optimum extraction and dehydration technologies for local spices
      - Pulsed Electric Fields
      - Isochoric Freezing
    - Smart Packaging Solutions
      - Self-heating mechanism for RTE food
      - Freshness indicators for local food products
  - Processing Technologies for Sustainable Food Products (i.e. Plant Based Food, Alternative Proteins, Sweeteners)
    - Extrusion Technologies (Dry, High Moisture, Thermal)
    - Biomass and Precision Fermentation
    - Cell-based food processing technology for meat, fish, and egg alternatives
    - 3D Printing for Meat and Fish Alternatives for Food Service
2. *Innovative Food Products* - these include projects on new product development for ingredients or intermediate food, emergency food, and other novel food products:
  - Valorization of Food Processing Industry By- Products for Food Applications as Ingredients/Additives
    - Shrimp production by-products (extracts, chitosan)
    - Alternative flours for food industrial use
    - Lycopene from tomato processing by-products as food ingredients/additives
    - Food fibers (Banana, bamboo, etc.)
    - Plant protein concentrates
    - Fruit bioactives and polysaccharides (mangosteen, pineapple, bignay) as food ingredients/additives
3. *Specific Industry or Regional Concerns* - these include projects conceptualized to address a particular problem or challenge of a company or an industry group with the intent to adopt and commercialize the technology. Proposals under the Collaborative Research and Development to Leverage Philippine Economy (CRADLE) fall under this theme:
  - Oleoresins, Essential Oils, and Dry Spices as Food Ingredients
  - Community-level Integrated Food Processing Systems

**Target Number of Projects: 3**

**Total Budget: 135M**

#### 2.1.2 Innovation for Philippine Food Systems Transformation (Solicited)

Innovation is essential for transforming food systems to achieve the United Nations' Sustainable Development Goals (SDGs) as it feeds into the triple bottom line – economic, environmental, and social sustainability. It is also identified as one of the state interventions towards inclusive and



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sustainable food system in the Philippines. This directed program lays out the innovative interventions to transform Philippine food systems to a more sustainable future with sufficient, safe, accessible, and affordable nutritious food supply that have positive or neutral impact on the environment.

In August 2023, the DOST forged a Memorandum of Understanding (MOU) with Alliance of Bioversity International and Centro Internacional de Agricultura Tropical (International Center for Tropical Agriculture, CIAT) in pursuing scientific and technological cooperation in mutually beneficial areas, including *food systems for improved human nutrition and healthier diets, food environment and consumer behavior*. Towards this goal, the Council together with the Food and Nutrition Research Institute (FNRI) led the conceptualization of projects in 2023.

### Priorities

- Scoping study on food systems transformation for the Philippines
- Capacity Building for food and nutrition researchers on geospatial data analysis
- R&D for supply chain optimization for reducing food waste and improving food distribution efficiency
- System development for mapping, monitoring, and analyzing food systems for improved food environment decision making, consumer behavior, and healthier diets

**Target Number of Projects: 3**

**Total Budget: 50M**

### 2.1.3 DOST Smart Food Value Chain Program

The DOST Smart Food Value Chain Program was conceptualized in 2020 in response to the need to ensure local food sufficiency for the new normal due to the severe disruption in the food value chain. This program integrates the initiatives of the DOST agencies: PCAARRD, PCIEERD, ITDI, FNRI, the Regional Offices, and our partner institutions to further develop and utilize smart and innovative technologies throughout the food value chain. Through the program, interventions are introduced along the different nodes of value chain from production, processing including packaging, distribution, to consumption.

As of 2023, there are 5 projects managed by PCIEERD under the program for processing and distribution aspects of the food value chain, 3 of which are on upgrading of processing centers and rollout of technologies, the mobile modular food processing facility, and the upgrading of distribution centers. In terms of 6Ps output, the following are the accomplishments of the program:

- Patents/IP: 2 patents and 3 UM filed; 2 approved trademarks
- Products: 6 (VF banana, green mango, sweet potato, mixed vegetables; coconut powder; tuna congee)
- Places: 3 upgraded processing centers, 3 upgraded distribution centers
- Partnerships: 14 MOU among HEIs, distribution centers, LGUs, and industry

A program review was conducted in 2023 with the DOST agencies and the project implementing agencies to discuss the next steps and continued support under the program.

### Priorities

- Development of Integrated Food Value Chain Resource Management System
- Smart / Innovative Technologies in Value Chain : Smart Retailing System

**Target Number of Projects: 2**

**Total Budget: 30M**



### Specific Features Sought in this Call

- The proponent should have established partnership with DOST Regional Offices, private institutions, local government units, and other government agencies that would contribute data on the different stages of the value chain.
- The proposed system must integrate existing developed systems/platforms of other agencies on value chain and resource management.
- Strategies should be identified for deployment and transfer of the proposed system to the end users.

#### 2.1.4 DOST Integrated Food Safety Program

Assurance of food safety from farm-to-fork is a shared responsibility of all the stakeholders in the food chain – from production, postharvest, processing, distribution, to consumption. It is imperative that appropriate R&D and S&T programs be in place to ensure the safety of the local food supply. The Republic Act 10611 or the Food Safety Act of 2013 was enacted to ensure the safety and quality of foods and to serve as the framework for the implementation of the farm to fork food safety regulatory system in the country. The Department of Science and Technology (DOST) supports this law's implementation through appropriate science, technology, and innovative programs with the DOST Integrated Food Safety Program.

There are 19 projects implemented under the program from 2017-2023. In terms of 6Ps, the projects under the program accomplished the following:

- Publication: 3 on risk profiling
- Products: 49 manuals, monographs, proceedings, and guidelines and protocols for sampling and analysis, 3 grading system tools for risk-based inspection of food establishments
- Places/Partnerships: 3 upgraded food safety facilities of implementing agencies and DOST OneLab food safety testing laboratories, 12 partner agencies
- People Services: 227 trained DOST Food Safety Team members, 77 DOST potential risk assessors, 3 graduate and 6 undergraduate students supported

Through the program, outcomes of improved food safety for industries across the regions were reported with 648 food MSMEs that complied with food safety standards, and 180 already acquired their FDA License-to-Operate. With these, the Council continues to support the program with the priorities validated with the DOST Food Safety Committee in 2023.

#### Priorities

1. Under *Food Safety R&D*:
  - Development of Guidance Manual on Safety Aspects of Food Processing Equipment
  - Development of MSMEs' Traceability Systems
  - Food Safety Risk Profiling
2. Under *Food Safety S&T Services*:
  - Application of globally accepted methods for food safety parameters: validation and standardization
  - Provision of analytical testing services for quality assessment of local products
  - Strengthening food safety and traceability through nuclear and isotope-based technology



- Development of Food Reference Materials and establishment of proficiency test methods
- 3. Under *Food Safety HRD*:
  - Human Resource Development on Food Safety
  - Updating and Development of food safety modules
  - Development of Massive Open Online Courses on Food Safety
- 4. Under *Food Safety Knowledge and Tech Transfer and Policy Advocacy*
  - DOST Food Safety Fora and Summit

#### **Specific Features Sought in the Call**

- Clearly presented values or the corresponding opportunity cost for the proposed interventions. This can include details on potential socio-economic impact in terms of the projected increase in productivity of risk managers or additional income of industry, as well as potential benefits in terms of public health.
- Defined partnerships or collaborations with food safety regulatory agencies and other relevant institutions for the project implementation and sustainability of operations
- For the Food Safety Risk Profiling Center
  - Multi-year project (maximum of 3 years) with a clear roadmap of R&D activities and outputs
  - Have at least three (3) R&D project proposals which may have different implementing agencies
  - Submit endorsement of the Regional Development Council (RDC) or its equivalent and by the Head of the Implementing Agency.
  - Organizational and operational structure of the proposed Food Safety Risk Profiling Center

**Target Number of Projects: 11**

**Total Budget: 138M**

#### **2.1.5 DOST Halal S&T Program**

The Philippines is poised to make its mark in the global halal market which is valued to reach USD 7.7 Trillion by 2025. Winning as an emerging Muslim friendly destination in the Halal in Travel Global Summit in 2023, the country is among the top 20 destinations in the Global Muslim Travel Index among non-OIC (Organisation of Islamic Cooperation) destinations. With the growing demand for high quality and culturally acceptable products and services, the Halal industry caters to the needs of not only the 1.9 billion Muslim population but the rest of the world.

As member of the Philippine Halal Export Development Board established under RA 10817 or the Philippine Halal Export Development and Promotion Act, the DOST implemented the Halal S&T Program to ensure the smooth execution of its role as provider of scientific and technical knowledge in support to the development of the Halal industry in the country.

The program has four (4) areas, namely: (1) Research and Development (R&D), (2) Human Resource Development (HRD), (3) Knowledge Transfer and Policy Advocacy, and (4) Halal Verification Laboratory (HVL) Testing. These initiatives hope to strengthen the local Halal industry in meeting technical standards for global competitiveness, enhancing capability in Halal verification, and transfer the knowledge from the R&D to help promote Halal awareness.



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The Philippine Halal Industry Development Strategic Plan 2024-2028 was launched in 2024 with the aim to *make the Philippines the fastest growing and most halal-friendly hub in Asia Pacific by being a collaborative, customer-centric, comprehensive, and competitive halal gateway and destination*. Overall, the Philippines aims to attract PhP230 Billion worth of investments, generate 120,000 jobs, and grow Halal businesses at 20% compounded annual growth rate.

To continue its holistic intervention in strengthening the Halal ecosystem of the country with the guidance of the DOST Halal S&T Committee, the Council is focusing the call on Knowledge Transfer and Policy Advocacy.

### Priorities

Under Halal *Knowledge Transfer and Policy Advocacy*:

- Establishment of Halal Knowledge Center as central repository with online database of R&D output and Halal-related activities
- System for traceability and promotion of Halal products and services
- Organized Halal S&T Summit in collaboration with stakeholders

### Specific Features Sought in this Call

- For the Halal Knowledge Center:
  - Endorsement by the DOST Halal S&T Program Leader
  - Strategic location in establishing the center and provide the capacity and how the operationalization will take place after the project completion.

**Target Number of Projects: 3**

**Total Budget: 25M**

## 2.2 Process Sector (Industrial Solutions and Competitiveness) (Environment & Natural Resources) (Climate, Disaster Resilience, and Human Security)

PCIEERD under the Process Sector covers the process industries where the primary production processes are either continuous or occur on a batch of materials that is indistinguishable such as chemicals, pharmaceuticals, petroleum, plastics, rubber, textiles, tobacco, food, beverages, etc. as cited by IISE (Institute of Industrial and Systems Engineers, US).

The Process Sector of PCIEERD invites R&D proposals for the following programs to assist specific key industries in the country:

- A. **Natural Products Program** (Regular and Directed Call)
- B. **Chemical and Biological Manufacturing and Allied Industries Program** for (a) Metrology Program; (b) Vaccine Manufacturing and its Allied Pharmaceutical Industries Program; (c) Controlled-Chemicals for Industrial Use; and (d) Green Polymer Research (Regular and Directed Call)
- C. **Textiles Program** (Regular Call)
- D. **Agro-Industrial Processing Program** (Regular and Directed Call)

With CFP 2024, the Process Sector aims to:

1. Assist the identified sub-sectors in their S&T needs through R&D Programs and interventions resulting to increased competitiveness of the industry
2. Engage the R&D Institutes and Academe in collaboration with the industry in developing R&D programs for the identified research calls



3. Contribute to the development of the industries by enabling R&D programs that are anchored/aligned to the following:
- Existing PCIEERD Roadmaps or its corresponding industry roadmap from government agencies (e.g. DTI and DA)
  - DOST Harmonized National R&D Agenda 2022-2028 under Section 4.II.V Industry, Energy and Emerging Technology Research and Development Agenda 2022-2028
  - Philippine Medium-Term Development Plan 2023-2028 under Chapter 8 Advance Research and Development, Technology and Innovation in support to Outcome2: Market-driven and customer-centered research and development and Outcome 3: Technology extension, adoption, utilization, and commercialization scaled-up.
  - Goal 9 of the Sustainable Development Goals, specifically under 9.5 *Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending.*

### **2.2.1 Natural Products Program (Regular and Directed Call)**

The Natural Products subsector is the program focused on products from extraction and downstream processing from agricultural and marine sources (Colors, Gums, Resins, and Oils) that would serve the needs of various industries such as personal care, cosmetics, food, household products, and non-active components of pharmaceuticals which do not claim medical or health benefits on the top diseases (e.g. pneumonia, heart disease, etc.) prevalent in the Philippines.

#### **Call Rationale**

According to Growth Market Reports, the global market size for natural skin care products is projected to reach an estimated USD 13.4 Billion by 2031, with an expected CAGR of 6.9% (2023 – 2031). Plant-based ingredients in the personal care market amounted to 12,070 MT in 2023, showing steady growth of 3.31% CAGR over the past 4 years ([www.euromonitor.com](http://www.euromonitor.com)). The opportunity in natural products is expected to increase as consumer preference increases toward sustainable and natural ingredients. This is also true for other industries which showed a positive impact on natural products such as the textile and food sectors.

On 07 November 2023, a stakeholder consultation meeting was conducted to review the midterm action plan for the 2026 to 2028 period of the roadmap. During the meeting, several pressing challenges were identified by the Natural Products Society of the Philippines (NPSP), including the high cost and low efficiency of extracting high-value natural products, and the expensive cost of testing services within the country. Forecasting the market opportunity of natural products and personal care products, the industry verified the need to develop natural products from novel sources and promote circularity by utilizing wastes products. The importance of incorporating the current regulatory requirements in the research proposals was also reiterated to maximize the potential benefits of the resulting products and technologies.

Subsequently, on November 10, 2023, a Focus Group Discussion with the industry stakeholders to further identify suitable R&D solutions. The outputs of these meetings are incorporated and outlined in the call scope.



### Call Objective

The objective of this call is to develop innovative technologies to enhance quality and even create new market segments for the use of natural products. This is to take advantage of the momentum driven by strong market demand on natural products with wide array of industrial application: food additives such as flavors and fragrances, and colors for food, also colors for textiles and paint, dyes, industrial enzymes as catalysts, and natural polymers that may not be commonly associated with the popular natural products. It will utilize indigenous resources through provision of relevant technologies that results in increased yield, improved quality, and a more cost-effective process.

### Call Scope

The R&D proposal may include the following potential study areas:

1. Scale-up extraction (cGMP for cosmetics, pharmaceutical and personal care industry) for high value products (e.g. essential oil)
2. Extraction, Characterization and Standardization of Natural Products for the following:
  - a. application and formulation in cosmetics
  - b. hydrocolloids for personal care applications
  - c. high value natural products from aquatic sources
  - d. Natural polymers for modified drug release in vivo for personal care applications excluding cosmeceuticals and pharmaceutical applications
3. Valorization of Various Wastes for extraction of natural compounds for various industry applications except as food ingredient (e.g. development of pharma excipient from agro-forestry, seed nut and seed cake pongamia, bitaog, malunggay, pili pulp and resin, banana, pineapple, coconut, molasses, and calamansi)
4. Development of Natural Dyes from Novel sources for industrial applications except as food ingredient (microbial, pili pulp skin and other sources)
5. New Technologies such as pulsed electric field (PEF), high pressure processing (HPP) for extraction of natural products for industrial application except as food ingredient
6. Establishment of testing services for active components in personal care and pharmaceutical products (directed call)

### Specific Features Sought in this Call

The proposals should demonstrate the following characteristics and should be well-written in the documents:

1. Results of industry roadmaps (if available)
2. Intensive Review of Literature showing no duplication in proposal concept with local research conducted
3. Technology Readiness Level between 2-6. It should encompass Technology Formulation, Validation of the Technology, Small Scale Prototype, Large Scale Prototype (if applicable).
4. Sustainability of both the supply of raw materials and finished product.
5. It has potential for commercialization. Commitment letter/s from industry partner/s to support the marketability of the proposed product to demonstrate interest is required. Ideally, the industry partner will use the resulting technology in its formulation during the validation phase.

PCIEERD will fund/endorse a maximum of 7 projects not to exceed Php165M budget covering all projects. The maximum duration for each project is 2 years.



### **2.2.2 Chemical and Biological Manufacturing and Allied Industries Program (Regular and Directed Call)**

This program will be carried out by supporting R&D initiatives on but not limited to, chemicals and allied industries, and food products. The products cover basic and specialty chemicals, manufacturing products by predominantly chemical processes [2], chemical preparations [3], sensors, chemical and biological reference materials and standards, and related technologies.

This program will also support the research agenda of the Philippine Chemical Industry Roadmap 2023-2028: Enabling Industry Linkages, Sustainability, Safer Materials and Operations, and Productivity of the *Samahan sa Pilipinas ng mga Industriyang Kimika* (SPIK).

#### **Call Rationale**

##### **2.2.2.1 Metrology Program**

Metrology, the science of measurement, is vital for fair trade, consumer protection, health, safety, product quality, R&D, and environmental protection of a country. The importance of measurement can be seen practically everywhere, for example, when buying commodities by weight, getting blood pressure for diagnosis, measuring diameter for proper fit, time of day, duration of metered call, speed, and for R&D, among other things. For the Philippines, metrology is led by and practically centered at the National Metrology Laboratory (NML) of the Industrial Technology Development Institute. The program, "Enhancement of the Competence and Capability of the National Metrology Laboratory of the Philippines" implemented by ITDI from 2017 to 2022 has substantially upgraded the competency and capability of the national metrology laboratory by expanding its services relevant to the testing requirement of the food industry as well as the manufacturing industry.

Consequently, the Metrology Act of 2003 or RA 9236 is one of the legislative priorities of DOST. This act aims to create a National Institute of Metrology to accelerate the measurement capabilities of the country in various technical measurement areas and enables computation confidence to facilitate fair trade.

This program will continuously support the research and development of the National Metrology Laboratory for both Metrology in Chemistry and Metrology in Biology.

##### **2.2.2.2 Vaccine Manufacturing and its Allied Pharmaceutical Industries Program**

The Virology and Vaccine Institute of the Philippines is one of the flagship programs of the Department of Science and Technology (DOST) in support to House Bill 9559 or the Virology Institute of the Philippines Act creating the Philippine Virology Science and Technology Institute (PVSTI) of the Philippines (VIP). This aims to be a premier channel of research and development in the fields of virology in humans, plants, and animals, diagnostics, therapeutics, and vaccines, and promote technological advances.

On 06 November 2023, a stakeholder consultation meeting was conducted to discuss the priority areas for the downstream processing of vaccine manufacturing. The industry reiterated the need to support technology transfer by bridging the gap between research and development, clinical trials, and commercialization. A feasibility study was further asked to be prioritized in the roadmap to thoroughly identify the current landscape and status of the vaccine manufacturing in the country, determine the interventions appropriate to the Philippine setting, and complement the efforts towards the national vaccine resiliency program. This was followed by a focus group discussion with experts and Balik Scientists further streamlined the activities of the roadmap based on latest



technological advancements in the field. on 17 November 2023. The output of these meetings is reflected in the call scope.

### 2.2.2.3 Controlled Chemicals for Industrial Use and Pyrotechnics

The Philippine chemical industry is a highly diverse industry that covers two major industries under the manufacturing sector: (1) chemical and chemical products, and (2) rubber and plastic products. Industry supplies products to other sectors such as agriculture/agribusiness, creative, construction, cement, automotive, fishing, housing, energy, health, and pharmaceutical industries. Chemicals touch almost 90% of all manufactured products. Chemicals are also one of the largest tradable products in the world amounting to USD 6 trillion in total trade. According to the Philippine Inventory of Chemical and Chemical Substances (PICCS) 2017, a list of all existing chemicals and chemical substances used, imported, distributed, processed, manufactured, stored, exported, treated, or transported in the Philippines, there are more than 46,000 chemical products registered in the country. Additionally, in the Philippines, there are 32 regulated chemicals (15 high risk and 17 low risk).

On 09 November 2024, a stakeholder consultation meeting was conducted with the objective of developing a 5-year plan, including specific plans and programs to address the identified gaps of the controlled chemicals and pyrotechnics industry. Some of the key issues identified included the absence of local testing laboratories for pyrotechnics products to support the global competitiveness of the industry, high cost and reliance to importation of bomb suits and fabrics for uniforms of Philippine National Police (PNP) Explosive Ordnance Disposal (EOD)/ K9 unit personnel, and unavailability of rapid scientific response for the identification of reported unknown chemicals. Additionally, suggested Research and Development (R&D) solutions were drafted to tackle these challenges. The output of this meeting was verified through a follow-up Focus Group Discussion last 06 February 2024, which is reflected in the call scope.

### 2.2.2.4 Green Polymer Research

The Philippines has continuously contributed to the solid waste crisis which is projected to increase by 165% by 2025. In October 2022, key stakeholders convened in a national forum organized by the United Nations Development Programme (UNDP) together with the government of Japan and DENR to discuss the position of the Philippines in the Circular Economy and revisit the plans to avert pressing climate crisis through the commitment of the Philippines in the Paris Agreement of 75% greenhouse gas emission reduction by 2023.

In line with this, The Extended Producer Responsibility Act of 2022 (EPR Law) was enacted in July 2022 requiring large companies to recover a certain percentage of their annual use of plastic in packaging materials.

On 25 October 2023, a Stakeholders Consultative Workshop for the Crafting of Circular Economy R&D Roadmap was conducted to identify research areas under the following thematic areas:

1. **Think Green** *Understanding and Planning for a Circular Economy*
2. **Make Green** *Green Processes and Technologies*
3. **Turn Green** *Getting Value for Wastes*
4. **Keep Green** *Waste Treatment Technologies*

In support to this initiative, the Process Sector will contribute by enabling the Make Green and Turn Green research areas through development of bio-based polymers from locally sourced raw materials and innovative technologies for pilot-scale production of bioplastics.



### Call Objective

This call aims to support R&D programs that will improve and develop technologies to enhance chemical and biological manufacturing and allied industries with economic, trade, human security, and health relevance. This is to also position the Philippines in a competitive advantage through a scientific-enabled research framework.

### Call Scope

The R&D proposal may include the following potential study areas:

#### **Metrology Program**

1. Metrology in Chemistry (directed call)

#### **Vaccine Manufacturing and its Allied Pharmaceutical Industries Program**

1. Feasibility Study on Modular Manufacturing Facility for Vaccines (directed call)

#### **Controlled Chemicals for Industrial Use and Pyrotechnics**

1. Development of materials in mitigating accidents (e.g. Bomb suit or PPE against explosion-related hazards, Antistatic and Fire-retardant standardized uniform, spills detection and decontamination) (directed call)
2. Establishment of laboratory for pyrotechnics testing (directed call)
3. Innovative solutions to support Human Security/ Biosecurity for chemical and biological defense (e.g. Testing services to ensure compliance to cross border trade, rapid test kits for identifications of chemicals in fieldwork)

#### **Green Polymer Research**

1. Reduction of the cost of production of bio-based polymers from indigenous feedstock for industrial application
2. Chemical Recycling of Polymers towards Cost Reduction
3. Development of Mono-material flexible packaging towards improved recyclability
4. Development of recyclable adhesives
5. Catalyst development for waste-to-fuel applications

### Specific Features Sought in this Call

The proposals should demonstrate the following characteristics and should be well-written in the documents:

1. Data demonstrating the importance of the proposed technology to support a strong value proposition
2. Results of industry roadmaps (if available)
3. Intensive Review of Literature showing no duplication in proposal concept with local research conducted
4. Technology Readiness Level between 2-6. It should encompass Technology Formulation, Validation of the Technology, Small Scale Prototype, Large Scale Prototype (if applicable).
5. Sustainability of both the supply of raw materials and finished product.
6. It has potential for commercialization. Commitment letter/s from industry partner/s to support the marketability of the proposed product to demonstrate interest is required. Ideally, the industry partner will use the resulting technology in its formulation during the validation phase.

PCIEERD will fund/endorse a maximum of 10 projects not to exceed Php200M budget covering all projects. The maximum duration for each project is 2 years.

### 2.2.3 Textile Program

The Textile sub-sector covers products that develop and make use of fibers, yarn intermediates, yarns, fabrics, and end-user products that retain all the strength, flexibility, and other typical



properties of the original fiber or filaments. This is based on the Standard Terminology Relating to Textiles, ASTM D123 – 19.

### Call Rationale

According to the Philippine Statistics Authority, as of 2023, the textile industry contributes 1.03% to the gross value added in the Philippine Manufacturing sector. The year-on-year revenue growth rate has slowed down to 4.9% in 2023 from 15.5% in 2022. The Philippine garments and textile industry exports are valued at around \$1.5 billion according to FOBAP. This lackluster performance of the textile industry is attributed by the integrated textile-garment industry roadmap (2020) to multiple external trade issues in the industry, such as the 1980s debt crisis, the lifting of the quota set by the Multi-fiber Agreement (MFA), the tariff reform program in the 1990s, and the recent COVID-19 pandemic, among others. Aside from these, internal issues like the lack of supply of natural raw materials and reliance on the import of raw materials, coupled with outdated technology and high energy costs, are key drivers of the loss of competitiveness of the textile manufacturing industry against neighboring countries such as China. The roadmap identifies government support through research and development is necessary to help the sector recover from these challenges to the industry. Thus, a parallel research and development roadmap was established by PCIEERD to support the efforts of the industry in revitalizing Philippine textile.

On 10 November 2023, a stakeholder consultation meeting was conducted to review the midterm action plan for the 2026 to 2028 period of the S&T roadmap. This was followed by a Focus Group Discussion with the research institute last 13 February 2024. The output of these meetings is reflected in the call scope.

### Call Objective

The objective of this call is to support R&D programs that will improve and develop technologies to enhance textile production using natural fibers and other low-cost, sustainable and comparable sources and create new materials for textiles with improved properties. To contribute to the economic status of the Philippine Textile industry, the market value of the target products should be highlighted to esteem endorsement for R&D support.

### Call Scope

The R&D initiatives may include the following potential study areas:

1. Enhancement of ICYT finishing technologies for Mainstream Fashion
2. Development of localized man-made polymers such as lyocell for textile applications
3. Development of tropical fabrics from novel fibers
4. Recycling of post-industrial polymers to produce filaments
5. High-Performance Medical Textiles and Health and Hygiene Materials Testing
6. Establishment of material resource center/library from fibers to textile

### Specific Features Sought in This Call

The proposals should demonstrate the following characteristics and should be well-written in the documents:

1. Results of industry roadmaps (if available)
2. Intensive Review of Literature showing no duplication in proposal concept with local research conducted
3. Technology Readiness Level between 2-6. It should encompass Technology Formulation, Validation of the Technology, Small Scale Prototype, Large Scale Prototype (if applicable).



4. Sustainability of both the supply of raw materials and finished product.
5. It has potential for commercialization. Commitment letter/s from industry partner/s to support the marketability of the proposed product/facility to demonstrate interest is required. Ideally, the industry partner will use the resulting technology in its formulation during the validation phase.

PCIEERD will fund/endorse a maximum of 6 projects not to exceed Php125M budget covering all projects. The maximum duration for each project is 2 years.

#### **2.2.4 Agro-Industrial Program**

The Agro-industrial Program is the sub-sector of the economy where farming meets technology. The main focus of this sub-sector is to uplift the lives of the country's farmers by introducing research and development to boost productivity, to improve existing products and create new ones, and to support or change existing policies with science.

This sub-sector complements ISPs of PCAARRD, where PCAARRD focuses on upstream industry, which covers genomics, plant cultivation, and up to harvest; while PCIEERD handles the R&D on the downstream processes - product development, by-products processing and/or conversion, and other post-harvest processing.

For CFP CY 2026, two commodities will be prioritized based on active initiatives of industries that expressed and supported the research agenda on the downstream processing of rubber and virgin coconut oil. Recognizing the market opportunity on other high-value crops such as citrus, mango, rice, sweet potato, tropical fruits, and sugarcane, value adding technologies supported by industry demand will also be considered for funding to support the global competitiveness of the sector.

#### **Call Rationale**

##### **Rubber**

According to the Association of Natural Rubber Producing Countries (ANRPC), the global consumption of rubber increased by 3.5% year-on-year. Moreover, the Future Market Insights (FMI) highlighted that the demand for natural rubber was projected to be at USD 18.3 billion in 2023 and is expected to increase by a CAGR of 5.4% from 2023 to 2033. Due to its low cost and versatility as lightweight material, natural rubber attracts demand across diverse sectors such as construction, pharmaceuticals, construction, etc. By the end of 2033, the market demand for rubber can reach up to USD 30.9 billion in terms of value.

Despite the demand, the rubber industry currently faces several issues. Last 17 October 2023, PHLRUBBER conducted their 31<sup>st</sup> Technical Working Group Meeting to discuss the status of the rubber industry. This was followed by a Focus Group Discussion (FGD) with the Philippine Rubber Association, Inc (PRIA) last 11 November 2023 to further identify the research need of the local rubber manufacturing industry. Through the FGD, several gaps were identified such as the need to improve the quality of processed rubber particularly its Mooney viscosity which does not meet the industry standards. Moreover, rubber fillers mainly used to enhance the physical properties of rubber are expensive as they are mostly imported. Lastly, the escalating demand for rubber has also led to an increase in rubber waste which is a potential for research to promote its circularity in the value chain. With this, several solutions are reflected in the call scope.



### **Virgin Coconut Oil**

Virgin coconut oil (VCO) is among the high-value products derived from the coconut. According to Fortune Business Insights (2022) the global VCO market is expected to increase at a compound annual growth rate (CAGR) of 7.35% from \$2.24 billion in 2021 to \$3.69 billion in 2028. Moreover, Philippines is one of the world's leading exporters of coconut derived products which include but are not limited to virgin coconut oil.

One of the main barriers in the exportation of VCO in countries such as Canada is the requirement for the analysis of sterols in VCO. However, sterol content is currently not included in the Philippine National Standards (PNS) as parameter to identify any coconut derived oil. The study of the sterol content is required as further evidence for authenticity and would be needed to protect Philippine VCO, especially in the worldwide market, due to the rise of the VCO industry and the growing demand for authentication.

### **Call Objective**

The objective of this call is to foster technological advancement fit for Philippine high-value crops and commodities that are significant economic drivers. The resulting products or technologies should be low-cost, efficient, and robust to support countryside development and inclusive growth.

### **Call Scope**

The R&D proposal may include the following potential study areas:

1. Process improvement to improve viscosity of processed rubber
2. Furnace improvement for rubber processing.
3. Integration of local material as rubber fillers to improve cost and properties.
4. Novel uses rubber wastes
5. Sterols in VCO (directed call)
6. Value adding technologies on citrus, mango, rice, sweet potato, tropical fruits, and sugarcane

### **Specific Features Sought in this Call**

The proposals should demonstrate the following characteristics and should be well-written in the documents:

1. Results of industry roadmaps (if available)
2. Intensive Review of Literature showing no duplication in proposal concept with local research conducted
3. Technology Readiness Level between 2-6. It should encompass Technology Formulation, Validation of the Technology, Small Scale Prototype, Large Scale Prototype (if applicable).
4. Sustainability of both the supply of raw materials and finished product. The mode of collection of target raw materials should be demonstrated to support logistics viability.
5. It has potential for commercialization. Commitment letter/s from industry partner/s to support the marketability of the proposed product to demonstrate interest is required. Ideally, the industry partner will use the resulting technology in its formulation during the validation phase.

PCIEERD will fund/endorse a maximum of 5 projects not to exceed PhP35M budget covering all projects. The maximum duration for each project is 2 years.



## 2.3 Creative Industries

### 2.3.1 Creative Industry (Game, Animation, and Film Cluster) (Learning, Education, and Culture) (Industrial Solutions and Competitiveness)

#### Call Rationale

The Creative Industry is considered as one of the growing sectors in the global economy which contributes significantly to Gross Domestic Product (GDP) of developed countries. The Philippines is among the developing countries with rich cultural heritage and pool of creative talents that can potentially boost the economy through its creative goods. The country has the potential to be a creative hub in Asia through developing different creative industries including games, animation, and film.

In 2023, the Philippines ranks 56<sup>th</sup> among the 132 economies featured in the Global Innovation Index in terms of creative outputs. To improve the ranking in this pillar, innovation investments must be effectively translated into more and higher-quality creative outputs including intangible assets, creative goods and services, and online creativity. To achieve this, the Council will support applied research and development projects that will address pressing concerns and strengthen the current capabilities of the local creative industries, particularly the game, animation, and film development sectors. This is in coherence with the research and development and innovation support provided by the Department of Science and Technology for the creative industries as specified in Section 12 Chapter IV of RA 11904, otherwise known as the Philippine Creative Industry Development Act. This is to finally achieve the vision of making the country the top creative economy in ASEAN in terms of size and value driving competitiveness and attractiveness of the local creative talent and content in the international market.

In 2022-2023, the following priority areas were realized in the roadmap:

In terms of Facilities and Services, a Virtual Reality (VR) Laboratory was established through the recently completed Imahe Labs project as implemented by the University of the Cordilleras. Also, with the new VAMR project being spearheaded by Ateneo de Manila University, an Extended Reality Laboratory is being established to provide a viable way to consume virtual, augmented, and mixed reality (VAMR) educational content by students from multiple disciplines. Furthermore, with the recently approved Volume Technology proposal, a transportable Volume Technology Facility is set to be developed by 2025. In 2026, the Council is looking to establish more facilities and services including Creative Innovation Hub for graphics design, motion capture, and audio post-production, and holographic environment simulator.

For human resources, the DOST-supported Creative Industry projects conducted respective trainings on game design and development resulting in 17 students assisted and 240 trained personnel. The Council also assisted the Department of Trade and Industry in developing the

Philippine Skills Framework for Game Development and Digital Art Animation. These frameworks specify the employment opportunities, career pathways, job roles, as well as functional and enabling skills and competencies needed to better capacitate our human capital in the creative industry sector. In the next years, the Department is looking to provide support in capability and capacity building of our local MSMEs not only to develop software but also to produce advanced hardware prototypes.



Various milestones were achieved by the Council in terms of R&D technologies. For game development sub-sector, eight (8) serious games were already developed for mathematics, biology, chemistry, physics, social studies, tourism, health, and STEM. The outputs are now available to the public for download and are presented to the Department of Education for adoption. Also, an ongoing game engine and framework are being developed to facilitate assembly-line style production of VAMR applications. Furthermore, the creation of a serious game for tertiary math was already approved for funding. In terms of design and visual arts domain, the Council provided support in developing 2D CAD and 3D Visualization software for digital apparel prototyping and printing hardware for creating sand-based images. These outputs are targeted to be deployed by 2024. In 2025 and beyond, the Council would explore the digitization of traditional sports and application of extended reality technology for cultural preservation. The use of artificial intelligence in game analytics, graphics design, automatic music generation, character simulation, and video editing would also be researched on. Emerging technologies including motion capture for facial, body, and hand gestures, 3D pre-visualization, and personalized sound control would also be included in the list of R&D priorities.

As for S&T policies, a Memorandum of Agreement was sent to the Department of Education for the adoption of the serious game projects. Also, a Memorandum of Understanding with Esports World Federation was signed to conduct collaborative programs, projects, and activities in digital gaming industry. Moreover, the Department assisted the Technical Working Group in crafting the Republic Act No. 11904 or the Philippine Creative Industries Development Act which was passed into law last 28 July 2022. Furthermore, the Council reviewed and provided position paper in the House Bill 1289 entitled "An Act Institutionalizing the Creative Philippines Program and Providing Funds Therefor". In the succeeding years, the Council is targeting to develop policies on using blockchain in gaming industry, piracy, and copyright issues on computer-generated arts.

### Call Objective

The main objective of this call is to support research and development projects in creative industries particularly in game, animation, and film development sectors that will address the needs and strengthen the local capabilities in terms of facilities and services, human resources, R&D technologies, and/or S&T policies.

### Call Scope

Creative industries have been interlinked and heavily influenced by information and communication technologies (ICT) including artificial intelligence, Internet-of-Things, cloud computing, big data analytics, extended reality, wearables, and intelligent interfaces among others, which are still considered in the Philippines as emerging technologies. These ICT tools will not only address the need but will also drive economic transformations and disruptions in the creative sector in the coming years.

To enable innovations, this call targets to support applied research projects on the following topics:

- A. Program 1: GAME-ONE – Game Apps and Metaverse Ecosystem for Online and Novel Experiences** | The following R&D projects may be proposed towards the establishment of Creative Innovation Hub for Holodeck or Holographic Environment Simulator:
- **Leveraging AI for Enhanced Sports Analytics** | Leveraging artificial intelligence (AI) in sports is poised to bring significant transformations. Different implementations of AI in sports include talent identification and acquisition, game analytics, training and coaching, predictive modelling, strategy improvement, injury prevention, audience engagement, and immersive experiences. With effective sensors and



algorithms, AI has all in hand for game strategists, sports companies, advertisers, franchise owners, and spectators. With such a broad scope of implementations, the DOST-PCIEERD will explore in supporting R&D for AI sports application development.

- **Application of Extended Reality for Training and Cultural Preservation I** Extended reality is a universal term inclusive to immersive learning technologies such as virtual reality, augmented reality, and mixed reality. These technologies extend reality by simulating the real world through digital materials providing multisensory environment for more interactive technical training.

programs. This is practically applicable to high-risk industries allowing safe experiential learning and providing convenience to scale and reuse. Target application may be for training/upskilling such as complex machinery troubleshooting or for cultural preservation such as traditional sports.

- **Development of Metaverse Platform with Digital Marketplace I** A metaverse marketplace is a platform trading digital assets such as virtual lands, in-game assets, and other non-fungible tokens (NFTs). All transactions done on the platform are based on blockchain technology. It offers a way to enable consumers to buy, sell, or trade NFT art, digital images, GIFs, audios, videos, gaming assets, and virtual real estate and explore products and services interactively. It also allows users to attend virtual galleries, explore game previews, attend presentations, conduct conferences, join live auction through avatars, and other unique online experiences.

#### **B. Program 2: CInEMA–Creative Inventions Enhancing Moviemaking and Animation**

I The following R&D projects may be proposed towards the establishment of Creative Innovation Hub for Graphics Design and Motion Capture.

- **Development of Motion Capture Technology for Facial, Body, and Hand Gestures I** Traditionally, motion capture requires special equipment, cameras, studios, and software. Recently, researchers have developed a machine learning algorithm that works with any off-the-shelf camera to track face, hand, and body gestures, eliminating the need for markers on bodysuits.
- **AI in 3D Animation/Character Simulation I** AI technology has been making significant strides in the field of 3D animation and character simulation, revolutionizing the way animators and developers create realistic and immersive experiences. Using deep learning, a character control system is now being developed to assist characters to walk, run, jump, avoid obstacles, and carry objects using simple control commands in real-time. As AI technology continues to advance, it is expected that applications such as automated animation, facial animation and expression, gesture recognition, behavioral simulation, animation enhancement, and real-time rendering will become even more sophisticated, leading to further advancements in the field of 3D animation and character simulation.
- **Process R&D on Graphics Design and Computer-Generated Imagery I** The development of graphic design techniques involves a continuous process of innovation, experimentation, and adaptation to emerging technologies and design



trends. Some of the emerging technologies on the horizon include 3D design modeling and rendering to create depth and realistic visuals. Augmented Reality (AR) and Virtual Reality (VR) platform design for interactive and immersive experiences, and AI-driven design tools that assist in tasks like image recognition, layout suggestions, and data visualization. This would be beneficial for animators to easily achieve a certain creative look and feel and for moviemakers to create more realistic special effects.

- **Development of Algorithmic Video Editing** | Algorithmic video editing is now being used to assist editors with footage organization and rough cutting. Recently, researchers were able to develop an algorithm designed to choose the best shots and string them together with continuity. While the future of post-production will not likely fall to robots anytime soon, the applications for algorithmic film technology are becoming more practical that tech-savvy editors can use to optimize the post-production workflow.
- **Development of 3D Pre-visualization Software** | 3D Pre-visualization (pre-viz) revolutionizes the pre-production value chain by integrating fully immersive digital replicas of the physical sets or locations to be used on a live-action production before the actual cameras begin to roll. The digital playgrounds of 3D pre-viz provide filmmakers the time and space to explore and experiment without incurring unnecessary expenses. With 3D pre-viz software and game engines, directors can better refine visual designs, production designers can increase construction precision, directors of photography can take the guesswork out of technical solutions, and producers can optimize the logistical flow of the entire production. With this software, producers can optimize the logistical flow of the entire production.
- **Development of Autonomous Drone Cinematography System** | Shooting cinematic motion videos using a drone is challenging because it requires users to analyze dynamic scenarios and at the same time, operate the controller. Today, researchers have developed autonomous drone cameras specifically

designed to film live action with all the necessary knowledge of filmmaking, camera angles, and techniques. If AI will be integrated in cinematography, it will help local filmmakers to produce unique shots and make a good film as compared to static cameras.

**C. Program 3: Harmonized Innovations for Intelligent Music Generation (HIIMIG)** | The following R&D projects may be proposed towards the establishment of Creative Innovation Hub for Audio-Post Production.

- **Automatic Music Generation and AI-Assisted Sound Engineering** | Audio-postproduction software for automatic soundtrack generation has been recently developed to streamline the process of implementing audio into films. The technology will help sound engineers to rapidly locate and apply sounds in scene footages considering sync points, genre, and intensity, providing an infinite range of alternate compositions.



- Prototyping of Personalized Sound Control Technology** | Personalized sound control technology is a loudspeaker technology that brings only the target sound to the listener without causing sound leakage. It can be applied in cars, in movie theaters, or even in airplanes enabling passengers to listen to different music or watch different movies without using earphones or without others in the room hearing them. DOST-PCIEERD is looking forward to supporting this kind of equipment prototyping project.

### Requirements

Priority Areas	Target No. of Projects	Total Budget (PhP)
Program 1: GAME-ONE – Game Apps and Metaverse Ecosystem for Online and Novel Experiences		
Leveraging AI for Enhanced Sports Analytics	1 (PCIEERD-GIA)	15M per proposal
Application of Extended Reality for Training and Cultural Preservation	1 (PCIEERD-GIA)	15M per proposal
Development of Metaverse Platform with Digital Marketplace	1 (PCIEERD-GIA)	15M per proposal
Program 2: CInEMA–Creative Inventions Enhancing Moviemaking and Animation		
Development of Motion Capture Technology for Facial, Body, and Hand Gestures	1 (PCIEERD-GIA)	15M per proposal
AI in 3D Animation/Character Simulation	1 (PCIEERD-GIA)	15M per proposal
Process R&D on Graphics Design and Computer-Generated Imagery	1 (PCIEERD-GIA)	15M per proposal
Development of Algorithmic Video Editing	1 (PCIEERD-GIA)	15M per proposal
Development of 3D Pre-visualization Software	1 (DOST-GIA)	20M per proposal
Development of Autonomous Drone Cinematography System	1 (DOST-GIA)	20M per proposal
Program 3: Harmonized Innovations for Intelligent Music Generation (HIIMIG)		
Automatic Music Generation and AI-Assisted Sound Engineering	1 (PCIEERD-GIA)	15M per proposal
Prototyping of Personalized Sound Control Technology	1 (DOST-GIA)	20M per proposal



### **2.3.2 Creative Industry Sector (Footwear, Furniture, Jewelry and Heritage Innovation) (Learning, Education, and Culture) (Industrial Solutions and Competitiveness)**

For 2024, the PCIEERD Creative Industry Sector shall accept proposals under the following priority programs:

1. Footwear Program
2. Furniture Applications Program
3. Jewelry Design and Innovations Program
4. Heritage Innovation Program

#### **Call Rationale**

Creative Industry is considered as one of the growing sectors in the global economy because of its profound implications and transformative power across economic and social dimensions of sustainable development. The Philippines, rich in cultural heritage and pool of creative talents, is ripe for innovation and development and has the potential to be a creative hub in Asia by propelling research and development efforts on its creative sectors such as footwear, furniture, jewelry and heritage.

2023 is the year that the Philippines ranked 56<sup>th</sup> in terms of creative outputs among the 132 economies featured in the Global Innovation Index. The recognition of creative industry's impact on the country's development despite the unique characteristics of the sector underlines its ability as a source of competitiveness. The implementation of the Philippine Creative Industries Development Act (RA 11904) charts a promising sustainable path for the sector. To sustain the milieu of innovation established for the sector, the Council encourages research and development through funding support for projects and programs that will address the pressing concerns of the local creative industries.

#### **Call Objective**

The Call aims to provide support to qualified S&T research proposals of programs and projects with innovation and R&D solutions to identified priority areas of the creative industries particularly on footwear, furniture, heritage, and jewelry.

Specifically,

1. To increase research and innovation that are relevant to future innovation waves in the creative industries sector.
2. To spur collaboration across innovation stakeholders in the Creative Industries and encourage long-term R&D partnerships between academe, research and development agencies, creative enterprises, and other stakeholders.
3. To encourage development of homegrown technology and technological capabilities that are relevant to the sector.

#### **2.3.2.1 Footwear Program**

##### **Call Rationale**

The footwear industry is considered a mature and stable industry but remains heavily concentrating on subcontracting arrangements with foreign and large domestic companies that produce branded footwear and shoes from venturing into exports. Some of the challenges of the sector are access to sustainable local materials and availability of footwear design tools and technologies for local production.



### Call Scope

To address these gaps, the Council will provide fund support for the following research areas:

- A. **Material Innovation for Footwear Applications**  
R&D on Sustainable Local Materials for Footwear
  
- B. Footwear Design and Technologies
  - a. R&D on Specialized Footwear
  - b. R&D on Design for Footwear

Target Program/Projects: 1

Total Budget: 20M

### 2.3.2.2 Furniture Applications Program

#### Call Rationale

The Philippine Furniture manufacturers are known for their great craftsmanship, handmade work (carving and weaving), antique reproduction and hand-finishing skills. One of the identified areas that needs to be addressed to elevate the sector on a global scale is the availability of sustainable raw materials and establishment of supply hubs for semi-process materials both from local and imported sources.

To catalyze the industry's goal, the Council is looking for proposals that will focus on material manipulation and furniture design tool aids and technologies for furniture production.

#### Call Scope

The program covers project proposals incorporating innovative solutions and research in material innovation and design tools on the following areas/priorities:

- A. **Material Manipulation**
  - a. Local Materials from Wood and Non-Wood
  - b. Sustainable Materials for Outdoor and Indoor
  - c. Sustainable and biodegradable furniture packaging materials
- B. **Furniture Design and Application**
  - a. AI-based solutions
    - i. Furniture Design tools
    - ii. Quality Control/Assurance for Production
  - b. Woodcarving technologies for furniture
  - c. Specialized Furniture

Target Program/Projects: 2

Total Budget: 25 M

### 2.3.2.3 Jewelry Design and Innovations Program

#### Call Rationale

The Jewelry Industry is expected to expand by 2030 and even with recession and financial crisis, consumer preferences are leaning towards branded and/or established brand jewelries due to unique design, trustworthiness, and authenticity. Technology impacts the transformation of the international industry scene from technologies on mining to 3D printing, cloud solutions and e-commerce platforms prompting the growth of the jewelry industry. At the local level, the industry is



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EMERGING TECHNOLOGY RESEARCH AND DEVELOPMENT**

yet to catch up despite the reported abundance supply of gold and silver, source availability of semi-precious stones such as jade and onyx, south sea pearls and other cultured pearls.

There are a few that already acquired casting machines and wax injectors for their operations but most of the fine jewelry makers are still dependent on labor-intensive production which applies manual or hand operated tools or *mano-mano*. With research and development, the technologies from the projects and programs offer a remarkable window into the renaissance of the industry and ignite the interest of the next generation of jewelry makers.

### Call Scope

The call will prioritize funding of research and development program/projects on the following topics/areas:

**A. Technologies for Design and Production of Fine and Fashion Jewelry**

**B. Software and Tools for Jewelry Making**

Target Program/Projects: 1

Total Budget: 20M

### 2.3.2.4 Heritage Innovation Program

#### Call Rationale

Culture and heritage are shaped by the community and an inheritance from the previous generations. Heritage is the driver of cultural and creative waves of the locality. While policies and laws are in place to preserve cultural heritage, the role of science in preservation and recovery has yet to be emphasized and realized. For this year's call, the creative industries are encouraged to find opportunities through science and technology to develop solutions and innovations for culture and heritage.

#### Call Scope

The call will prioritize R&D program/project that will focus on the following: A. Innovations for Traditional Knowledge Preservation and Protection and B. Technologies for Cultural and Heritage Management and Protection.

Target Program/Projects: 1

Total Budget: 20 M

### 2.4 Metals and Engineering (Food and Agriculture) (Industrial Solutions and Competitiveness) (Environment & Natural Resources) (Climate, Disaster Resilience, and Human Security)

#### Call Rationale

Metals and Engineering is one of the priority sectors of DOST-PCIEERD that supports different industries (i.e., food, mining, agri/agro, environment, creative) through fabrication of appropriate machineries/equipment, upgrading/strengthening of S&T services through facility establishment, and the development of diverse metalworking technologies through R&D. This is the Council's support for the vital and significant role of the Metals and Engineering (M&E) industry in the country's economic growth and development. The Philippine economic sectors—manufacturing, agricultural, and service sectors—are greatly dependent on the M&E industry, especially in terms of their requirements for machineries and equipment, metal-based parts, and assemblies, among others.



To acknowledge and address the needs of the local industry in promoting its growth and competitiveness, the PCIEERD M&E sector spearheaded the development of a six (6)-year roadmap in 2020, covering the period 2020-2025 for the Machining and Fabrication Sector, Metalcasting Sector, Tool and Die Sector and Surface Engineering Sector. These roadmaps were identified by the stakeholders composed of representatives from the government, industry and academe during the conduct of online consultations in the following regions: NCR, CAR, I, II, III, IVA, IVB, V, VI, VII, VIII, IX, X, XI, XII and CARAGA. However, the data and information gathered from the conducted roadmapping sessions were broad and necessitates further verification. Thus, it needs to be refined thoroughly in order to translate into high impact plans and programs.

In 2022-2023, the M&E sector conducted a series of industry consultations with the companies that are in the fields of Machining and Fabrication Sector, and Metal Casting Sector in Region III and in the National Capital Region (NCR) to revalidate the developed roadmaps and to better comprehend their pressing gaps and needs. It is undertaken to create a strategic action that will support the metalworking industry.

### **Call Objective**

The objective of this Call is to enjoin qualified local institutions, engineers and scientists and individuals to take new advances in implementing R&D to produce world-class metal products/equipment/technologies that will bolster the progress and competitiveness of the local Metals Industry (i.e., Metalworking, Metalcasting, Surface Engineering, Tool & Die).

The following fields are being prioritized in this call:

#### **2.4.1 Machining and Fabrication**

##### **Call Rationale**

Based on the consultations, there are many factors affecting the level of competitiveness of the metalworking industry. In the National Capital Region (NCR) the following industry gaps have been identified: (1) low number of clients, (2) need for locally developed equipment for various industries (e.g., food, creative, defense, process, mining, environment, etc.) and (3) difficulty in finding fabricator for a specialized equipment (e.g. pressure vessel). Also, the Maritime Industry Authority (MARINA) has been consulted and mentioned that one of the gaps identified of shipyard companies is the scarce supply of basic machineries, equipment and spare parts used for shipbuilding and ship repair using marine grade steel.

In Region III, the identified gaps of the industry are: (1) decreasing number of skilled workers in the field, (2) limited funds for equipment acquisition to support fabrication processes, (3) availability of cost-effective and efficient semi-automated and fully automated equipment for agri-industry (e.g. lessening tedious task of laborious harvesting), and (4) high cost of equipment for operation such as CNC machines, thus, the company suggested to have a retrofitting program to convert the conventional machines to semi-CNCs.

Furthermore, another area of concern identified is the Metrology. This area supports the entire works of the metals industry thru proper calibration of their tools and instruments being used in their manufacturing processes. Calibration aims to ensure that readings from the instrument are consistent with measurements from other instruments, determine the accuracy of the instrument



readings and establish the reliability of the instrument. The Industrial Technology Development Institute (ITDI) of the Department of Science and Technology (DOST) established the National Metrology Laboratory (NML) to provide one national reference serving the country's industry, secondary calibration laboratories and regulatory authorities with credible calibration services in different measurement areas (e.g., mass, temperature, volume, pressure, etc.). NML is currently in the pursuit of R&D studies on establishing the S.I. units in the Philippines to become self-sufficient in terms of calibration in the field of Mass and Temperature. However, there are no established data on the demand for metrology services particularly in primary calibration in the field of Mass and Temperature (i.e., establishment of S.I. units). Thus, this needs to be identified through scoping prior to R&D of its S.I. units.

To address these gaps, below are the topics sought in this call:

### Call Scope

1. FASTPhils: Fabricators Assessment and Scoping in the Philippines
2. Scoping for Physical Metrology (e.g., Mass, Temperature, Electrical, Fluid Flow, etc.)
3. Local Design and Development of innovative, cost-effective, and appropriate Metal Equipment (mechanical/automated), Machine Parts and Engineered Products for the following:
  - a. Food Industry
    - food processing industry (e.g. coconut, coffee, cacao, etc.)
    - food service
  - b. Agri-industry
  - c. Creative industry (e.g. equipment for furniture, raffia weaving)
  - d. Environment Industry (e.g. equipment for waste processing/elimination)
  - e. Mining industry (e.g. equipment for metal product development like copper rods and sheets)
  - f. Defense industry (e.g. military weapon manufacturing)
  - g. Ship Repair Industry (e.g. parts and equipment manufacturing)

PCIEERD will fund/endorse maximum of 8 projects not to exceed PhP145M covering all projects. The maximum duration for each project is 3 years.

### 2.4.2 Metal Casting

#### Call Rationale

Based on the consultations conducted, there are several gaps identified for the Metal Casting and these are: (1) higher price of locally produced products over competitors due to high energy costs in their operation/production and logistics and container costs for imported raw materials (i.e., steel, sand, machines), (2) need for equipment upgrading for metal casting processes (3) no support mechanism such as government law that promotes the use of locally produced products to boost its market.

On the other hand, another area was identified by the sector which is Metal Product Recycling that falls under the circular economy initiatives of the government. Metals are valuable materials that can be recycled again and again without degrading their properties. In 2019, 490.98 million (32%) of the 1,532.51 million metric tons of crude steel produced worldwide was made using recycled materials. Scrap metal has value and has the following advantages: (1) Enables the preservation of natural resources while requiring less energy to process than the manufacture of new products using virgin raw materials (2) emits less carbon dioxide and harmful gasses and (3) it allows manufacturing business to reduce their production cost. One of the largest contributors for scrap metals are metals



from ships. Generally, at least 70% of the overall light displacement tonnage of broken ship comprises of re-rollable scrap and these are converted into rods and bars which are used for construction applications. Moreover, the primary source of raw material for the re-rolling mills are steel scrap from the damaged and demolished ships.

According to the 2022 Philippine Ship Building and Ship Repair (SBSR) Situation Report of the Maritime Industry Authority (MARINA), our country has always been considered as an ideal place to maximize the potential of maritime industry particularly SBSR sector. Over the years from 1970 up to present, the SBSR sector in the Philippines continued to grow as another shipbuilding giant which made the local firms to expand their capability and capacity to cater projects in SBSR industry. This leads to maintaining the status of the country as the fifth (5<sup>th</sup>) largest shipbuilding country worldwide. Despite this fact the SBSR is currently facing these challenges that needs possible solutions: (1) lack of manpower due to emigration of highly trained technical and skilled workers, (2) 66% of the total main yard facilities nationwide need rehabilitation/upgrading, (3) continuous importation of ship, (4) environmental hazards and (5)

in 2022, 80% of the MARINA-registered shipyards nationwide have not yet applied for ISO Certification, (6) no existing conversion of the International Association of Classification Societies (IACS) to local standards for the establishment and verification of compliance with technical and engineering standards for the design, construction and life-cycle maintenance of ships and other marine-related facilities, (7) the domestic shipyards are not able to comply with international standards because addressing its requirements may be very expensive and (8) the current shipyards doesn't know how to identify hazardous materials in ship recycling and proper disposal of metals. Hence, DOST is being sought to include aspects and concerns on ship recycling since MARINA already has an initiative to revive the steel industry in the country to lessen the country's dependency on importation and recycling of metals and remanufacturing of reusable metals from ships are needed.

To address mentioned gaps, below are the identified potential areas for R&D initiatives for this roadmap:

#### **Call Scope**

1. R&D on Localization of Metal Casted Products through Metal Casting Processing Technologies for Various Applications (e.g., vacuum sand casting, lost-foam casting, sand system, etc.)
2. R&D on Metal Product Recycling and Development (e.g. ship recycling)

PCIEERD will fund/endorse maximum of 3 projects not to exceed Php80M covering all projects. The maximum duration for each project is 3 years.

With these matters related to be critical to the stability and vigor of Metals and Engineering industry, therefore, the programs and projects to be generated under the said roadmaps will serve as a blueprint for the industry, academe, and research institutions in identifying appropriate interventions that could address these gaps and issues identified from the conducted industry consultations.

#### **Specific Features Sought in this Call**

The proposal should have the following features and should be well written and included in the document to be submitted:

1. Technology roadmap (if available).
2. Thorough Review of Literature to clearly present the related research/activities, baseline studies which have been conducted (including patent search, showing no duplication of the



proposed technology), as well as the state-of-the-art technology or current information from which the proposal will take off.

3. Please include the sustainability plan for the proposed equipment/technology to be developed (e.g., maintenance of the developed equipment or technology).
4. Secure commitment letter from the identified beneficiary/end-user of the proposed technology.
5. Identify potential licensee/fabricators/mass producers for proposals that entails fabrication of equipment.
6. Secure a fabricator in proposing equipment development projects.
7. For proposals with development of equipment, clearly specify (possibly quantify) these **NSDB-ME** in the proposal: Need, Solution, Differentiation (show this in a matrix), Benefits, Maintenance and repair and service commitment and economic viability.

Parameter	Existing Equipment/Process/Technique in the Market	Proposed Fabricated Equipment/Process/Technique	Remarks
Process/Techniques			
Material			
Speed/performance			
Capacity			
Dimension/design			
Quality (e.g., produced product/equipment)			
Manpower Needed			
Cost			
Others (Pls specify other parameters applicable/suitable to the proposed equipment)			

## 2.5 Mining and Minerals (Industrial Solutions and Competitiveness) (Environment & Natural Resources)

The Philippines is one of the world's most well-endowed country in terms of mineral resources with rich and vast amounts of metallic and non-metallic mineral deposits, with 30 million hectares of land area identified as mineral potential and 9 million hectares as having high mineral potential (*source: MGB*). To name a few of our reserves, Iron and iron-rich minerals have an estimated reserve of lump magnetite of almost 56 million MT, magnetite sand of less than 2 billion MT, and laterite ores of less than 2 billion MT. Copper has an estimated reserves of 4 billion MT while for chromite, 43.6 million MT.

In terms of mineral resources and development projects, the country, as of 2023, has 56 operating metallic mines (12 gold mines, 3 copper mines, 33 nickel mines, 4 chromite mines and 4 iron mine),



59 operating non-metallic mines (28 limestone, 2 shale quarries, 5 marbleized limestone, 4 silica quarries, 14 basalt/aggregates quarries, 1 dolomite quarry and 3 clay quarries, 1 sand & gravel, 1 volcanic tuff), 55 Declared Minahang Bayan (45 gold, 8 chromite, 1 magnesite, 1 silica quartz), 4,229 estimated number of LGU issued permits (small quarries and sand & gravel operations) (*source: MGB*) and two (2) large scale offshore mining. The mining industry's economic contribution in 2022 is PhP 238.30M from metallic mineral production and US\$ 7.53B from mineral exports (*source: MGB*), thus, the mining and mineral industry is an important contributing factor in the catalyzation of the country's economic development.

Mining provides the essential components for virtually everything – from building roads and infrastructures to generating electricity and producing goods that improve the consumers' standard of living as well as providing the world with key mineral commodities it needs for technology innovation. Critical Minerals are the building blocks of green and digitized economy ([nrcan.gc.ca/our-natural-resources/minerals-mining/critical-minerals](http://nrcan.gc.ca/our-natural-resources/minerals-mining/critical-minerals)). These minerals are significant in the development of cutting-edge technologies that are innovating the world. With the rapid innovation globally, and with the dire need for such minerals', rapid growing demand is foreseen in the coming years. As such, this would be a good opportune for the Philippines to be the hub for critical minerals.

In pursuit towards making the Philippines the hub for critical minerals, the DOST envisions the need to conduct extensive onshore and offshore exploration of critical minerals to support the modern society's growing need for such minerals. Hence, to ensure the mining industry's long-term viability and sustainability, as the minerals are extracted from non-renewable resources, the DOST is supporting the development of novel methods for the conduct of (1) extensive ore exploration with advanced ore characterization of critical minerals in the country's mineral reserves, and (2) ex-ante assessment of offshore mining. In the development of methods, it should consider economics, environment, social responsibility, and sustainability to prevent generation of complex environmental and socio-economic issues.

### **Call Objectives**

The call aims to further revitalize the country's mining industry and accelerate its economic development without compromising the environment and the health of the people by:

1. Developing a novel method to conduct extensive critical minerals exploration and characterization, to support the scientific research on the extraction of critical minerals from metallic and non-metallic minerals and process/refine the minerals for green and emerging technology application, and
2. Developing a novel method to conduct ex-ante assessment of offshore mining leading to the development of the most appropriate science-based framework for the management of offshore mineral resources.

### **2.5.1 Extensive Critical Minerals Exploration and Characterization**

#### **Call Rationale**

Critical Minerals are the building blocks of the green and digitized economy ([nrcan.gc.ca/our-natural-resources/minerals-mining/critical-minerals](http://nrcan.gc.ca/our-natural-resources/minerals-mining/critical-minerals)). These minerals and elements are highly demanded globally due to its significant use for advanced green and emerging technologies, yet the supplies are at risk because of their natural scarcity and because of geopolitical issues and trade policies that complicate their distribution, among other factors. Critical minerals include Aluminum, Antimony, Bismuth, Cesium, Chromium, Cobalt, Copper, Fluorspar, Gallium, Germanium, Graphite, Helium,



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DEPARTMENT OF SCIENCE AND TECHNOLOGY

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EMERGING TECHNOLOGY RESEARCH AND DEVELOPMENT**

Indium, Lithium, Magnesium, Manganese, Molybdenum, Nickel, Niobium, Platinum group metals, Potash, Rare Earth Elements (REE), Scandium, Tantalum, Tellurium, Tin, Titanium, Tungsten, Uranium, Vanadium, and Zinc (source: Canada's List of Critical Minerals).

With the global demand for critical minerals for green and emerging technology application to support low carbon future, the DOST and PCIEERD have started funding proof of concept and/or at laboratory scale level research projects related to the geological characterization and viable extraction of potential minerals. An innovative technology for the extraction of nickel and copper using Deep Eutectic Solvents (DES) has been introduced and currently testing its technical and economic viability using our local nickel and copper ores. While new research projects on the extraction of REE from bauxite, gold from refractory gold ores and copper from copper ores have started its implementation in 2023, completed projects that have proven technical viability to extract critical minerals at laboratory scale level were continuedly supported by the DOST. The extraction of REE at higher scale level from coal fly ash and phosphogypsum tailings are expected to commence in 2024.

To establish a secure and resilient supply chain to support the high global demand for said minerals, the DOST, will embark on the development of novel methods for the conduct of extensive exploration and advanced characterization of ores for nickel, cobalt, copper, chromite, aluminum, rare earth elements (REE) and other high value critical minerals in the country. This is a step to making the Philippines the hub for critical minerals.

### **Call Objective**

To develop a novel method to conduct extensive exploration and advanced characterization of ores for nickel, cobalt, copper, chromite, aluminum, rare earth elements (REE) and other high value critical minerals from metallic and non-metallic minerals in support of green energy and emerging technology applications.

### **Call Scope**

In the development of novel method for ore exploration with advanced characterization for critical minerals, extensive exploration and characterization will cover six (6) areas of metallic and non-metallic mineral reserves in the country. To enhance the quality and quantity of mineral resources, extensive exploration techniques should include state state-of-the-art equipment and software (e.g. remote sensing, geological, geochemical techniques, geophysical methods, artificial intelligence, GIS, etc.). For the advanced ore characterization, to produce valuable data for mineral and metal extraction, techniques to be used should be innovative, automated and quantitative.

The maximum budget allotted for the above research is PhP 200,000,000.00 with a duration of three (3) years covering CY: 2026-2028

## **2.5.2 Ex-ante Assessment of Offshore Mining**

### **Call Rationale**

Marine mineral resource development activities in the Philippines are expected to increase in the next several years, as the country holds rights to significant marine mineral resources within its EEZ offshore area of 2.2 million square kilometers. These are mineral resources that are potential ores of gold, silver, platinum, palladium, iron, manganese, cobalt, copper, and aggregate resources to name a few. The titano-vanadium-magnetite resources alone, are estimated to be approximately one billion tons of raw mineral material (MGB Proposal on Marine Mineral).



Based on some research, offshore mining could have environmental effects. The most direct impacts at mining sites are destruction of natural landforms and the wildlife they host, compaction of the sea floor, and creation of sediment plumes that disrupt aquatic life. (Deep-sea Mining FAQ-Center for Biological Diversity). It is therefore important that all offshore mining activities are guaranteed to be environmentally, socially, technically, legally, and economically sustainable.

As such, for the 202 CFP for 2026 funding, the DOST is prioritizing the conduct of ex-ante assessment of offshore mining and develop the most appropriate science-based framework for the management of offshore mineral resources such as resource assessment and management, governance, policymaking, regulation and planning, environmental impact assessments, environmental risks, mitigation, use of appropriate technologies, and performance monitoring based on the recommendation of MGB.

### **Call Objective**

To develop a novel method to conduct ex-ante assessment of offshore mining leading to the development of the most appropriate science-based framework for the management of offshore mining/ mineral resources in the country.

### **Call Scope**

Ex-ante assessment of offshore mining will cover the effect of offshore mining on several habitats (threshold area), socio-economic assessment and test of impact significance and issues. Specifically, the research is expected to conduct the following: resource assessment and management, governance, policymaking, regulation and planning, environmental impact assessments, environmental risks, mitigation, use of appropriate technologies, and performance monitoring.

The maximum budget allotted for the above research is PhP40,000,000.00 with a duration of three (3) years covering CY 2026-2028

### **Specific Features Sought in this Call**

- Proposals should be submitted by qualified Researchers from HEIs, RDIs and other government R&D institutes. Any proposals submitted by a private entity, consultants and the like shall be automatically disapproved.
- All proposals must submit at least one (1) Commitment Letter/Letter of Cooperation from an Industry Partner and concerned agency/ies that will adopt/use the research outputs. Failure to submit the said requirement is a ground for disapproval or non-consideration.
- The research proposal should have a potential to be transferrable to the industry and locality.
- The proposal should exhibit clear Social and Economic Impact and should answer any of the seventeen (17) Sustainable Development Goals (SDGs).
- The Line-item Budget (LIB) should include a 20% counterpart funding from the private industry or cooperator. Only eligible and allowable costs may be used for counterpart fund and/or in-kind contribution (ex. utility costs, office space rental, etc.), as determined by DOST-PCIEERD. The proposal must describe how the applicant will provide the counterpart fund/in-kind contribution.



## 2.6 Industry 4.0 (Industrial Solutions and Competitiveness)

### Call Rationale

PCIEERD, in line with its thrust to propel the Philippines to achieve its Industry 4.0 aspirations, is calling for research proposals to develop integrated sensor-actuator systems and technologies for sensor and actuator with decentralized controls and connectivity, sensor/actuator networks, streaming data analytics for optimal and adaptive manufacturing. The proposed project should be able to set up an intelligent, agile or reconfigurable and fully networked production line or subline that integrates physical input objects, machines, smart sensors, and demonstrate the application of manufacturing data analytics across the boundaries of organization.

For the past two (2) years, the Council has supported the establishment of advanced mechatronics, robotics, and automation laboratory or AMERIAL. However, such facility must be maintained, sustained, and even expanded to accommodate beyond the training program that it can offer. The Council is on the lookout for possible establishment of manufacturing grid and smart factory web that will allow interoperability of smart factories for cloud and eventually ubiquitous manufacturing.

Bulk of the efforts so far were focused on capability building. The Council has been part of the Industry 4.0 Technical Working Group (TWG) as organized by the Semiconductor and Electronics Industries in the Philippines Foundation Inc. (SEIPI) where series of industry-led webinars were already held for Industry 4.0 awareness and adoption. Also, through the established TWG, local standards were developed to assess the smart industry readiness and smart manufacturing maturity of industrial companies with initial focus on electronics industry. It is targeted in the upcoming years to come up with modules on Supervisory Control and Data Acquisition (SCADA) to accelerate the connectivity and automation of micro, small, and medium enterprises (MSMEs). Also, certification of Industry 4.0 assessors and conduct of skills microcertification programs will be explored in the coming years.

As for the R&D technologies, the Council has already supported a project on the development of non-intrusive sensor-based prescriptive maintenance platform particularly for wire manufacturing on anomaly detection for wire extruder. A more advanced utilization of big data and analytics for demand forecasting and predictive and proactive maintenance will be explored as part of the next phase. With the recently approved proposal, a modelling and simulation of a digital predictive twin will be studied in the next year. It is the vision of this sector to create and foster a flourishing innovation ecosystem for Industry 4.0 in the country.

Finally, for S&T policy, in collaboration with DTI and SEIPI, initiatives were already made in providing incentive systems for Industry 4.0 readiness assessment and certification. Curriculum changes and formulation of cybersecurity protocols will be explored in the coming years to increase responsiveness with the rapid pace of innovation in smart manufacturing.

### Call Scope

This call intends to solicit proposals on the integration of intelligent sensor networks, coupled with AI, to improve existing systems and/or develop new services and breakthroughs in science as applied to Intelligent Factories. To adopt the elements of the Industry 4.0 architecture, the Council will prioritize projects in the following fields.



#### **A. Smart Manufacturing**

- Development of integrated and intelligent sensors and actuators with big data analytics for demand forecasting and predictive and proactive maintenance
- Development of local manufacturing execution systems (MES), supervisory control and data acquisition (SCADA), enterprise resource planning (ERP) software, and digital twin
- Process visualization through augmented reality technology for worker maintenance and training
- Development of collaborative robot for materials handling

#### **Requirements**

**Maximum Budget Allocation:** PhP20M per proposal

**Target Number of Project/s to be Funded:** 4 (DOST-GIA)

Proposals should be submitted with a letter of support from the target beneficiaries or adopters for sustainability.

### **III. Enabling/Development of Core Technologies**

#### **3.1 Advanced Materials and Nanotechnology Sector (Health and Wellbeing) (Industrial Solutions and Competitiveness) (Climate, Disaster Resilience, and Human Security)**

The world stands on the brink of a materials revolution, driven by remarkable advancements in nanotechnology and material science. These breakthroughs hold the promise of transforming industries and catalyzing scientific discoveries that will shape global socio-economic progress. To lead this transformative wave, DOST-PCIEERD invites research and development (R&D) proposals that focus on pioneering materials and nanotechnologies with the potential for transformative and sustainable impacts.

This call is informed by a rigorous technology foresight exercise and extensive stakeholder consultations, which have identified pivotal trends and emerging opportunities within the advanced materials and nanotechnology landscape.

#### **Call Rationale**

Research and development are fundamental drivers of innovation across industries, enhancing a nation's overall technological competitiveness. The advanced materials and nanotechnology sectors play a pivotal role in developing novel materials or refining existing ones, unlocking their diverse properties and applications. These materials serve as the cornerstone for progress across various sectors.

Breakthroughs in emerging technologies address existing technological gaps, foster the creation of new markets and industries, and stimulate economic growth. Additionally, supporting R&D in these fields fosters skill development and cultivates the expertise necessary for sustaining innovation leadership.

#### **Call Objective**

Building on its legacy of supporting research and development in areas such as plasma science and technology, hydrogen fuel cells, materials informatics for energy applications, smart packaging utilizing nanomaterials, and nanosafety, DOST-PCIEERD aims to continue driving innovation in these domains toward discovering new materials and their industrial applications by 2026.



### Call Scope

We invite proposals aligned with the following key areas:

- **Plasma Technology**

Explore the applications of ionized gases in semiconductor manufacturing, health care, surface modification, thin film development, and agricultural treatments.

- **Nanostructured Thin Films/Coatings**

Utilize plasma processes to deposit nanostructures and nanostructured thin films tailored for applications in optoelectronics, sensors, aerospace, automotive, and energy storage devices.

- **Plasma Surface Engineering for Energy Applications**

Customize surface properties for applications such as smart textiles and membranes in energy-related fields.

- **Environmental Applications**

Harness plasma systems for wastewater treatment, desalination, carbon capture, air purification, and explore byproducts of these processes.

- **Hydrogen Fuel**

Develop and demonstrate fuel cell systems for diverse applications, including transportation, residential, and industrial sectors.

- **Materials Informatics for Energy Applications**

Leverage computational and data-driven methods to accelerate the discovery and design of novel materials for energy-related applications, spanning from batteries to catalysts.

- **Smart Packaging using Nanomaterials**

Innovate food and medical packaging with active or intelligent concepts to extend shelf-life, enhance safety, and provide intelligent functionalities.

- **Nano-safety**

Advance understanding and mitigate potential risks associated with nanomaterials to ensure the safety of humans and the environment.

### Requirements

Priority Areas	Target No. of Projects	Total Budget (PhP)	Documents/Eligibility
Plasma Technologies	4	15M with maximum of 3 years duration per project proposal	To ensure that the research output will be utilized, a clear <b>technology commercialization pathway</b> must be submitted.
Hydrogen Fuel Cell	3	15M with maximum of 3 years duration per project proposal	
Materials Informatics for energy applications, etc.	2	15M with maximum of 3 years duration per project proposal	
Smart packaging	3	10M with maximum of 3	



		years duration per project proposal	
Nanosafety	2	10M with maximum of 3 years duration per project proposal	

### 3.2 Additive Manufacturing Sector (Health and Wellbeing) (Industrial Solutions and Competitiveness) (Climate, Disaster Resilience, and Human Security)

The Philippines stands on the brink of a manufacturing revolution with Additive Manufacturing (AM), commonly known as 3D printing, poised to reshape industries, drive innovation, and spur economic growth. To harness this potential, DOST-PCIEERD invites proposals aimed at fostering the development and widespread adoption of AM technologies across the nation.

#### Call Rationale

The current landscape of Additive Manufacturing (AM) presents a diverse array of applications, ranging from the production of clothing, basic electronics, and industrial components to the groundbreaking realms of human organ fabrication, solar cells, and even vehicles. The versatility of AM is exemplified by its ability to continually expand into new domains, promising a future limited only by imagination.

As we look ahead to the next decade, the trajectory of AM innovation appears boundless. Advancements in component design and manufacturing processes are steadily maturing, rendering technology more accessible, cost-effective, and reliable. This trend is poised to accelerate the emergence of specialized sub-categories such as 3D and 4D Printing, as well as Nano-Manufacturing.

In 2022, a pivotal Additive Manufacturing Conference-Workshop, co-organized by AMCEN (MIRDC and ITDI) and DOST-PCIEERD, convened key stakeholders from government, academia, and industry. Through collaborative efforts, recommendations were formulated to address critical needs:

#### □ Talent Development

Recognizing the imperative for skill enhancement, the stakeholders emphasized the importance of local demonstration projects to nurture a proficient workforce.

#### □ Stakeholder Engagement

Acknowledging the disruptive nature of AM, active involvement of stakeholders was deemed essential to navigate and capitalize on industry shifts.

#### □ Materials Expertise

Establishing a comprehensive understanding and management of materials at local and institutional levels, guided by subject matter experts, was underscored as pivotal for sustainable growth.

In the manufacturing sector, while some private entities have embarked on mainstream adoption of AM, it's imperative to ensure alignment with the evolving roadmap. Crucial considerations include the availability of a skilled talent pool and catering to diverse stakeholder needs, such as environmental impact and surface quality requirements.



Noteworthy achievements within the AM sector include the establishment and operationalization of the Additive Manufacturing Center of DOST-MIRDC (DOST-AMCen), catalyzing advancements across various industries. AMCEN's endeavors span from the inception of specialized laboratories to hosting milestone events like the Philippine Conference on Additive Manufacturing (PhilCAM). Moreover, its outreach efforts encompass training initiatives and groundbreaking projects like the 3D-printed monument of Dr. Jose P. Rizal.

Building upon these successes, DOST's commitment extends to the expansion of AMCEN into the Central Hub for Advanced Manufacturing R&D in the Philippines (CHAMP) Program. Comprising projects like TRIAMPH and MAST3R, this initiative aims to bolster additive manufacturing capabilities, foster collaborative ecosystems, and position the Philippines as a regional leader in science, technology, and innovation.

Notably, the dedication to excellence is exemplified by sending researchers for AI training in Additive Manufacturing in the United States, under the guidance of esteemed mentors (Prof. Advincula). Additionally, R&D breakthroughs, such as utilizing locally available materials for 3D Concrete Printing and advancing multiple materials platforms for AM, signify a steadfast commitment to innovation and sustainability.

### **Call Objective**

Proposals should focus on developing technologies aligned with the call scope within a timeframe of 2-3 years.

### **Call Scope**

Proposed projects should explore applications of AI and Machine Learning in Additive Manufacturing, including but not limited to:

- **AI-Based Design Optimization**

Harnessing AI algorithms for generative design to create complex and lightweight geometries, showcasing examples of AI-generated designs that surpass traditional approaches.

- **Intelligent Material Selection**

Utilizing AI to analyze material properties, develop new feedstocks, and optimize material selection for enhanced performance and cost-efficiency.

- **Real-time Process Monitoring and Quality Control**

Implementing AI-driven sensor systems for real-time monitoring, anomaly detection, and predictive maintenance to ensure high-quality printing outcomes.

- **AI-Driven Process Parameters Optimization**

Optimizing process parameters using AI to enhance production efficiency and part quality across different materials and printing techniques.

- **Machine Learning for Post-Processing and Finishing**

Automating post-processing steps such as support removal and surface finishing through machine learning algorithms to improve efficiency and quality.

- **AI in Quality Assurance and Certification**

Leveraging AI for certifying AM parts, ensuring compliance with industry standards, and maintaining part consistency.

- **Integration of AI with Robotics in AM**

Exploring synergies between AI and robotics for automated part handling, assembly, and continuous AM processes.



## Requirements

Priority Areas	Target No. of Projects	Total Budget (PhP)	Documents/Eligibility
Additive Manufacturing	5	5-10M (year depending on the scope of work being proposed) per project proposal	To ensure that the research output will be utilized by the target industry/ adopter, a letter of interest together with a <b>3- to 5-year technology pathway</b> must be submitted.

### 3.3 Electronics (Industrial Solutions and Competitiveness)

#### Call Rationale

The Philippine electronics industry is the largest contributor to the country's manufacturing sector. The potential for the industry remains high as local firms intend to move to higher value-added manufacturing to meet global demand. According to the Semiconductors and Electronics Industries in the Philippines Foundation Inc. (SEIPI), member companies plan to improve current production capacities, to expand current research and development and design capabilities, and to further develop the labor force over the next several years. To support this, the industry recommends that the government shall continue with its programs in improving the country's business environment, conducting R&D capability development, and aggressively promoting local industries and SMEs.

In 2022-2023, the following accomplishments were achieved:

In terms of Facilities and Services, five (5) mirror laboratories were being established as part of the network of Center for Integrated Circuits and Devices Research (CIDR). This includes IC design laboratory in University of the Philippines – Diliman (UPD), Mindanao State University – Iligan Institute of Technology (MSU-IIT), University of Science and Technology of Southern Philippines – CDO, Caraga State University, and Surigao Del Norte State University. In the succeeding year, four (4) more mirror laboratories are projected to be established: one each in University of Sto. Tomas, University of San Carlos, Batangas State University, and Mindanao State University – General Santos. In collaboration with the Department of Trade and Industry (DTI) and Semiconductor and Electronics Industries in the Philippines Foundation Inc. (SEIPI), the Council is also eyeing to create a laboratory scale wafer fabrication facility to provide the country capability in producing IC design prototypes. DTI will conduct a feasibility study to assess its viability and know how to optimize the benefits of the facility.

Achieving and maintaining a critical mass of IC design engineers are crucial to the continued and sustainable growth of the local IC design ecosystem. For human resources, the Council supported projects that assisted 117 students and trained 702 personnel through the nationwide conduct of graduate-level classes and trainings on front- and back-end full custom IC design. By next year, the Council will support the conduct of more joint graduate-level classes to cast a wider reach of IC design professionals.

As for R&D technologies, through the CIDR Program, new classes of electronics are being developed which are reconfigurable, self-healing, and battery-less. The component projects are interlinked with each other which can be combined to form an autonomous, intelligent, and energy-



efficient wireless sensor network. With the recently approved proposals, a computing-in-memory technology and a versatile and error-resilient IoT trainer board will be developed. For the next cycle of Call for Proposals, the Council is looking to develop other new classes of electronics which are flexible, paper-based, and radiation-hardened including advancement in memory and logic technologies. R&D and feasibility study on wafer fabrication will also be explored. In terms of electronics manufacturing services sub-sector, prototyping of collaborative and swarm robots, implementation of robot-as-a-service, and development of biomimetic sensors and smart dust will all be included in the priorities.

For S&T policies, new elective courses were introduced in UPD including Physical Unclonable Functions in Digital Integrated Circuits and Introduction to Microfabrication and Microelectronic and Mechanical Systems. Also, with the DOST-supported CIDR project, a Master of Science in Electrical Engineering program and curriculum was approved in MSU-IIT. By next year, in coordination with DTI and Organization for Economic Cooperation and Development, the Council will provide support in drafting the Philippine Semiconductor Ecosystem Report to leverage the capabilities of the country in assembly, testing, and packaging as well as in IC design for investment prospects and business opportunities with the passage of US CHIPS (Creating Helpful Incentives to Produce Semiconductors) Act.

Hence, this Call was made in support of achieving the vision of carving a niche in the global electronics market, building a “Made in the Philippines” brand that will capture market opportunities among end-product manufacturers and end-users.

The priority topics identified were based on the following stakeholders’ consultations and references:

- Griffin, M. April 2020. Exponential Technology Codex 2020 to 2070. Codex of the Future Series. 311 Institute.
- Harmonization of DOST-PCIEERD and DOST-ASTI Roadmaps on Electronics, ICT, and Quantum Technology, December 15, 2022.
- DTI Sectoral Working Group Consultation on Electronics and Semiconductor, 2023

### Call Objective

The main objective of this call is to support research and development projects in electronics and semiconductor industries manufacturing services.

### Call Scope

This call targets to support applied research projects on the following topics:

#### A. Semiconductor Manufacturing Services

- **Development of New Classes of Electronics including Flexible, Paper-Based, and Radiation-Hardened Electronics** | PCIEERD already supported projects on printed, reconfigurable, self-healing, and battery-less electronics. For this call, the Council will accommodate proposals for the development of other classes of electronics, particularly flexible, paper-based, and radiation-hardened electronics.

Flexible electronics use stretchable conductive materials laid on flexible substrates to produce circuits that can be bent, twisted, and stretched without breaking or losing functionality. This will allow embedding compute and intelligence into more products from new flexible displays, gadgets, wearables, to new fabrics and implanted medical devices.



A subset of flexible electronics is paper-based electronics that use paper as a substrate for printed electronics. Recent developments include converting any cardboard or paper into smart packaging that humans can interact with. Other promising applications of paper-based devices include biosensing, energy storage and generation, optoelectronics, and soft actuators among others.

Finally, radiation-hardened electronics are electronic components, single-board computer CPUs, and sensors that are designed and produced to be less susceptible to damage from exposure to radiation and extreme temperatures. Radiation-hardened (rad-hard) electronics may be applied for reactors, spacecraft systems, and other space and terrestrial applications. Proponents

shall identify the technology development necessary to get the proposed integrated circuit to the performance needed for the intended environment and application.

- **R&D and Feasibility Study on Wafer Fabrication** | R&D in wafer fabrication is critical for driving innovation, reducing costs, improving quality, gaining a competitive advantage, addressing specific industry needs, reducing environmental impact, ensuring supply chain resilience, and enabling emerging technologies. R&D in wafer fab leads to the development of new technologies and processes, enabling the semiconductor industry to create smaller, more powerful, and energy-efficient chips. Investments in this area are essential for the continued growth and development of the semiconductor manufacturing services industry. R&D in wafer fabrication allows companies to tailor their manufacturing processes to meet specific requirements. This is particularly important in the era of specialized applications, where different industries demand chips optimized for their unique needs.

- **Advanced Memory and Logic Technologies** | Advanced memory and logic technologies can be made relevant in semiconductor manufacturing services

through their impact on performance, innovation, user experience, data security, customization, IoT applications, and environmental sustainability. Development of energy-efficient memory and logic technologies can contribute to environmental sustainability by reducing the overall power consumption of electronic devices. It also enables the convergence of various functionalities into single devices, leading to the development of integrated solutions like System-on-Chip (SoC) and System-in-Package (SiP) technologies. Semiconductor manufacturers investing in research and development of these technologies are well-positioned to meet the demands of a rapidly evolving digital landscape and provide solutions for a wide array of industries and applications. Collaboration with an industry partner that will potentially manufacture and adopt the memory technology that will be developed is a requirement for this call topic.

## **B. Electronics Manufacturing Services**

- **Prototyping of Smart Wearables** | Wearable technology is a category of electronic devices that can be worn as accessories, embedded in clothing, or implanted in the user's body. The devices are hands-free gadgets with practical uses powered by microprocessors and enhanced with the ability to send and receive data. Proposal shall focus on novel specialized and practical applications including safety or security use cases.



- **Prototyping of Collaborative and Swarm Robots and Implementation of Robot-as-a-Service** | Swarm robotics is the use and coordination of large numbers of multi robot systems to produce specific collective behaviors and interactions. It is the field of research concerned with developing robots, of all shapes and sizes, that are capable of coming together in swarms and intelligently collaborating and coordinating with one another to accomplish tasks that any one individual would have problems accomplishing alone. Recently, there have been a number of breakthroughs in the field including in the development of control systems that let the robots autonomously

collaborate with one another without the need for external human input to evaluate, solve, and complete random tasks such as lifting and moving as well as coming together to form specific formations.

On the other hand, collaborative robots, referred to as cobots, are new type of robots designed to interact with people in a shared work environment. Manufacturers say these machines are likely to revolutionize production for small- and medium-sized factories. Unlike the regular robots, cobots use advanced visual technology and are equipped with sensors that enable them to detect people and stop or change their activity. They come in handy in a process that is highly repetitive, droning, or even dangerous tasks from transporting of sharp piercing items, packing of commodities, palletizing, to handling hot industrial workpieces. Given the high level of adaptability, easy mobility, and lightweight, cobots can be used from industrial production floor, PLC automation, to offices.

To allow MSMEs to benefit from the developed robotics without the often cost-prohibitive initial investment, implementation of robot-as-a-service may be explored. This will allow MSMEs to scale up and down rapidly and easily in response to changing market conditions and client needs. Proposals under this

call topic must secure letter of collaboration from one or more industry partners who are committed to utilize and adopt the cobot that will be developed.

- **Prototyping of Biomimetic Sensors** | Biomimetic sensors are sensors that mimic the behaviors, capabilities, and functional properties of biological systems. Recent breakthroughs include the development of sensors that can mimic all five human senses which are thousands of times more sensitive. Today, biomimetic sensors are being used to create robots that navigate by the stars rather than GPS, biomedical devices that can smell disease, and virtual reality systems that expose the user to smells, tastes, and other sensations.
- **Prototyping of Smart Dust** | Smart dust are tiny sensors equipped with computing capabilities. In electronics manufacturing, their small size allows them to be embedded in various components and devices without altering their structure significantly. This miniaturization facilitates unobtrusive monitoring and data collection. Smart dust particles can be dispersed throughout manufacturing facilities to collect data remotely. They can monitor environmental conditions, equipment performance, and even worker safety. This remote sensing capability enhances the overall efficiency and safety of the manufacturing processes. smart dust technologies offer innovative solutions for enhancing efficiency, improving quality control, ensuring



safety, and optimizing various aspects of electronics manufacturing processes. The importance of smart dust lies in its ability to provide precise, real-time data, enabling manufacturers to make informed decisions and maintain a competitive edge in the industry.

### Requirements

Priority Areas	Target No. of Projects	Total Budget (PhP)
Semiconductor Manufacturing Services		
Development of New Classes of Electronics including Flexible, Paper-Based, and Radiation-Hardened Electronics	3 (DOST-GIA)	30M per proposal
R&D and Feasibility Study on Wafer Fabrication	1 (DOST-GIA)	30M per proposal
Advanced Memory and Logic Technologies	1 (DOST-GIA)	30M per proposal
Electronics Manufacturing Services		
Prototyping of Smart Wearables	1 (PCIEERD-GIA)	15M per proposal
Prototyping of Collaborative and Swarm Robots and Implementation of Robot-as-a-Service	2 (DOST-GIA)	20M per proposal
Prototyping of Biomimetic Sensors	1 (DOST-GIA)	20M per proposal
Prototyping of Smart Dust	1 (DOST-GIA)	20M per proposal

### 3.4 ICT Innovations (Food and Agriculture) (Industrial Solutions and Competitiveness) (Climate, Disaster Resilience, and Human Security) (STI Governance)

#### Call Rationale

Information and communication technologies (ICT) are key enablers of innovation and encompass a broader array of activities. The overall strategies outlined in this roadmap are fundamentals in attaining the Networked Society. The key technology trends or R&D solutions that will stimulate innovations within the ICT industry in the coming years will create new value streams for consumers, government, industry, and society. A technology-enabled ecosystem is made possible through a universal, horizontal, and multipurpose communications platform. The R&D technologies in ICT Innovations is combined with the next generation of networks such as 5G to provide support to IoT, creation of cyber driver dynamic content, retrieval, and analysis, among other applications.

#### Call Objective

The main objective of this call is to support research and development projects for ICT innovations particularly in the field of (1) computing and data science, (2) connectivity and communication, and (3) cybersecurity. Proposals shall address the needs and strengthen the capabilities of the local industry in terms of facilities and services, human resources, R&D technologies, and/or S&T policies.



### Call Scope

This call targets to support applied research projects on the following topics.

#### A. Computing and Data Science

- **R&D on Sovereign Cloud Computing** | Sovereign cloud computing refers to the concept of using cloud computing services that are exclusively provided and controlled by the government or a trusted entity within a specific country. The primary goal of sovereign cloud computing is to ensure data security, privacy, and compliance with local regulations and laws. Research and development (R&D) in this field are crucial for creating robust and secure cloud computing infrastructures tailored to the specific needs of the intended user of the project.
- **Development of Smart Data Capture Software** | Smart data capture enables real-time decision making and workflow automation by capturing data from barcodes, text, IDs, and objects. It is a flexible, future-proof technology that connects retailers, frontline

workers, and customers with real-time information to provide actionable insights, automate processes end-to-end, and deliver digitally enriched experiences. It can be integrated into any application or ecosystem powering operational and customer-facing processes for store associates and shopping experiences for consumers. The technology enables retailers to transform any device with a camera into a high-performance data capture and visualization tool including smartphones, tablets, robots, drones, and wearables.

- **Application of Data Ontology and Data Archiving for DOST Public Services** | E-government services have now been developed to cover the basic services that should be delivered to citizens and enterprises. However, a number of issues regarding e-services has to be addressed including e-service composition, e-service cataloguing, change management, and administrative responsibility. This reveals the need for semantically rich means for representing the various aspects of e-services which can be addressed through data ontology. Hence, proposals shall focus on practical use cases of data ontology for e-government public services particularly intended for the DOST R&D outputs.

#### B. Connectivity and Communications

- **Development of Swarm Communication** | Swarm communication, inspired by the collective behaviors of social insects like bees and ants, refers to a network of small, interconnected devices (often drones or robots) working together to achieve a common goal. This concept has various applications, including environmental monitoring, disaster response, agriculture, and autonomous exploration. To develop effective swarm communication systems, several key aspects need to be considered in the research and development process to include distributed algorithms, communication protocols, sensing and perception, robustness and fault tolerance, security and privacy, user interfaces, real-world testing and simulation, regulation and ethics. By focusing on these areas, researchers and developers can contribute to the advancement of swarm communication systems, making them more intelligent, efficient, and reliable for a wide range of applications. Additionally, interdisciplinary collaboration between experts in robotics, artificial intelligence, communication systems, and ethics is essential to addressing the complex challenges associated with swarm technology.



- **Development of Software-Defined Radio Platform and Cognitive Radio** | Software-Defined Radio (SDR) technology allows for flexible and programmable radio systems where traditional hardware components are replaced or augmented by software-based processing. This approach provides a wide array of possibilities for communication systems, from enabling rapid prototyping and experimentation to creating adaptive and reconfigurable wireless devices. The key aspects involved in the development of SDR platforms and techniques include hardware design, software development, reconfiguration and adaptability, spectrum sensing and access, security, network integration, standardization and interoperability. By focusing on these areas, researchers, engineers, and industry professionals can contribute to the advancement of SDR technology, making it more versatile, efficient, and accessible for various applications in wireless communications.

Prototyping a Cognitive Radio (CR) system involves creating a functional prototype that demonstrates the capabilities of cognitive radio technology, including spectrum sensing, intelligent decision-making, and dynamic spectrum access. Throughout the prototyping process, collaboration with experts in software development, wireless communication, and signal processing is essential.

- **R&D Addressing Wave Spectrum Challenges with 5G Technology towards Establishment of 5G Ecosystem Innovation Center** | 5G, the successor to 4G, is a low latency, hyper connected multi-Gigabit mobile wireless communications standard. While researchers see great potential with a high-frequency version of 5G, it comes with a key challenge as it is very short range. Objects such as trees and buildings cause significant signal obstruction, necessitating numerous cell towers to avoid signal path loss. Currently, multiple-input, multiple-output (MIMO) technology is proving to be an effective technique to address this issue. However, even with MIMO technology, line of sight will still be important for high frequency 5G and massive base stations remain to be a necessity. Hence, proposals shall focus on addressing signal path challenges to expand the capacity of 5G connectivity and to establish a 5G ecosystem innovation center which can be used as shared service facility for R&D, standardization, and interoperability testing of 5G technologies.

### **C. Cybersecurity**

- **AI in Cybersecurity** | Cybersecurity threats continue to evolve in sophistication and scale, posing significant challenges to organizations and individuals alike. As the reliance on technology grows, there is an increasing need for innovative solutions to detect, prevent, and respond to cyber-attacks effectively. Artificial Intelligence (AI) holds tremendous promise in augmenting cybersecurity defenses by leveraging advanced analytics, automation, and adaptive learning capabilities to detect and mitigate threats in real-time.

Proposed topics include, but not limited to:

- Threat / Intrusion / Phishing Detection and Prevention
- Vulnerability Management and Patching
- Malware Analysis and Sandboxing
- Intelligent Security Automation
- User and Entity Behavior Analytics



- **Application of Homomorphic Encryption** | Homomorphic encryption is a method of performing calculation and analysis on encrypted information without decrypting it first. It is the field of research concerned with developing ways to securely encrypt information in a way that still allows third parties to analyze it without having to give the encryption keys. Today, homomorphic encryption is being used to give crowdsourced data scientists access to confidential data to mine for patterns and identify investment opportunities and trends in a way that would not have been possible using the traditional encryption technologies.
- **Application of Behavior-Based Security** | Behavior-based security, also known as behavioral analysis or behavioral analytics, is an approach to cybersecurity that focuses on monitoring and analyzing the behavior of users, applications, and systems to detect and respond to suspicious activities and security threats. This method aims to identify anomalies and potential threats by understanding the typical patterns of behavior within a network or system. Several applications of behavior-based security in the field of cybersecurity include user and entity behavior, advanced persistent threat (APT) detection, malware and ransomware detection, phishing and social engineering protection, endpoint security, network security, incident response and forensics, cloud security, compliance and enforcement. Behavior-based security solutions are essential components of modern cybersecurity strategies, providing a proactive and adaptive approach to identifying and mitigating evolving cyber threats. By leveraging behavioral analysis, organizations can significantly enhance their security posture and respond effectively to a wide range of security challenges.

### Requirements

Priority Areas	Target No. of Projects	Total Budget (PhP)	Documents/Eligibility
Computing and Data Science			
R&D on Sovereign Cloud Computing	1 (PCIEERD-GIA)	15M per project	✓ For R&D on Sovereign Cloud Computing, collaboration with the Department of National Defense or with its attached agencies must be secured.
Development of Smart Data Capture Software	1 (PCIEERD-GIA)	15M per project	✓ For Development of Smart Data Capture Software, proposals shall include letter of collaboration and certificate of technology adoption with an industry partner.
Application of Data Ontology and Data Archiving for DOST Public Services	1 (PCIEERD-GIA)	15M per project	✓ To ensure that the research output will be utilized by the target industry or local regulatory agency, a letter of support / commitment / collaboration must be secured. The proponent should be able to secure
Connectivity and Communications			
Development of Swarm Communication	1 (PCIEERD-GIA)	15M per project	
Development of Software-Defined Radio	1 (DOST-GIA)	20M per project	



Platform and Cognitive Radio			training data sets from the target partner institution.
R&D Addressing Wave Spectrum Challenges with 5G Technology towards Establishment of 5G Ecosystem Innovation Center	1 (DOST-GIA)	30M per project	
Cybersecurity			
AI in Cybersecurity	1 (PCIEERD-GIA)	15M per project	
Application of Homomorphic Encryption	1 (PCIEERD-GIA)	15M per project	
Application of Behavior-Based Security	1 (PCIEERD-GIA)	15M per project	

**3.5 Artificial Intelligence (Food and Agriculture) (Industrial Solutions and Competitiveness) (Climate, Disaster Resilience, and Human Security) (STI Governance)**  
**AI PINAS: AI ENABLING SOLUTIONS FOR EMERGING NEEDS**

**Call Rationale**

Artificial Intelligence (AI) is one of DOST-PCIEERD’s priority areas because it is tagged as one of the important technologies that will usher the country to the fourth industrial revolution. Although considered as a powerful agent for good, AI can also disrupt traditional business models and processes, thereby making it a threat. To maximize the benefits of AI, there is a need to develop our capability in this area. As technological landscapes evolve and new challenges emerge, there is also an increasing demand for innovative solutions that harness the power of AI to address emerging needs across various domains.

In the Asia Pacific AI Readiness Index Report 2023, the Philippines ranked 12th out of 12 economies in the region. This is a drop from its 10th place ranking in the previous year's report. The Philippines scored 55.42 out of a possible 100 points, which is above the global average score of 44.61. However, it is still significantly below the scores of the top-ranking countries in the region, such as Singapore (80.39), Japan (77.06), and China (75.61).

The Philippines' lowest score was in the Talent and Skills pillar, where it scored only 48.39 points. This is likely due to the relatively small number of Filipinos who have the AI expertise required to develop, deploy, and manage AI solutions.



The Philippines scored its highest score in the Business Investment and Adoption pillar, where it scored 61.67 points. This is likely due to the growing number of businesses in the Philippines that are investing in and adopting AI solutions.

Overall, the Asia Pacific AI Readiness Index Report 2023 suggests that the Philippines is still in the early stages of AI development. However, the country has made some progress in recent years, and it is likely that the Philippines' AI readiness will continue to improve in the years to come.

Here are some recommendations for how the Philippines can improve its AI readiness:

- Invest in AI education and training to develop a pipeline of AI talent.
- Support the growth of the Philippine AI startup ecosystem.
- Promote the adoption of AI solutions by businesses and government agencies.
- Implement its national AI strategy that outlines the country's goals for AI development and deployment.

From 2022-2023, 13 mission-driven AI R&D Projects were supported to jumpstart the AI R&D in the Philippines, as follows:

- AI Robotics for autonomous missions (ASIMOV HAWKS and ROAMER)
- AI for DRR and Infrastructure
- AI-TEWS: Development of an AI-assisted Thunderstorm Early Warning System from Analysis of Doppler Radar Data
- Intelligent Structural Health Monitoring via Mesh of Tremor Sensor
- Image and Video Recognition
- Cost-effective Technology for Monitoring and Quantifying Benthic Area Covered by Marine Litter in Shallow Coastal Areas
- Development of a CNN and RNN Topology for Impedance Spectroscopy Analysis
- Unistar Automated Repossessed Motorcycle Assessment System
- Development of Multi-lingual Chatbot for Health Monitoring of Public-School Children
- Design and Development of Intelligent Traffic Control and Management System
- Diachronic Representation and Linguistic Study of Filipino Word Senses Across Social and Digital Media Contexts

In terms of facilities and services, AI Data centers with HPC in selected HEIs (8 HEIs: CarSU, DLSU, UPD, UPLB, UPMIN, DOST-ASTI, USTP, MSU-Naawan) were established. One of the ongoing projects is working on the platform for open data sharing and infrastructure for AI – Robotics R&D specifically the Philippine Sky Artificial Intelligence Program (SkAI-Pinas) Program.

In terms of capacity building, aside from the series of trainings conducted in the past years, DOST also supported PCIEERD's Online Training on Multi-tasking AI for ASEAN Member States conducted in 2022. In 2024, AI Summer School and Hackathons will be conducted to encourage more students and researchers to learn more about AI and its responsible use.

The First AI PINAS R&D Conference – Workshop was also held in March 2023 as venue for researchers from Higher Education Institutions and R&D Institutions, as well as representatives from the government, private, and public sectors for the sharing of AI R&D initiatives, review of AI roadmap and development of R&D proposals for potential funding. 115 participants participated and 10 proposals submitted. The thematic and mission-driven applications on artificial intelligence identified during the conference served as basis for the call for proposals in 2024.



### Call Objective

AI is rapidly transforming our world, presenting both unparalleled opportunities and complex challenges. To ensure AI's responsible development and maximize its benefits for society, DOST-PCIEERD is calling for research and development (R&D) proposals focused on harnessing the power of AI while mitigating its potential risks.

We seek proposals that address the following crucial aspects:

- Explainable and trustworthy AI - Develop methods for making AI models interpretable and trustworthy, fostering user understanding and building public confidence.
- Fairness, bias, and inclusion - Mitigate potential biases in AI systems, promote fair and inclusive algorithms, and address societal risks.
- Human-AI collaboration - Design AI systems that seamlessly collaborate with humans, augmenting human capabilities and empowering decision-making.
- Security and privacy - Ensure the security and privacy of data used in AI development and deployment, protecting individuals, and upholding ethical principles.
- Emerging AI applications - Explore novel applications of AI in various sectors, addressing critical challenges and contributing to positive societal impact.

### Call Scope

Proposed projects must develop technologies on the following priority areas with specific applications that will help address pressing national problems. The proposal should support applications on the following topics:

#### A. Machine/Deep Learning

- **AI for Government Operations and Services Delivery**
  - AI-powered decision support systems for policy formulation and implementation
  - Predictive analytics in resource allocation and planning
  - Intelligent automation for streamlining bureaucratic processes and reducing administrative burdens.
- **AI for Banking and Finance**
  - Investment Management (portfolio management, credit and market risk analysis, trading, etc.)
  - Risk and Compliance Management (Anti-Money Laundering/ /Combating the Financing of Terrorism)
- **AI for Education/Learning**
  - Prototype personalized Learning pathways for K-12 education, higher education and lifelong learning that integrate with existing curriculum frameworks and learning management systems.
  - Interactive and Collaborative Learning Environments
  - Natural Language Understanding and Generation
  - Ethical and Inclusive AI in Education

#### B. Natural Language Processing (NLP)

- **Real-time Translation System for Multilingual Conversation**
  - AI Assistants and Chatbots in customer service, e-commerce, and virtual assistants
  - Real-time translation capabilities into IoT devices to enable seamless communication as well as efficient interaction with connected environments



### C. Intelligent Robotics

- **Development of Autonomous Underwater Robot**

Applications include, but not limited to:

- Exploration and navigation through underwater environments, collecting data on marine life, geological features, and ocean conditions
- Inspection and maintenance of underwater infrastructure, such as dams, bridges, and submerged structures.
- Development of autonomous underwater robots capable of establishing communication networks for data transmission and coordination.

- **Local Prototyping of Robot for Radiation Detection, Monitoring, and Radiation Protection Services**

Applications include, but not limited to:

- Detection, monitoring, and recognition of radiation sources and radiation level in nuclear sites and public areas
- Platform for analysis and decision-making of radiation related scenarios
- Enhancement of safety during inspections of nuclear facilities/research facilities/laboratories/manufacturing plants, contaminated sites, or disaster-stricken regions
- Improve adherence to safety regulations in the transport of hazardous materials

### D. Prototypes Demonstrating Emerging AI Platforms

*Maximum Budget Allocation: PhP30M per proposal*

*Target No. of Project/s to be Funded: 1 per topic (DOST-GIA)*

- **Generative AI**

- Interactive Storytelling to co-create immersive narratives
- Fashion Design Assistant
- Generative Art and Music
- AI-driven Content Creation and Curation

- **Cognitive Computing**

- Legal Research Assistant
- Customer Service Automation

- **Federated AI**

- Privacy-preserving Healthcare Analytics
- Edge Computing and IoT
- Supply Chain Management and Logistics

- **Swarm AI**

- Multi-robot Collaboration
- Distributed Sensing and Monitoring
- Distributed Computing and Edge Intelligence



### Requirements

Priority Areas	Target No. of Proposals	Total Budget (PhP)	Documents/Eligibility
Machine/Deep Learning			✓ For all proposals, to ensure that the research output will be utilized by the target industry or local regulatory agency, a letter of support / commitment / collaboration must be secured. The proponent should be able to secure <b>training data sets</b> from the target partner institution. ✓ For AI for Education/Learning, letter of collaboration / commitment / support from Department of Education (DepEd) is required. ✓ For Local Prototyping of Robot for Radiation Detection, Monitoring, and Radiation Protection Services, letter of collaboration / commitment / support from Philippine Nuclear Research Institute (PNRI) is required.
AI for Government Operations and Services Delivery	1 (PCIEERD-GIA)	15M per proposal	
AI for Banking and Finance	1 (PCIEERD-GIA)	15M per proposal	
AI for Education/Learning	1 (PCIEERD-GIA)	15M per proposal	
Natural Language Processing (NLP)			
Real-time Translation System for Multilingual Conversation	1 (PCIEERD-GIA)	15M per proposal	
Intelligent Robotics			
Development of Autonomous Underwater Robot	1 (DOST-GIA)	30M per proposal	
Local Prototyping of Robot for Radiation Detection, Monitoring, and Radiation Protection Services	1 (DOST-GIA)	30M per proposal	
Prototypes Demonstrating Emerging AI Platforms			
Generative AI	1 (DOST-GIA)	30M per proposal	
Cognitive Computing	1 (DOST-GIA)	30M per proposal	
Federated AI	1 (DOST-GIA)	30M per proposal	
Swarm AI	1 (DOST-GIA)	30M per proposal	

### 3.6 Optics and Photonics (Industrial Solutions and Competitiveness)

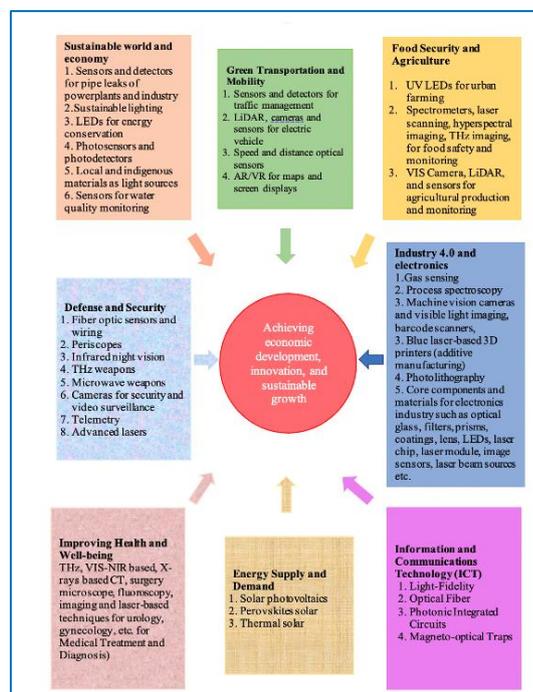
#### Call Rationale

Photonics is the physical science of light (photon) generation, detection, and manipulation through emission, transmission, modulation, signal processing, switching, application and detection/sensing. The global photonics market has reached USD 911.5 Billion in 2023 and is projected to grow at USD 2.25 Trillion by 2029 (CAGR at 6.5%). Countries such as China, Europe, United States, Japan, Singapore, Korea, and Taiwan have heavily invested in photonics to further



boost their economic development through science and technology. Based on the Allied Market Research in 2022, the following emerging optics and photonics technologies will grow significantly by 2030: (i) Augmented and Virtual Reality (ii) Imaging including surface imaging, see through imaging, and analytical sensing; (iii) photonics sensors (i.e., Fiber optic, image sensor, biosensors etc) for laser and fiber optic technology; (iv) Light- Fidelity (Li-Fi); (v) Fiber Optics with applications in electronics and telecommunication industry; (v) Silicon PV and Perovskites Solar for renewable energy; (vi) Infrared and Terahertz spectroscopy; and (vii) Ultrafast lasers.

Since Optics and Photonics technologies are key enabler towards achieving socioeconomic development and sustainable growth, the Philippines can benefit from the utilization of these technologies with diverse applications to primary industries in agriculture, ICT, manufacturing and services as well as public goods such as utilities (energy supply, water quality management, etc.), environment, military, and healthcare. Figure 1 shows the summary of O&P technologies and applications to various sectors and its contribution to the country's growth and innovation.



**Figure 1.** Optics and Photonics Technologies and its real-world applications

It is apparent that O&P sector is a crucial input in supporting the Sustainable Development Goals (SDGs) in achieving Clean Water and Sanitation (SDG No.6), Affordable and Clean Energy (SDG No. 7), Industry, Innovation, and Infrastructure (SDG No.9) and Sustainable Cities and Communities (SDG No.11).

In 2023, the AMNP Group and S&T Fellows conducted the annual Optics and Photonics (O&P) FGD and consultation with stakeholders to assess the status of the sector, map-out current projects, initiatives, and capabilities of our researchers and experts in the country, as well as to solicit inputs in validating and identifying priority areas in the roadmap. The workshop was attended by 40 stakeholders, researchers, and representatives from academe and government research institutions. Further, the results of the FGD and consultation were presented in the *41st Samahang Pisika ng Pilipinas (SPP)* Annual Conference for additional inputs from the participants. Based on



the consultations and discussions with the stakeholders, the priority areas were identified, and the roadmap was updated accordingly.

In setting the direction to achieving the advancement in the O&P sector, the results of the stakeholders' consultations which have identified the local expertise and capacities in the country, and industry needs, among others were merged with the global market research projections and future growth in the sector, to identify the priority Call Scope for 2026 Funding. The Council has come up with the list of priority areas for 2026 funding that are aligned with the medium- term and long-term plans as reflected in the O&P Roadmap.

### Call Objective

The Optics and Photonics Sector aims to cater to the needs of different industries and sectors by leveraging O&P research to serve as an input to developing product-based technologies/devices/components with applications to different sectors.

The 2024 Call for Proposal (2026 Funding) aims to increase the number of innovative photonics-related projects and research collaborations in the specific fields of Imaging, Manufacturing, Optical Information and Communication, and Biophotonics.

Proposals to be submitted should develop devices/components/technologies aligned with the call scope to be implemented within 2 to 3 years.

### Call Scope

Proposals to be submitted should be aligned to the indicators specified under the **OPTICS AND PHOTONICS R&D ROADMAP** including the following priority topics:

- **Optics and Photonics R & D (200 M)**
  - **Imaging (PhP50 M)**
    - Photodetectors, photosensors, ranging visual sights, periscopes, optical beam forming and steering, analog radio over fiber, imaging and image processing, fluorescence spectroscopy, TeraHertz spectroscopic imaging, Raman Imaging, Near-field Imaging, 3D Imaging Instrumentation.
  - **Optical Information and Communication (PhP50 M)**
    - LiFi, Optical Fiber Networks, Optical Wireless Access, Optical Cross-Connects
    - Information Processing
    - Optical Field Programmable Gate Arrays
  - **Manufacturing (PhP 50 M)**
    - Photolithography, optical amplifiers, holographic interferometry
    - Lasers development (parallelized beam sources (diode solid state, high energy), beam shaping, beam guidance
  - **Computational Optics and biophysics (PhP50 M)**
    - Computational optics
    - Foundational biophysics (simulation and modelling)
    - Computational molecular dynamics

### Requirements



Priority Areas	Target No. of Projects	Total Budget (PhP)	Documents/Eligibility
Imaging	5	50M with maximum of 3 years duration per project	To ensure that the research output will be utilized, a clear 5-year <b>technology roadmap or development pathway with emphasis on future plans for commercialization with target Technology Readiness Level (TRL)</b> must be submitted. Potential adopters and industry partners must also be reflected in the technology roadmap/development pathway.
Optical Information and Communication	5	50M with maximum of 3 years duration per project	
Manufacturing	5	50M with maximum of 3 years duration per project	
Computational optics and biophysics	5	50M with maximum of 3 years duration per project	

### 3.7 Geomatics for Innovative Application (Food and Agriculture) (Industrial Solutions and Competitiveness) (Environment & Natural Resources) (Climate, Disaster Resilience, and Human Security) (STI Governance)

#### Call Rationale

In the past years, DOST-PCIEERD funded various Space Technology Applications projects for disaster preparedness and mitigation, resources assessment (agriculture, coastal, forest, watersheds, and renewable energy), drought and crop assessment and forecasting, as well as monitoring of reforestation and irrigation projects to help enhance the mandated agencies in delivering key services for the Filipino people.

To date, we have access to different satellite data, including freely available sources, various satellite subscriptions, and data from our country's own microsattellites. These resources have been effectively utilized and/or translated into applications to address several issues and improve public service delivery.

Some of the notable STA projects supported from 2022-2023 and approved for implementation for 2024 onwards include the following.

- **Synthetic Aperture Radar (SAR) and Automatic Identification System (AIS) for Innovative Terrestrial Monitoring and Maritime Surveillance I** In the conduct of the project, ASTI developed various applications such as automatic ship detection and classification, vessel track prediction, monitoring and assessment of offshore islands, post-disaster assessment, port traffic and customs collections, forest mapping, rice estimation and aquaculture structural assessment.



- **Development of Underwater Sensor Network for Tsunami Detection through Ground Station Terrestrial and Nanosatellite Communication I** This project aims to establish Ground Sensor Terminals on buoys and sea vessels in strategic locations, such as the Verde Island Passage, Balabac Strait, Sibutu Channel, and Balintang Channel. A Ground Station will be established to collect data from underwater sensors. This data will be accessible to the local community and the Philippine Navy through the ASEANSat Nanosatellite or other nanosatellites under a cooperation agreement with the Philippines. The initiative is designed to enhance tsunami warnings for the local community and to explore the potential for surveillance in underwater territories.
- **Development and Application of GEO data (Geospatial and Earth Observation Data) Analytics Tools for Marine Spatial Planning (DAGAT) I** This project focuses on addressing issues like limited Earth Observation data integration and lack of sophisticated and localized EO analytics tools. The project will establish a Data Cube to house the data which will be used to develop dynamic ecological niche model (ENM)-based tools for MSP. The adaptive analytics tools to be generated by the project will be initially tested and applied in the Tañon Strait, an area known for its biodiversity but is threatened with increasing human impacts and climate change. The project will also develop web applications to mainstream the use of the analytic stools under different MSP scenarios and goals including habitat suitability assessment, conservation prioritization, and vulnerability assessment. The project aims to facilitate informed decision-making, boost conservation efforts, align local marine spatial plans with national priorities, and contribute to the achievement of the Sustainable Development Goals (SDGs), particularly SDG 14 (Life Below Water).
- **Development of an Automated Land Use and Zoning Compliance Assessment and Monitoring (AutoCAM) tool using Remote Sensing and Geographic Information System I** Through this system, DHSUD envisions a monitoring and evaluation mechanism that will enable the national and local governments to scope, assess, and rectify non-compliant land use projects, and mitigate the negative impacts it may cause such as haphazard conversion of agricultural lands, increase of climate and disaster risks, destruction of ecosystems, and prevalence of urban-related issues such as traffic congestion and pollution. The system will make use of existing and emerging space technologies and their applications using machine learning and artificial intelligence to aid in executing the process. Products and methodologies developed will be adopted by DHSUD in its future policies and systems development/enhancement.

## Call Objectives

Proposals should make use of space borne and/or remote sensing technologies along with geospatial technology. These include, but are not limited to, the Light Detection and Ranging (LiDAR, Unmanned Aerial Vehicle (UAV), Global Navigation Satellite System (GNSS), Synthetic Aperture Radar (SAR), and other remote sensing technology for the call scope or priority areas.

## Call Scope

Proposals to be submitted should be aligned with the STA Roadmap and must fall within the following priority topics.

- A. Earth Observation (EO) Data Cubes and its applications I** This call topic is to solicit innovative and impactful projects that leverage EO Data Cubes to address specific challenges or advance knowledge in various domains. This may include proposals that



explore and develop novel applications and methodologies related to EO Data Cubes, promoting collaboration between researchers and institutions and contributing to the advancement of Earth observation science and its practical applications. The call also seeks to enhance our understanding of environmental processes, support sustainable development goals, and address specific societal or scientific needs through the use of EO Data Cubes.

- **Development of EO Data Cubes for Big Data Analytics and Management of EO data**
  - **Geo-data management for Big EO data** | Focus on developing Earth Observation Data Cubes as robust frameworks for efficiently managing vast amounts of EO data. The emphasis is on creating systems that can handle the challenges of big data in Earth observation, ensuring seamless storage, retrieval, and analysis of geospatial information.
  - **AI in remote sensing and geoinformatics** | Explore the integration of Artificial Intelligence (AI) techniques in remote sensing and geoinformatics within the context of EO Data Cubes. This involves leveraging AI algorithms for image processing, feature extraction, and geospatial analytics to enhance the accuracy and efficiency of EO data interpretation.
  - **Machine Learning and Deep Learning in Image and Spatial Analyses** | Focus on harnessing the power of Machine Learning (ML) and Deep Learning (DL) for image and spatial analyses using EO Data Cubes. Develop methodologies for automated classification, change detection, and pattern recognition, enabling advanced insights from EO data.
- **Development of EO Application Products from the Open Data Cube addressing Sustainable Development Goals and contributing to Global Policy Frameworks** | This initiative aims to utilize EO Data Cubes to develop application products aligned with Sustainable Development Goals (SDGs) and global policy frameworks.
- **Establishment of Web-based or Cloud computing services for big data EO analytics**
  - **EO Sensor web and IoT** | Develop integrated solutions that leverage EO Sensor Web and Internet of Things (IoT) technologies. This includes incorporating real-time data from various sensors to enhance EO Data Cube applications and contribute to IoT-enabled geospatial analytics.
  - **Cloud Computing for Big Data EO Analyses** | Explore on the establishment of web-based or cloud computing services tailored for big data EO analytics. Explore scalable cloud solutions for processing, storing, and sharing EO data, facilitating efficient access and collaboration.
  - **Collaborative, cloud-source and volunteered geospatial data** | Encourage projects that integrate collaborative efforts, cloud-sourced data, and volunteered geospatial information. This involves creating platforms that enable the collective contribution of geospatial data, fostering a collaborative and inclusive approach to EO analytics.



- **Development of thematic applications for EO Data Cubes**
  - **Urban and Pollution** | Focus on developing thematic applications within EO Data Cubes to address urban and pollution challenges. This includes monitoring urban growth, air and water quality, and contributing to sustainable urban development.
  - **Hydrology and Water Resource** | Explore applications within EO Data Cubes for effective management of hydrological systems and water resources. This involves monitoring water availability, quality, and supporting sustainable water resource management.
  - **Environment and Disaster Management** | Develop applications for EO Data Cubes that contribute to environmental monitoring and disaster management. This includes real-time monitoring of environmental changes and providing timely information for disaster preparedness and response.

**B. Application using other and new available satellite data** | This call topic invites proposals for projects that harness the potential of other satellite data sources, including Synthetic Aperture Radar (SAR), Hyperspectral imagery, satellite altimetry, and other satellite remote sensed data. The goal is to advance applications across multiple domains by leveraging the unique capabilities offered by these advanced satellite technologies.

- **SAR and InSAR applications**
  - Explore innovative uses of SAR data for applications such as terrain mapping, environmental monitoring, disaster response, and infrastructure assessment.
  - Use of Interferometric Synthetic Aperture Radar (InSAR), for deformation monitoring, subsidence analysis, and infrastructure stability assessment.
  - Fusion of SAR with other remote sensed data to enhance the accuracy and resolution of geospatial information.
- **Hyperspectral imaging**
  - Exploit the rich spectral information provided by hyperspectral imagery for mineral exploration, environmental analysis, and biodiversity monitoring.
  - Explore novel algorithms and techniques for processing and extracting valuable insights from hyperspectral data.
- **Satellite altimetry and other space geodetic techniques**
  - Develop applications utilizing satellite altimetry data for oceanography, hydrography, climate monitoring, and precise topographic mapping.
  - Investigate the synergy between satellite altimetry and other geodetic techniques to enhance accuracy and reliability in elevation measurements.
  - Explore the use of satellite geodetic techniques to provide comprehensive and accurate reference system.

**C. Development of High Altitude Pseudosatellite (HAPS) and High-altitude long-endurance (HALE) unmanned aerial vehicle** | High Altitude Pseudosatellites (HAPS)



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and High-Altitude Long-Endurance (HALE) Unmanned Aerial Vehicles (UAVs) have garnered significant attention in the field of research and development due to their diverse applications and innovative capabilities. These platforms, designed to operate at high altitudes for extended durations, offer several advantages across various domains.

Apart from their capabilities for surveillance and reconnaissance, as well as disaster response, these platforms are employed for scientific research purposes, including atmospheric studies, environmental monitoring, and geological surveys. Their high-altitude capabilities allow for the collection of valuable data in areas that are challenging to access by traditional means.

This call for proposal invites innovative projects that will focus on the development of High Altitude Pseudosatellite (HAPS) and High-Altitude Long-Endurance (HALE) Unmanned Aerial Vehicles, ushering in a new era of advanced aerial platforms for various applications.

**D. Small satellite subsystem or components for research and applications** | The aim of this call is to support cutting-edge research that focuses on the development and advancement of small satellite technologies. This may involve exploring various aspects, including:

- ***Conduct of research on small satellite subsystem or components for various applications (e.g., M2M/IoT enabled satellite, AI for onboard systems)***
  - Small satellite subsystems or components, with a focus on Machine-to-Machine (M2M) or Internet of Things (IoT) capabilities, enabling advanced communication and data gathering
  - Integration of Artificial Intelligence (AI) in small satellite onboard systems, fostering advancements in autonomous operations, data processing, and decision-making capabilities
- ***Nano-/Microelectromechanical system (N/MEMS) for small satellites and aerospace applications***
  - Development of Nano-/Microelectromechanical Systems (N/MEMS) specifically designed for small satellites and aerospace applications, aiming to enhance precision, efficiency, and miniaturization.
- ***Lightweight materials and components for spacecraft and satellite applications***
  - Development of lightweight materials and components tailored for spacecraft and satellite applications, contributing to overall weight reduction and increased efficiency in space missions.

### Requirements

Priority Areas	Target No. of Projects	Total Budget (PhP)	Documents
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Earth Observation (EO) Data Cubes and its applications	4	11M per project	✓ Proposals should be submitted with a letter of support from the target beneficiaries or adopters for sustainability. A clear technology pathway must be submitted.
Application using other and new available satellite data	3	5M per project	
Development of High Altitude Pseudosatellite (HAPS) and High-altitude Long Endurance (HALE) unmanned aerial vehicle	2	50M per project	
Small satellite subsystem or components for research and applications	3	10M per project	

### 3.8 Quantum Technology (Industrial Solutions and Competitiveness)

#### Call Rationale

Quantum Technology is an emerging field that has caught the attention of many different nations due to its potential to revolutionise the current technologies we enjoy today. DOST-PCIEERD aims to jumpstart and sustain Quantum Technology Research and Development in the Philippines to be able to utilize and benefit from its wide-range applications when the field matures enough for practical use. As evident in the roadmap of Quantum Technology, the mid to long-term goal of DOST-PCIEERD is the eventual establishment of the Quantum Innovation Laboratory. This facility will merge a wide range of scientific and engineering fields and will serve as a center of excellence in Quantum Technology of the Philippines.

The priority areas in this call are based on the Stakeholder's Consultations and capability survey to scope out the needs of the academe and industry, and to scope out the current capability of the HEIs and Industry in terms of Quantum Technology. The first Stakeholder's Consultation last 27 May 2021, which were attended by representatives from academe,

government, and industry, serves as an initial reference on the Quantum Technology Roadmap where the call priorities are based. The second Stakeholder's consultation with a private organization was also conducted last 18 August 2022. In January 2023, PCIEERD convened the First Quantum Advisory Board Meeting to prioritize the R&D areas that can be supported. This call scope's objective is to further increase the number of researchers capable in Quantum Technology.

#### Call Objective

The objective of this call is to look for project(s) that use available technologies such as the Quantum Circuit Simulator (DOST-ASTI) for validation and optimization of Quantum Algorithms, prototyping of Quantum Processors for development of actual Quantum Computer and experimental platforms for Quantum Simulation. Theoretical research proposals are also welcomed to develop stronger fundamentals in Quantum Technology and to capacitate the local community of researchers.

#### Call Scope

The call is looking for proposals that will work on the following key research areas:



- A. Development of algorithms for quantum networks** | The development of algorithms for quantum networks is a rapidly evolving field at the intersection of quantum computing and quantum communication. Quantum networks aim to distribute quantum information securely and efficiently over long distances, enabling tasks such as quantum key distribution, quantum teleportation, and distributed quantum computing. The development of algorithms for quantum networks is a highly interdisciplinary effort, involving concepts from quantum information theory, computer science, and telecommunications. Researchers continue to explore these areas to enable the practical implementation of quantum networks for secure and efficient quantum communication and computation.
- B. Application of quantum cryptography** | The development of algorithms for quantum networks is a highly interdisciplinary effort, involving concepts from quantum information theory, computer science, and telecommunications. Researchers continue to explore these areas to enable the practical implementation of quantum networks for secure and efficient quantum communication and computation. Some of the key applications include Quantum Key Distribution, Quantum Secure Communication, Quantum Digital Signatures, cryptographic protocols, among others. Quantum cryptography, while still in the experimental stages for some applications, holds the promise of revolutionizing the field of cybersecurity by providing theoretically secure methods for communication and data protection.
- C. Implementation of error-corrected logical qubits with fault-tolerant gates** | Implementing error-corrected logical qubits with fault-tolerant gates is a critical area of research in the field of quantum computing. Quantum error correction is essential because quantum systems are inherently noisy, and errors can occur due to various factors such as environmental noise, imperfect gates, and decoherence. Error correction techniques are used to detect and correct these errors, allowing quantum computations to be executed reliably.
- D. Quantum communication** | Quantum communication explores the use of quantum mechanics to secure and transmit information with the prime objective of creating secure communication channels by providing methods that are theoretically protected to certain types of attacks or eavesdropping.

#### Requirement

**DOST/DOST-PCIEERD will fund at most three (3) projects under Quantum Computation with a maximum budget of PHP50M** per project depending on the scope of work being proposed. A clear technology pathway must be submitted.

## **IV. SCIENCE COMMUNICATION (Learning, Education, and Culture)**

#### Call Rationale

Science Communication (Scicom) is a growing area of practice and research (Burns, 2003) that plays a vital role in today's development challenges. The Philippines, although having a rich documented history of science and its development (e.g. Anderson, 2007 Velasco & Baens-Arcega, 1984), still needs to delve into the "identity" or "face" of Scicom in the country.



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The weak state of science culture in the Philippines is brought by several factors; one of which is the Filipino attitude towards science and the traits distinct to it, or the whole science culture. This scenario is experienced in a typical Filipino home as well as in schools. (Licuanan 1998, Nebres & Intal, 2007)

It is in this light that constant efforts should be made to foster science culture in a variety of ways. First is to improve science communication throughout the nation while educating influential figures in academia, the media, and the scientific community. Secondly, is to make the most of the museum's potential as a resource for nontraditional education.

Efforts in promoting and communicating science are continually initiated by DOST in collaboration with other significant key players in the scientific and non-scientific community. Recently, the DOST's Science Communication Agenda was put into place along with the presentation of the

DOST's Harmonized Science Communication Framework that was projectized thru UPLB-College of Development Communication (CDC). Meanwhile, the Science Communication Roadmap is being updated along with other undertakings in the said field.

In 2023, a Focus Group Discussion was conducted by PCIEERD's Information Group which focused on the role of scientific communication in the nation, the value of science centers as a vehicle for communicating and disseminating information in science, and the emphasis on research extensions on accelerated communication to DOST R&D projects.

Gaps such as the need for basic research, evaluation metrics, and technologies on Scicom were identified in these FGDs. Thus, it is vital to maintain endeavors towards an integrated, inclusive, and innovative strategy on Science Communication in the country thru R&D support.

### **Call Objectives**

The specific objective of the call is to provide R&D support for research on science communication, establishment and/or development of science communication infrastructure, science centers, and technologies.

#### **4.1 Science Communication for Innovation**

**Science Communication** | The proposed project should be researches on collective relationship of Filipinos to Science within the following topics.

- Behavior/attitude of Filipinos towards Science
- Audience's information consumption and behavior
- Information materials in the mother tongue

**Evaluation of Science Communication** | We are looking for proposal that aims to evaluate science communication activities and programs based on a framework. (i.e. evaluation and roll out of the harmonized science communication framework)

**Infrastructure for Science Communication** | The Council will fund proposed project for the establishment of a center for Science Communication that will cater activities and programs relative to the said discipline. (i.e. Science Communication centers in different state universities and different regions in the country)

**Science Communication Technologies** | The proposed projects should be intended for the development or use of technologies for science communication needs or applications. Below are specific objectives:



- Use of technologies for the needs of science communicators and/or relative science communication stakeholders
- Technologies for science communication
- Digital asset management using AI or other emerging technologies
- Examination of knowledge management systems and how they can aid in the advancement of science communication.
- Investigation on the causes of low R&D adoption and knowledge management system uptake

### Call Scope

**Science Communication** | This initiative aims to support research endeavors focused on enhancing science communication. Projects under this category will receive a maximum budget of Three (3) Million Pesos per year per project and are expected to be completed within a one-year duration.

**Evaluation of Science Communication** | With the goal of evaluating the effectiveness of science communication strategies, this funding opportunity offers a maximum budget of Three (3) Million Pesos per year per project. Projects in this category are anticipated to conclude within a one-year timeframe.

**Infrastructure for Science Communication** | Projects aimed at developing infrastructure to facilitate effective science communication are eligible for funding under this program. The maximum budget allocated per project is Ten (10) Million Pesos, with project durations spanning from four to five (4-5) years.

**Science Communication Technologies** | This funding opportunity supports projects focused on the development of technologies to enhance science communication efforts. Projects in this category will receive a maximum budget of Five (5) Million Pesos per project and are expected to span a duration of four to five (4-5) years.

These Calls are open to all researchers, science communicators, stakeholders, and other key players of Science Communication

Priority Areas	Target No. of Proposals	Total Budget (PhP)
Science Communication	2	3M with 1 year duration per project proposal
Evaluation of Science Communication	1	3M with 1 year duration per project proposal
Development of Infrastructure for Science Communication	1	10M with 4-5 years duration per project proposal
Development of Science Communication Technologies	1	5M with 4-5 years duration per project proposal

### [4.2 Advancing Science Centers' Innovation through Research and Development \(ASCEND\) Program](#)

To uplift the status of science centers in the country, this program will provide support to address gaps in the science center ecosystem through research and development.



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**Research on Science Centers** | Proposed project should seek to address research gaps in the science centers' ecosystems geared towards development of policy issuances.

**Technologies for Science Centers** | Proposed projects should be intended for the development of technologies to address gaps in science centers' operations, development, and systems.

### Call Scope

**Researches on Science Centers** | Funding is available for research projects aimed at advancing science centers. Each project may receive a maximum budget of Three (3) Million Pesos per year and is expected to be completed within a one-year timeframe.

**Technologies for Science Centers** | Projects focusing on developing technologies to enhance science centers can receive funding with a maximum budget of Five (5) Million Pesos per year per project. The duration for projects in this category ranges from two to three (2-3) years.

These Calls are open to all researchers, science communicators, stakeholders, and other key players of Science Communication.

### 4.3 Science Communication for Innovation Program Research Extension to Accelerate Communication Hub (REACH) Program

To support researchers and innovators who have completed the council's R&D training and aim to diversify the integration of their studies into science and technology-based solutions, the program will focus on showcasing their research outputs through targeted information and dissemination activities

**Information & Dissemination Activities** | We will be accepting proposed projects that are aimed to develop capacity building among targeted beneficiaries (seminars, conferences, town hall meetings) as well as promotional and public engagement efforts like press conferences, media engagements, media buying, exhibitions.

**Production of IEC Materials** | Proposed projects that are aimed to develop materials to include traditional and non-traditional methods such as learning management systems, knowledge management systems, websites and social media accounts, video production, physical kiosks and among others in selected locations will be accepted for possible funding.

### Call Scope

**Information & Dissemination Activities** | This program aims to fund projects focused on developing information and dissemination activities to enhance science communication efforts. Each project is eligible for a maximum budget of Two (2) Million Pesos per year and may span a duration of one to two (1-2) years.

**Production of IEC Materials** | Projects focusing on the production of Information, Education, and Communication (IEC) materials to support science communication will receive funding with a maximum budget of Three (3) Million Pesos per year per project. The project duration for this category ranges from one to two (1-2) years.

### Requirements



Priority Areas	Target No. of Projects	Total Budget (PhP)	Documents/Eligibility
Science Communication for Innovation			These Calls are open to all researchers, science communicators, stakeholders, and other key players of Science Communication.
Science Communication	2	3M with 1 year duration per project proposal	
Evaluation of Science Communication	1	3M with 1 year duration per project proposal	
Development of Infrastructure for Science Communication	1	10M with 4-5 years duration per project proposal	
Development of Science Communication Technologies	1	5M with 4-5 years duration per project proposal	
Advancing Science Center's Innovation through Research and Development (ASCEND)			
Researches on Science Centers	2	3M with 1 year duration per project proposal	
Technologies for Science Centers	1	5M with 2-3 years duration per project proposal	
Research Extension to Accelerate Communication Hub (REACH)			<ul style="list-style-type: none"> <li>Completed R&amp;D and Non-R&amp;D Projects supported by DOST-PCIEERD that aim to conduct activities for knowledge sharing and information dissemination. (Supported with terminal reports)</li> <li>The initiative's project leader can continue to serve as the project leader with assistance from a co-project leader who is a science communication expert and who will serve as the focal person for information sharing and promotions. (Supported with CV and track record)</li> </ul>



	<ul style="list-style-type: none"><li>• With measurable projected outcomes that can benefit its intended audience with a minimum of one year-period or a maximum two-year period project implementation</li><li>• With sustainable plans to guarantee that the project will continue its effort to disseminate information even after the project completion.</li><li>• Letter of commitment from beneficiary agency, partners, cooperating organizations/stakeholders.</li></ul>
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## V. Impact Assessment

### PAVING THE WAY FORWARD: AN EVIDENCE-BASED IMPACT ASSESSMENT OF DOST PROGRAMS (STI Governance)

#### Call Rationale

The DOST plays an important role in fostering innovation, research, and development within the Philippines. The DOST, through PCIEERD, had numerous programs and initiatives aimed at advancing scientific research, fostering innovation, and driving socio-economic development across the Philippines.

As stewards of public funds and promoters of scientific advancement, it is imperative for DOST to evaluate the effectiveness and impact of its investments. Impact assessment (IA) of DOST and PCIEERD-funded projects is crucial for ensuring accountability, optimizing resource allocation, and maximizing societal benefits. By systematically evaluating the outcomes and impacts of its investments, DOST can optimize resource allocation, inform decision-making, promote innovation, and demonstrate value to stakeholders. Through IA, DOST reaffirms its role as a catalyst for scientific advancement, economic development, and societal progress in the country.

#### Call Objective

The objective of this call is to determine and measure the impacts, including but not limited to social, economic, and environmental impacts, of completed projects funded and monitored by DOST and PCIEERD.

#### Call Scope

Proposals should assess the impacts of the following research and development projects:

- Regional R&D Consortia
- Energy Projects
- Communicating Science for the People Program



- Human Resource Intervention for the Sustainable Growth, Productivity, and Competitiveness of the Metals & Engineering Sector: Development and Implementation of Appropriate Training Curriculum Design for CNC Machine Tool Programming and Operation
- Advanced Transport Program (Automated Guideway Transit, Road Trains, Hybrid Electric Trainset)

### Specific Features Sought in this Call

The proposed projects should demonstrate the following characteristics and should be well-written in documents:

- Describe the processes and dynamics involved in the conceptualization, formulation, and implementation of various DOST and/or PCIEERD-funded programs/projects;
- Validate the R&D programs/projects' theory of change and impact pathways;
- Determine the actual direct and indirect outcomes and impacts associated with the programs/projects;
- Estimate the economic returns from the programs/projects;
- Identify the best practices and lessons learned during and after the implementation of the programs/projects;
- Formulate policy recommendations for the improvement and sustainability of the programs/projects.

PCIEERD will fund/endorse five (5) projects not to exceed PhP30M budget covering all projects. The maximum duration for each project is 1.5 years for PCIEERD-GIA and 2 years for DOST-GIA respectively. The breakdown is as follows:

	<b>Themes</b>	<b>Budget (in PhP)</b>	<b>Fund Source</b>
1	Impact Assessment of the PCIEERD Regional R&D Consortia	5M	PCIEERD-GIA
2	Impact Assessment of the Communicating Science for the People Program	5M	PCIEERD-GIA
3	Impact Assessment of DOST/PCIEERD Energy Projects	5M	DOST-GIA
4	Impact Assessment of Human Resource Intervention for the Sustainable Growth, Productivity, and Competitiveness of the Metals & Engineering Sector: Development and Implementation of Appropriate Training Curriculum Design for CNC Machine Tool Programming and Operation	5M	DOST-GIA
5	Impact Assessment of the Advanced Transport Program (Automated Guideway Transit, Road Trains, and Hybrid Electric Trainset)	10M	DOST-GIA