IV. PROCESS SECTOR

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 Research and Development proposals for the following programs to assist specific key industries in the country:

1. ***Natural Products Program*** for (a) Gums, Oils and Resins Industries and (b) Food Industry as user of Natural Dyes (Direct Call)
2. ***Chemical and Biological Manufacturing and Allied Industries Program*** for (a) Industry as customers of Metrology such as Food, Beverage, etc. and Laboratories supporting them
3. ***Textiles Program*** for revitalizing Textile Industry

With CFP 2023, 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:

    - 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*
    - Philippine Medium-Term Development Plan 2017-2022 under Part 4. Increasing Growth Potential: Vigorously Advancing Science, Technology, and Innovation which states that *by 2022, the efficiency and productivity of agriculture, industry, and services sectors will be improved. New public goods and services (or how services are delivered) will be created and improved. These will be done through maximizing and adopting science, technology and innovation (STI).*
    - Harmonized R&D Agenda under Section IV. Industry, Energy and Emerging Technology Research and Development Agenda 2017 – 2022 in B. Countryside Development where more micro, small and medium enterprises (MSMEs) will be developing and producing competitive and world class products and services and C. Competitive Industry where more industries will be enabled by the state-of-the-art R&D, technologies and science-based policies, moving up the value chain and attracting foreign direct investments

A. Natural Products Program

Natural Product is a compound or substance produced by a living organism such as plants, animals, and microorganisms. Usually it is classified according to primary and secondary metabolites produced naturally. It will utilize indigenous resources through provision of relevant technologies that results in increased yield, improved quality, and a more cost-effective process.

The **Call for Proposals for CY 2023-2025** will focus on the program for gums, resins, and oils and natural colorants for food.

Call Rationale

Improvement of Extraction, Processing, Application, Standardization Technologies and Performance Assessment of Selected Gums, Resins and Oils

According to the Market Research Report, the global market size of essential oil is more than US$6.0 billion in 2015. Per DTI Chamber of Herbal Industries of the Philippines survey shows that manufacturing firms engaged in the production of natural ingredients products are operating at around 50% of their installed operating capacity per year. Natural and organic products estimated total value export (FOB) in 2011 is about US$153M. This resource from the forest is one of the highest valued processed product.

The popularity of aromatherapy, which uses essential oils and other aromatic compounds for their therapeutic effects, has created an important demand for high quality oils. Additionally, the interest in natural perfumes and cosmetics continues to increase, along with the demand of natural essential oils. Increasing applications in aromatherapy coupled with rising demand for fragrances and flavors in food & beverages and personal care is expected to drive market growth over the forecast period. Rapid industrialization and increasing disposable consumer income are the other major factors driving the market growth, mainly in developing countries such as China, India, Vietnam, and Thailand.

The exorbitant amount of plant matter is required to create a single ounce of oil and increasing concerns regarding resource depletion are likely to hamper the industry over the forecast period. Manufacturers in the market have to overcome numerous challenges such as high capital costs and government certification which hinders to provide high-quality products with value for money to consumers.
Gums on the other hand, is also one of the high-value products from forests. The global gum arabic market size was valued at USD 373.1 million in 2018 and is estimated to expand. Gum arabic, also known as acacia gum, is a natural emulsifier used in various applications such as food and beverage, cosmetics, pharmaceuticals, and paints. It is primarily used as a filling and thickening agent in most confectionery items (source: https://www.grandviewresearch.com). France and Sudan take almost two thirds of the export market at 33% and 32%, respectively. Curiously enough, France is also the number one (1) importer of gum arabic taking 19% of the market, with USA following behind importing 14% (source: https://oec.world/). Resins is also one of the less explored products due to limited forest access as most sources are usually found in the wilderness. Pine resin, which is called the “new gold” has been reported of 14.880 tons production in China in 2018.

Excluding the gum arabic trade, the estimated world export value of gums and resins amounted to USD 453M in 2017, with Afghanistan leading exports at 23% market share; on the other hand, India is the leading importer at 31% (source: https://oec.world/).

With these market potentials, it is very timely for the Philippines to explore R&D on development of gums, resins and oils in the country, being a country blessed with forests as natural resources.

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 gums, oils and resins. This is to take advantage of the abundant resources of our country for the important group of non-wood forest products which can be various sources of GRO such as almaciga, elemi/pili, ferns, and many more. Furthermore, it can possibly support establishment of new industry players for extraction of GRO or provide new materials to industry end-users. Aligning our abundant natural resources with additive needs of the industries for GRO through progressive R&D, specifically for its extraction, refinement and purification technologies and even application studies to assess as potential substitution candidates for important additives, will be targeted in the program. For the oils, conventional technologies including steam diffusion, hydro-distillation, destructive distillation and cold expression may require time-consuming and resource-intensive processes, therefore the call can include studies highlighting the need for better technologies that are eco-friendlier and more efficient.

Call Scope

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

1. Improvement technologies in all aspects of the industry such as processing, grading, and classification for increased yield and improved quality control
2. Application and product development studies for utilization of natural gums and resins to broaden its usage and increase market position
3. Enhanced extraction and preservation technologies of high value oils in the market such as supercritical fluid, microwave, etc. by improving yield, purity, and cost of production
4. Development of extraction and collection technologies for possible new GRO sources (such as ipil-ipil, bitaog, talisay, Philippine cinnamon, cashew, rubber seed, pili) with properties comparable to existing in-demand GRO, to be sourced from bark, seed, stem, husks, etc.
5. Formulation studies to enhance natural properties of exudates
6. Utilization of by-products generated from processing exudates

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

1. Results of industry roadmaps (if available)
2. Technology Readiness Level between 2-6. It should encompass Technology Formulation, Validation of the Technology, Small Scale Prototype, Large Scale Prototype (if applicable).
3. Sustainability of both the supply of raw materials and finished product.
4. Has a 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.
5. A maximum of 5 projects will be funded. Total budget for the call is P35 Million covering all projects. The maximum duration for each project is 3 years.

Call Rationale

Natural Dyes Color Stability Improvement Technologies for Food Applications **(Direct Call)**

Natural dye is a potential market growth driver in both local and global trade, with high demands for application in different industries such as textile, food, and cosmetics, brought about by the shift in consumer preference to natural products, food safety issues, and environmental awareness. According to statistics, the global demand for natural dyes is expected to show an increasing trend of 5.7% annually until 2023 that can amount to $5.12 Billion.

Call Objective

The objective of the call is to develop extraction technologies for natural colorants, fit for food applications and compliant to international standards. The stability of the food colorants sourced naturally should be tested in different food systems to determine wide applicability of use.

Call Scope

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

1. Upscaling of Extraction, Characterization and Application of Natural Colorants in Food
2. Technologies for improvement/development:
    a. stability and sensory quality at all stages of the production chain (i.e., production, transportation and marketing)
    b. efficiency in extraction process and can be translated to large scale process (reduction of solvent used, reduction of extraction time, reduction in energy used)
    c. improved cost of production
3. Characterization of food systems where natural colorant was used

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

1. Results of industry roadmaps (if available)
2. Technology Readiness Level between 2-6. It should encompass Technology Formulation, Validation of the Technology, Small Scale Prototype, Large Scale Prototype (if applicable).
3. Sustainability of both the supply of raw materials and finished product.
4. Has a 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.
5. Maximum of 3 projects will be funded. Total budget for the call is P70 Million budget covering all projects. The maximum duration for each project is 3 years.

B. Chemical and Biological Manufacturing and Allied Industries Program

This program will be carried-out by supporting R&D initiatives on but not limited to, the chemicals and allied industry, 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.

The Call for Proposals for **CY 2023-2025** will focus on the advancement of metrology capabilities of the country.

Call Rationale

Strengthening the Philippine Physical, Chemical and Biological Metrology for Advancement of Industries **(Direct Call)**

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.

With the NML granted ISO 17025:2005 accreditation by DAkkS in Braunschweig, Germany in 2012, it has been a great milestone for NML to be recognized worldwide for metrology. At present, NML of the Philippines has CMC in the field of mass.

The current program being implemented by NML is working towards achievement of additional CMCs in the future. The Calibration and Measurement Capabilities or CMCs have been vouched for competence by all the Regional Metrology Groups worldwide. Under a CMC, the measurement or calibration should be (a) performed according to a documented procedure and have an established uncertainty budget under the management system of the NMI or the calibration laboratory; (b) performed on a regular basis (including on demand or scheduled or convenience at specific times in the year); and (c) available to all clients.
Continuous R&D programs and provision of S&T services related to metrology will help in accomplishing the goal of global recognition in metrology through unceasing work towards maintenance and additional CMCs.

Call Objective

In the four (4) projects of the current program, one (1) focused on strengthening the physical metrology capabilities of the NML while the others are building on the enhancement of traceability for metrology in Chemistry and Biology. To sustain and further stabilize the Chemical and Biological metrology, the development of technologies for the next priority list of analytes/microorganisms should be done. This is to also support the industries heavily reliable on dependable testing results such as food, beverage, chemical and other related industries. Moreover, the programs will continuously upgrade the capability of the physical metrology laboratories to be at par with international standards and sustain traceability through its accreditation, continued competitiveness of its personnel and completeness of its facility.

Call Scope

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

1. Development of Reference Materials for use of Testing and Quality Assurance Laboratories for analytes and matrices concerning contaminants or toxic substances or microorganisms in:
    - food including herbal supplements
    - water
    - cosmetics
    - toys
    - environment
2. Conduct of Proficiency Tests for target analytes/microorganisms (identified above) among Testing Laboratories and Quality Assurance Laboratories
3. Development of Methods for Reference Value Assignments for target analytes/microorganisms (identified above)
4. Strengthen the measurement areas of physical metrology namely: Temperature, Pressure, Length, Mass, Humidity, Density, Volume, Hardness, Force, Flow, Electricity, Frequency, Torque, Photometry, Vibration and Acoustics, Gravity, Ultrasound Vibration, Viscosity, Radiometry, Magnetism, Gravity and Nanometrology

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

1. Data demonstrating the importance of developing RMs/conducting PTs for the target analytes/microorganisms in the identified matrices, such as detention cases for exports, product recalls for detected health hazards, poisoning cases related to products, etc.
2. List of target participants for the provision of PT/use of RMs and letter/s indicating participation (if available, highly encouraged)
3. Sustainability plans and roadmap for metrology in chemistry and biology
4. Results of industry roadmaps identifying specific needs related to metrology (if available)
5. DOST will fund maximum of 4 projects not to exceed P500 million budget covering all projects. The maximum duration for each project is 3 years.

C. Textile Program

The Textile sub-sector covers products that develops and makes 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 from the Standard Terminology Relating to Textiles, ASTM D123 – 19.

The Call for Proposals for **CY 2023-2025** will focus on the identified call scope for Textiles.

Call Rationale

Technical Support to the Philippine Textile and other Allied Industries
Over the years, the industry was challenged due to the decreasing survival of big industry players.

With the continuous support to the textile industry yearning for Philippine-sourced fibers and other materials to be used in the production of textiles for garments, and even extending to other marketable products such as bags, shoes, etc., the provision of S&T support is essential to the industry's revitalization and sustainability.

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. Latest trends yet cost-effective technologies focusing on textile upcycling/recycling
2. Development of cost-effective technologies using natural fibers resulting to highly acceptable wearability for consumers covering all aspects of production such as fiber treatment, spinning, finishing, etc.
3. Improved body measuring technologies for textile and other related industry applications compatible with garments/textiles developed from natural fiber sources

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

1. Results of industry roadmaps (if available)
2. Technology Readiness Level between 2-6. It should encompass Technology Formulation, Validation of the Technology, Small Scale Prototype, Large Scale Prototype (if applicable).
3. Sustainability of both the supply of raw materials and finished product.
4. Has a 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.
5. Maximum of 3 projects will be funded not to exceed P125 Million covering all projects. The maximum duration for each project is 3 years.