



Annual Report **2023**

Thailand Institute of Scientific and Technological Research
Ministry of Higher Education, Science, Research and Innovation

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A Message from the Governor

In 2023, the Thailand Institute of Scientific and Technological Research (TISTR) encountered significant challenges amid the global economic slowdown. Meanwhile, worldwide countries were navigating the aftermath of the COVID-19 pandemic, endeavoring to revive their economies amidst various external pressures.

Throughout the past year, TISTR prioritized advancing research, technology, and innovation to bolster SMEs and the industrial sector, particularly showcasing expertise in cosmetics and nutritional supplements derived from indigenous plants, resulting in international award recognition. TISTR also expanded successful

initiatives like the “Tan Deow Model” through collaborative efforts with the public and private sectors. A significant achievement was the establishment of Thailand’s first Circular Economy Innovation Center in Rayong Province, located within the Eastern Economic Corridor (EEC).

Furthermore, TISTR expanded its services to support government initiatives such as New S-curve industries, providing testing for aerospace materials and biodegradability standards. Additionally, TISTR established an innovative ecosystem, highlighted by the launch of the online platform “TISTR JUMP,” providing 24-hour science and technology-related services,

with the goal of transitioning into a fully digital organization.

Socially, TISTR placed a priority on regional economic development, with a focus on the Sufficiency Economy Philosophy. This involved enhancing the production of ornamental and decorative flowers and improving agricultural potential in disadvantaged provinces like Kalasin, Sakon Nakhon, Nakhon Ratchasima, and Narathiwat. TISTR actively promoted knowledge expansion of bio-organic culture, particularly through fermentation tanks and collaborative forest planting initiatives aimed at distributing production outcomes across various regions of the country.

In global research initiatives, TISTR actively pursues collaborative partnerships with international organizations, striving towards sustainable global development goals (SDGs). TISTR has received support for its projects from various entities, including

the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), the Asia-Pacific Economic Cooperation (APEC), and Horizon 2020: the EU Framework Programme for Research and Innovation.

As a result of the determination of executives, researchers, academics, and personnel, TISTR has achieved its goals, evidenced by several prestigious awards spanning diverse fields, such as recognition as an outstanding digital organization, exemplary public service provider, and distinguished human rights organization. Particularly noteworthy are the significant economic and social impacts resulting from TISTR's research endeavors, valued at 17,650 million baht, which is 19.69 times the allocated budget. These achievements demonstrate that the research and innovation efforts of TISTR can truly benefit the nation for sustainable success.



Dr. Chutima Eamchotichawalit

Governor

Key Risks of Business Operations

Policy of Good Corporate Governance, Risk Management, and Compliance (GRC)

The Board of Directors of the Thailand Institute of Scientific and Technological Research (Board of TISTR) recognizes the importance of supporting the board, executives, employees, and staff of the institute in participating in linking the principles of good corporate governance with their work practices. This alignment includes adherence to risk management principles, as well as relevant laws, rules, and regulations, to elevate organizational management, create transparency, sustainability, and values, and enhance the value of operations for acceptance by stakeholders, communities, and society. Therefore, the Governance Risk Management and Compliance Policy is hereby announced as follows:

1. Establishing good corporate governance, risk management and internal control, compliance, and continuous business management practices. This includes fostering an environment and culture where the board, executives, employees, and staff of TISTR are aware of the importance, possess the knowledge, understanding, and capability to appropriately apply these practices as part of their responsibilities.

2. Defining objectives and operational goals that create and enhance value for TISTR in alignment with its context and expectations of stakeholders, communities, society, and the environment. These objectives should be based on risks, opportunities, limitations, as well as relevant laws, rules, and regulations.

3. Executing operations to achieve objectives and goals effectively and efficiently within the boundaries of laws, rules, regulations, contracts, agreements, risk management, internal controls, ethics, and morality. This includes providing relevant, credible, and timely information to stakeholders, communities, and society.

4. Continuously and regularly monitoring and evaluating operations and practices to serve as input for examination, review, improvement, and development of systems and work processes, enhancing their efficiency, suitability, and adaptability to changes in both internal and external environments.

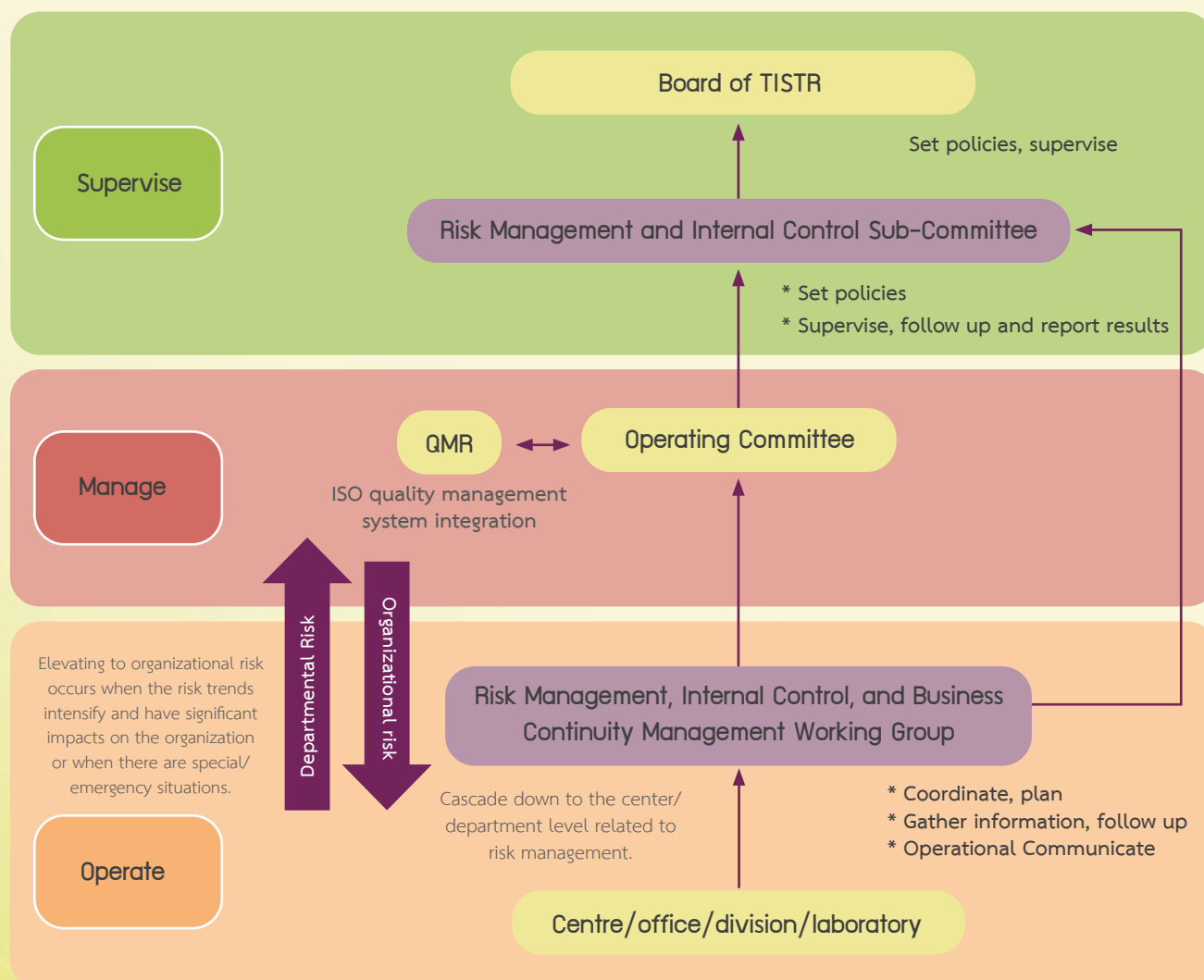
5. Promoting the use of information technology systems to support more effective and efficient operations, overseeing the management of information technology systems systematically and ethically, ensuring confidentiality, accuracy, readiness, and reliability.

Risk Management Framework of TISTR

TISTR determines the structure of risk management and internal control according to the Risk Management and Internal Control Sub-Committee, which is responsible for setting policies, supervising, monitoring, and reporting results to Board of TISTR.

At the unit level, TISTR has appointed a risk management, internal control, and business continuity management working group to coordinate and drive operations with the center/office/division/laboratory and Quality Management Representative (QMR) of the ISO 9001 to achieve the integration of risk management and internal control according to ISO requirements.

TISTR's risk management structure



TISTR categorizes risks into four types:

1. Strategic Risk (S): Risks related to strategic decisions.
2. Operational Risk (O): Risks associated with day-to-day operations.
3. Financial Risk (F): Risks pertaining to financial matters.
4. Compliance Risk (C): Risks concerning adherence to regulations.

This includes primary risks, risk management guidelines, as well as the outcomes of operations for the year 2023.

Risk Factor	Cause of Risk	Effect	Management Approach	Performance Monitoring
R-01: Assessment results of Core Business Enablers may not meet the target (S).	- Lack of systematic development of strategies and master plans in each aspect. - Operations within each category do not yet comply with the criteria.	Impacts on the overall score of the Performance Agreement for the year.	- Develop a consolidation plan for operations according to SEAM criteria in each area, focusing on collaborative work in the identified issues. - Prepare improvement plans for each category based on the recommendations from the annual performance progress.	Developing a consolidation plan between categories and plans for improvement within each category, tracking progress through the Core Business Enabler working group of TISTR on a quarterly basis.
R-02: Extension of the project timeline for research projects under the budget of Thailand Science Research and Innovation (TSRI) (O).	- Lack of a real-time digital tracking system. - Project plans and budget disbursement are not in line with the allocated funding periods. - Procurement processes may experience delays beyond the specified timelines. - Budget management results are insufficiently monitored. - Tracking systems for procurement requests are not adequate.	If unable to proceed with project closure within the scheduled time, it may affect the allocation of budget for the following year.	- Develop a realtime digital project progress tracking system. - Create plans and budget disbursement in accordance with allocated funding periods, and supervise budget management according to the plan. - Analyze delayed procurement transactions. - Monitor results and report budget management. - Adjust the procurement tracking system.	- Develop an application to extract data from the project research operation database and budget expenditure system, presenting it in a dashboard format and sending notifications when operations are behind schedule. - Create plans and monitor progress according to the plans and budget expenditure through reports in the Research Project Monitoring and Evaluation Committee.

Risk Factor	Cause of Risk	Effect	Management Approach	Performance Monitoring
				• Report the results of procurement and investment budget disbursement, finding that disbursements have been completed according to the plan with no issues of delayed procurement. • Improve the remaining budget reporting system, allowing users to check the actual available budget and enhance the procurement tracking system on the Web PR page.
R-03: Limitations in commercializing research outcomes and intellectual property (S).	• Customer and IP data survey that aligns with the market is still insufficient. • Marketing promotion activities have not effectively facilitated the utilization of research outcomes. • Research funding consideration for commercial benefit is still incomplete (30 percent coverage).	It is a risk that affects the PA goal, which is the commercialization of intellectual property.	• Survey customer and market data to present research outcomes with potential and aligned with demand, and plan to consider IP that matches the market. • Organize marketing promotion activities to encourage the utilization of research outcomes. • Improve the process of evaluating research funding for commercial utilization.	• Monitor progress through reports in the operations committee, with customer meetings to present research outcomes and achieve the goal of 20 presentations. • Evaluate the project's alignment with TISTR's TRM for the fiscal year 2023 and the completeness of project proposals that respond to driving TISTR's research activities (New projects for the fiscal year 2025).

Risk Factor	Cause of Risk	Effect	Management Approach	Performance Monitoring
R-04: Financial Status (Funding TISTR) Decreasing (F)	- Large-scale research project proposals do not yet conform to the organization's funding guidelines. - There is a lack of expansion in revenue-generating services. - Short-term and long-term expense reduction plans are still incomplete.	Impacts on the overall score of the Performance Agreement for the year.	- Develop guidelines for preparing large-scale research project proposals that integrate both internal and external organizational units, aligning with the funding guidelines of the organization. - Expand new revenue-generating service activities. - Study the income structure, costs, and remaining funds to supplement the TISTR's fund for the purpose of establishing short-term (variable cost) and long-term (fixed cost) expense reduction plans.	- Regularly monitor the status of funds entering the organization in monthly operations committee meetings. - Develop a format for high-value research project proposals and expand the scope of analytical testing services, resulting in increased research service revenue. - Explore strategies to reduce utility costs, such as installing solar cells for long-term electricity cost reduction.
R-05.1: Development of executive-level personnel may not support changes in the digital aspect (O).	- Development of executive-level personnel to have digital competency is not sufficient. - Current technologies are changing rapidly.	Executive-level personnel lack digital competency, which does not align with driving the organization digitally to keep pace with rapidly changing technologies.	Develop executive-level personnel to have digital competency.	Develop executives through training courses on digital skills for executives, with 100% of executives undergoing assessment after training.

Risk Factor	Cause of Risk	Effect	Management Approach	Performance Monitoring
R-05.2: Employees may not have sufficient digital competency for the use of TISTR's digital systems (O).	- The development of employees to have digital competency is not sufficient. - Current technologies are changing rapidly.	The employees lack digital competency to perform their duties, which is not aligned with driving the organization digitally to keep pace with rapidly changing technologies.	Developing operational-level personnel to have digital competency.	Developing personnel in using information systems within the organization to enhance understanding, along with conducting Digital Transformation training to elevate digital knowledge and drive the adoption of new digital practices within the organization. The total training participants were 425 people, accounting for 89.53%.
R-06: Cybersecurity threats arise (O).	- Plans for handling hardware and software are not sufficient. - Providing knowledge to personnel is not sufficient. - Personnel lack awareness of cybersecurity threats.	The organization may not be able to cope with the increasing trend of cybersecurity situations at present, resulting in severe damage.	- Develop a plan for hardware to inspect threats and vulnerabilities. - Develop a plan for software to assess the status and threats to system operations. - Provide training for knowledge enhancement for system administrators and developers. - Build and reinforce awareness of cybersecurity threats.	- Verify the network's performance, finding no abnormalities in CPU, RAM, and Disk. - Inspect vulnerabilities in the operating system and related software, updating security patches. - Employees and staff of the Digital System Development Division (DSD) have received training in Basic Cybersecurity through MOOC by the NCSA. - Immediately address and resolve issues upon receiving vulnerability alerts.

Risk Factor	Cause of Risk	Effect	Management Approach	Performance Monitoring
R-07: Operations may not comply with relevant laws, regulations, and rules.	- Inadequate monitoring of legal compliance, regulations, and related rules. - Insufficient assessment of conformity with laws, regulations, and relevant rules.	Possible non-compliance with the law may affect the organization's reputation and image.	Monitoring and evaluating compliance with laws, regulations, and relevant regulations related to business operations.	- Reporting on compliance with laws, regulations, and relevant regulations related to business operations, as well as reporting on the performance of the Compliance Unit's activities within the legal framework. - Creating a diagram illustrating the linkage between job practices and relevant laws, and reporting on the assessment of the unit's performance to the Good Governance Committee (CG) on a quarterly basis.

Business Overview, Plans, and Strategies

TISTR has consistently invested in Science, Technology, and Innovation (STI) infrastructure and human resources. This investment includes the augmentation of specialized personnel in various fields such as microorganisms, herbs, green agriculture, food, extracts, and environmental sciences.

With over 60 years of dedication, TISTR has actively contributed to national policies aimed at enhancing the competitiveness of industries, small and medium-sized enterprises (SMEs), and entrepreneurs. This contribution is realized through extensive research and development (R&D), testing, and analysis, focusing on the creation of value-added products, waste reduction in production processes, and building credibility with both domestic and international customers.

In light of the prolonged impact of the global epidemic, economic shifts, and changing environmental dynamics, numerous public and private entities are compelled to adapt to a new normal and disruptive technologies. TISTR, recognizing these challenges, has strategically managed its work environment and ecosystems. This approach facilitates the transformation of knowledge into tangible results, effectively addressing the national development issues using Science, Technology, and Innovation (STI). TISTR places a strong emphasis on cultivating digital literacy within its workforce, recruiting scientific professionals with diverse expertise, and staying current with the latest advancements. This has allowed TISTR to offer comprehensive solutions, setting its services apart from competitors.

In terms of research, TISTR aligns its focus with the needs of target industries and those supported by government policies. This includes a commitment to developing technology and expanding services to meet evolving industry requirements.

TISTR's business plan is executed under the 5th Strategy, emphasizing self-reliance capability. As outlined in the Annual Action Plan on Science, Research, and Innovation for 2023, TISTR has achieved notable results under three key strategies, detailed as follows:

(1) To enhance benefits for target customers, TISTR has established infrastructure to extend research into production. These infrastructures align with the Board of Investment's (BOI) merit-based criteria for competitiveness enhancement. Notable examples include the Food Innovation Service Plant (FISP), the Innovation Centre for Production Industry Microorganism (ICPIM), and the SMEs Building.

(2) TISTR is committed to promoting the utilization of infrastructure to empower entrepreneurs. The organization has developed supportive factors for Research and Development (R&D) at its headquarters and administrative areas, resulting in a growing number of customers making use of these facilities. TISTR collaborates with public agencies, private entities, universities, and communities (quadruple helix) across upstream, midstream, and downstream sectors. This collaboration supports

R&D and technology transfer to local areas, fostering the development of local wisdom into innovative community identities. As a result, TISTR has contributed to economic and social benefits totaling up to 24,000 million baht.

(3) TISTR's business development and introduction of new services, particularly through the Industrial Services Group (IDS), adhere to international standards and span various industries such as steel, machinery, food, rubber and rubber products, paints and varnishes, and electrical appliances.

Recognized by the Thai Industrial Standards Institute (TISI), the national standard regulator, TISTR is a trusted agency. The Innovative Cosmeceutical Service Centre (ICOS) within TISTR provides services that cater to the needs of entrepreneurs in the cosmetic, cosmeceutical, and extract industries.

TISTR has also embraced digital transformation by developing a digital platform for services and information retrieval. This platform serves both external customers and internal personnel, offering data storage for analysis, forecasting, and proactive decision-making. The online platform enhances efficiency and adds value to TISTR's operations, influencing aspects such as service improvements, product presentations, promotional items, and clear planning and direction for more concrete impacts on target customers and specific groups.

Research Highlights

TISTR has harnessed its expertise in science, technology, and innovation to address the imperatives of personnel development, poverty alleviation, and economic fortification. This approach aims to enhance the capacity of individuals and the nation sustainably, enabling them to keep pace with global dynamics.

Over the past six decades, TISTR has garnered recognition from domestic and international institutions for its outstanding contributions. These efforts align with the BCG economic policy, bolstering the entire economic system, increasing GDP, distributing incomes to communities, fostering strong and environmentally friendly communities, and propelling the three main economies: (1) Bio Economy, focusing on the cost-effective use of biological resources, linked to (2) Circular Economy, promoting the reuse of materials, all underpinned by (3) Green Economy, a sustainable approach to solving problems and reducing global negative impacts.

1. Natural Rubber Coating Patient

TISTR, through the Expert Centre of Innovative Materials (InnoMat), has pioneered the development of a natural rubber coating patient using Science, Technology, and Innovation (STI). The team has refined latex processing to create value-added materials for rehabilitation and healthcare, catering to the needs of an aging society on a global scale. The developed latex processing exhibits properties ideal for use and can be coated on belts for patient transfer, meeting the abrasion resistance standards outlined in EN388. This rubber-coated belt, three times more efficient than ordinary belts, ensures secure adhesion, tightens well around the waist and body, and remains in place during use. This innovation significantly reduces accidents for patients. A petty patent was filed, and the technology was transferred to Unity MediTech Company Limited. The products are now utilized by leading hospitals and clinics in Thailand. Recognized by the National Research Council of Thailand (NRCT), it represented Thailand at the 34th International Invention, Innovation, and Technology Exhibition (ITEX 2023) in Kuala Lumpur, hosted by the Malaysian Invention & Design Society (MINDS). The innovation received three prestigious awards: Gold Medal Award of ITEX 2023 in Malaysia, JIPA Award for Best Invention in Green Technology in Japan, and WIPA Special Award in Taiwan.



2. Cosmeceutical Products and Dietary Supplements

TISTR, through the Expert Centre of Innovative Herbal Products (InnoHerb), in collaboration with its technology recipients, has achieved remarkable success, securing 10 innovation awards:



- A dietary supplement utilizing peptides extracted from jasmine rice to reduce blood pressure earned a SILVER MEDAL. Another product targeting acne treatment through peptides extracted from germinated jasmine rice won a BRONZE MEDAL. Both products, high-efficiency innovations suitable for all ages, have seen the patented technology for their active ingredient extraction transferred to OD Style Company Limited. This initiative adds value to rice bran and encourages the use of diverse and potentially impactful local resources, substituting imported ingredients.

- The innovation of an Antihypertension Agent from Rice Bran Peptide in Soft Gel, emphasizing the utilization of protein extracts or peptides from rice for health treatment and chronic disease prevention, garnered a SPECIAL AWARD from the Association of Polish Inventors and Rationalizers in the Republic of Poland.

- These three products collectively received three awards at the research competition held during the 48th Geneva International Invention Fair from April 26 - 30, 2023.



- The “Helios Face Serum” leveraging *Cajanus cajan* (L.) Mill sp. peptide extraction for collagen stimulation, anti-wrinkle effects, chin and neck lifting, had its technology transferred to Supersayo Company Limited. This innovation received three awards: a Gold Medal from Euroinvent 2023, a Diploma of Excellence from the National Institute of Research and Development in Electrical Engineering ICPE-CA Bucharest, and a Special Award from TISIAS Toronto International Society of Innovation an Advanced Skills.

- This product also clinched seven awards at the European Exhibition of Creativity and Innovation: EUROINVENT 2023 held from May 11 - 13, 2023.

Helios face serum and liquid soap

Cajanus cajan (L.) Millsp. peptide extraction process as active ingredient in micellar Helios face serum and liquid soap

Supanat Sakayawong and Ubon Rong-asi
* Super sayo co., Ltd, *Thailand Institute of Scientific and Technological Research



Introduction

molc, yeast and bacteria enzyme

Ethanol

Chemical profile

Component	Value	Component	Value
1. Calcium and	17.017	10. Phosphorus	276.27
2. Iron	22.01	11. Sodium	113.47
3. Sulfur	24.01	12. Potassium	24.01
4. Magnesium	24.01	13. Nitrogen	14.01
5. Zinc	24.01	14. Chlorine	35.45
6. Copper	24.01	15. Fluorine	19.00
7. Manganese	24.01	16. Iodine	126.90
8. Barium	24.01	17. Selenium	78.96
9. Strontium	24.01	18. Bismuth	208.98
10. Calcium	24.01	19. Thallium	204.38
11. Sodium	24.01	20. Lead	207.2
12. Potassium	24.01	21. Tin	118.71
13. Nitrogen	24.01	22. Antimony	121.75
14. Chlorine	24.01	23. Tellurium	127.6
15. Fluorine	24.01	24. Polonium	209

Product feature

Helios Face Serum and liquid soap: are contained Pigeon pea peptide extract and ethanol: crude extract as active ingredient, that have properties:

- Antioxidant activity: lipid peroxidation, Nitric oxide Scavenging, ABTS scavenging, Singlet Oxygen scavenging etc.
- Anti collagenase, elastase assay close to Chondroitin acid
- Anti tyrosinase, anti-melanin synthesis close to arbutin arbutin
- Stimulating effect of collagen type I synthesis
- Non toxic on human dermal fibroblast, melanoma and RAW 264.7 cell line using MTT assay method
- Anti-inflammatory activity on RAW 264.7 cell line using Nitric oxide assay
- Anti-Acne Causing Bacteria Activity

Product innovation

High pressure homogenizer and combination of emulsifier

Application

- Green products, Save the earth and Environmentally Friendly
- Vegan products: Ingredients from plant
- No animal testing

1. Biological activities are tested in vitro (tested in a lab with cell line and colorimetric assay)
2. Efficacy and safety tests are performed in vivo (with volunteers, and evaluated by dermatologist)

Volunteer used after 3-4 days treatment:

- Skin color becomes an even tone and forehead
- Redness and flaking disappear
- Reduced skin pores
- Reduce blemish and redness

Volunteer used after 5-6 days treatment:

- Lifting wrinkles around the neck
- The skin is firm and soft

The anti-wrinkle and anti-melanin were evaluated for 8 weeks which subjected on 20-22 healthy Asian skin type female with their age between 35-45 years old. The anti-melanin was tested by using densitometry technique. The solution of 0.2 % peptide was able to significantly lighten the treated melanoma after 8 weeks. Skin replica with Shadow casting analysis for anti-wrinkle effect on the forehead area, was significantly decreased the number of wrinkles (11.6% ± 17.4%, p<0.05), and mean depth (0.1mm ± 0.03%, p<0.05). The results showed that the peptides were extracted with alkaline Pigeon pea suitable as active ingredients in cosmetics.



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SPECIAL AWARD

Presented to
in recognition of creative innovation/innovation of
Helios face serum and liquid soap

submitted and accepted at
The 15th European Exhibition of Creativity and Innovation
"EUROINVENT 2023" held from 11 - 13 May 2023 in Iasi, Romania

DIPLOMA OF EXCELLENCE

awarded to: **INNOVATION OF ETHNOCULTURE AND INVENTION**
...**HELIOS FACE SERUM AND LIQUID SOAP**...
for invention ...**HELIOS FACE SERUM AND LIQUID SOAP**...
Presented at
EUROINVENT 2023
11 - 13 May 2023, Iasi, Romania
General Director of INCIE ICPE-CA,
Dr. eng. Sergiu NICOLAE
EUROINVENT 2023

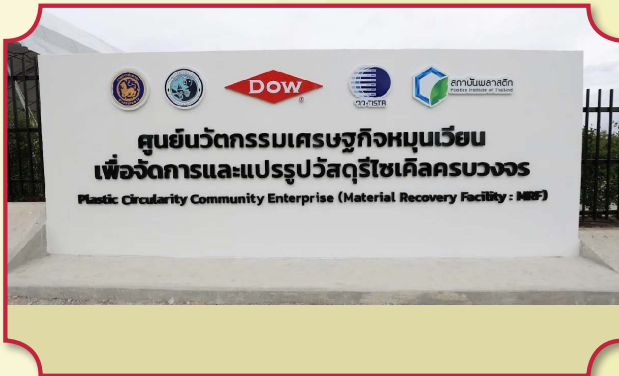


3. Thailand's Pioneering Circular Economy Innovation Centre for Comprehensive Recycled Material Management/Processing

TISTR, through the Expert Centre of Innovative Clean Energy and Environment (InnoEn), has extended its successful recycled material management to the private sector. Collaborating with various stakeholders, both public and private, including the Dow Thailand Group (Dow), Ban Chang District, Ban Chang Sub-district, and the Plastics Institute of Thailand, TISTR has initiated a groundbreaking project. Local communities in the Ban Chang District, Ban Chang Sub-district, Rayong Province, situated in the Eastern Economic Corridor (EEC), actively participate in this initiative.

The result is Thailand's inaugural circular economy innovation center, dedicated to the complete management and processing of recycled materials in the target area. This initiative addresses community waste management, plastic packaging, and waste within communities in a comprehensive and sustainable manner. It adds significant value to waste management practices and improves the quality of second-round raw materials through circular economy principles. The objective is to effectively reuse 1,000 – 2,000 tons of waste annually. Anticipated positive impacts on the economy, society, and environment include job creation and income generation for local communities, reduced waste management costs, the reuse or recycling of plastic waste, a decrease of over 200 tons of greenhouse gas emissions (carbon dioxide equivalent) per month, enhanced awareness of waste separation at the source, and the establishment of a pilot circular economy innovation centre.





4. The Innovative Cosmetic Service Centre: ICOS

The Innovative Cosmetic Service Centre (ICOS), a key infrastructure within TISTR under the Expert Centre of Innovative Herbal Products (InnoHerb), has earned GMP accreditation from the FDA. This recognition underscores ICOS's commitment to delivering comprehensive cosmetic production services to a diverse clientele, including entrepreneurs, SMEs, startups, and community enterprises in the cosmetic industry.

ICOS focuses on transforming research into commercial success by emphasizing cosmetic products that adhere to the quality and standards outlined in the ASEAN Guidelines for Cosmetic Good Manufacturing Practice. The center offers total solutions, enhancing the potential and competitiveness of entrepreneurs in alignment with government policies promoting research, development, and innovation as essential drivers of the economy.

Apart from supporting commercialisation, ICOS provides a range of services to the cosmetic manufacturing industry, encompassing safety assessment, quality control, production, and packaging. Meeting the requirements for superior beauty, ICOS contributes to the growth of new entrepreneurs and fortifies existing ones. Over 500 large entrepreneurs and SMEs have availed themselves of ICOS's services, utilizing them for commercialization to bolster their competitiveness and contribute to the strength of the national economy.



5. Vortex-Circulating Solar Dryer

TISTR, through collaborative efforts from the Expert Centre of Innovative Health Food (InnoFood), the Expert Centre of Innovative Herbal Products (InnoHerb), the Expert Centre of Innovative Agriculture (InnoAg), and the Expert Centre of Innovative Industrial Robotics and Automation (InnoRobot), has introduced a remarkable innovation - the Vortex-Circulating Solar Dryer.

This dryer incorporates an aerodynamic design to facilitate optimal air circulation and heat dissipation within the drying chamber. The heat dissipation process is consistent and thorough, ensuring efficient drying. The machine features 10 raw material trays, each capable of supporting up to 5 kilograms of raw material. With a compact footprint of 2X2 square meters, it maximizes utility space utilization. Notably, its drying rate is 5 - 10 times higher than that of a conventional solar dryer. Furthermore, it can seamlessly integrate additional heat from LPG gas during periods of insufficient sunlight.

Designed for versatility, the Vortex-Circulating Solar Dryer is suitable for food drying, reaching temperatures of up to 60 degrees Celsius. This makes it ideal for drying various items such as meat, fruits, and herbs, offering an innovative solution with enhanced efficiency and adaptability.

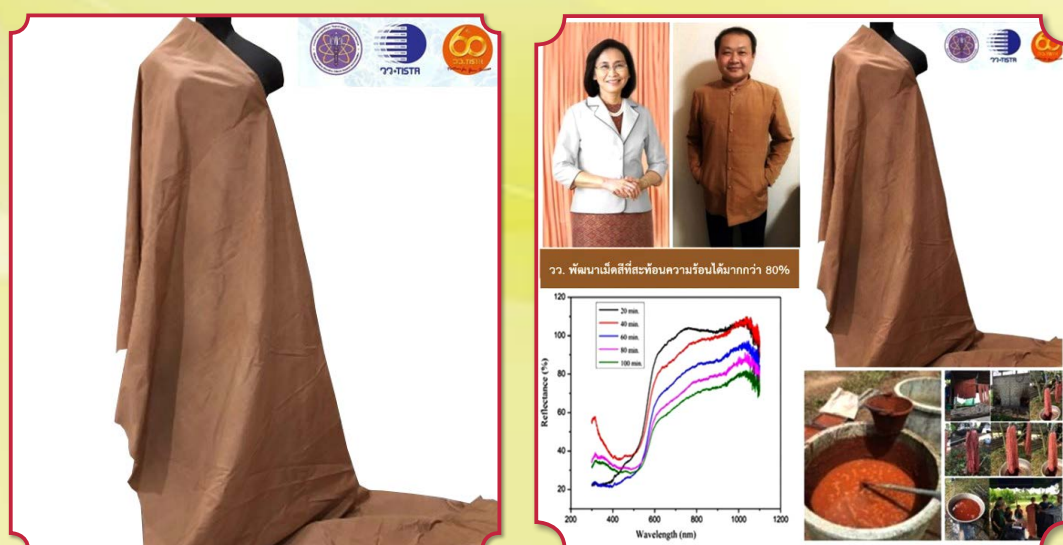


6. Thailand's First Heat-Reflecting Fabric Product

TISTR, through the Expert Centre of Innovative Materials (InnoMat), in collaboration with the local community of Ban Santiphab Pattana, Non Pa Sang Sub-district, Pha Khao District, Loei Province, has achieved a milestone by successfully developing Thailand's inaugural heat-reflecting fabric product. This innovative creation is achieved through a dyeing technology using laterite soil to reflect heat, elevating the community's identity and innovation by utilizing locally available raw materials.

This heat-reflecting fabric product outperforms regular fabrics in heat reflection. The process involves using color pigment derived from laterite soil, developed with heat-reflecting technology by TISTR. The pigment is combined with bark water to dye the thread, utilizing a high alkaline plant to firmly affix the pigment to the thread. The threads are then woven into pieces, resulting in a unique heat-reflecting fabric with a distinctive local identity.

The product logo further embodies the community's identity, incorporating the plant name 'Sang bamboo' and the village name 'Santiphab' in its design. This thoughtful integration establishes meaningful connections between the product, the logo, and the local area. Beyond its innovative qualities, this product presents an opportunity for increased income as it can be marketed at a price 100 percent higher than cotton and 50 percent higher than silk, based on their regular market prices.



7. Innovative Prototype of Ready-Made Composite for Enhanced Water Distribution Efficiency and Water Shortage Mitigation

TISTR, through the Expert Centre of Innovative Materials (InnoMat), has achieved a significant breakthrough with the successful development of an erosion prevention system utilizing natural materials. This system is strategically positioned on riverbanks to counteract erosion caused by water flow. Unlike traditional structures, it boasts a ready-made design that allows for immediate installation, making it easily adaptable and adjustable to the surface. Importantly, in cases of soil subsidence beneath the covered area, this system effectively mitigates structural collapse and water leakage issues, distinguishing it from conventional concrete slabs.

The composite materials devised for water distribution canals offer versatile applications. They can be employed in soil canals or utilized for canal repairs with ease and convenience. This innovative solution contributes to heightened water delivery efficiency and reduced water loss. Particularly beneficial for farmers and communities located at the end of canals, it ensures a faster and increased water supply, thereby addressing the issue of water scarcity. The ready-made composite prototype is a tangible outcome resulting from governmental initiatives aimed at addressing social problems within policy frameworks and practical applications in real-world scenarios. Beyond its immediate benefits, this innovation also contributes to reducing reliance on foreign technology, ultimately bolstering and sustaining the national economy.



Important Events 2023

TISTR's Showcase of Innovative Services/Products in Comprehensive Food Research at FiAsia 2022 to Empower Entrepreneurs



On October 5, 2022, Dr. Apakorn Supunya, Deputy Governor of Strategies and Innovation Management at TISTR, delivered a welcome speech during the opening ceremony of FiAsia 2022. FiAsia 2022, an international food and beverage exhibition and conference, was held at the Queen Sirikit National Convention Center (QSNCC) with the aim of promoting and enhancing the potential of the Thai food industry. Mr. Suchat Tancharean, Vice President of the House of Representatives, presided over the opening ceremony.

TISTR, a key supporter of Informa Market Thailand, actively participated in organizing the event, which took place from October 5 to 7, 2022, at Booth E-80 in Hall 3 of QSNCC. The showcase featured innovative services and products in comprehensive food research, demonstrating TISTR's commitment to empowering entrepreneurs in the food industry.

TISTR Delivered Water Hyacinth Soil Conditioners to the Royal Volunteer Administration Center



On October 3, 2022, Dr. Jittra Chaivimol, Deputy Governor of Administration at TISTR, and Dr. Rochana Tangkoonboribun, Director of the Expert Centre of Innovative Agriculture (InnoAg) at TISTR, personally delivered 50 kilograms of soil conditioners derived from water hyacinth to the Royal Volunteer Administration Center. This contribution aims to support the center's missions and was handed over at the Royal Volunteer Administration Center, located in the Dusit District of Bangkok.

TISTR Unveils Thailand's First Learning Center for Alcohol Production – “Malai Wittaya Stan” – to Foster Grassroots Economy and Advance BCG Policy on NRCT Foundation's 63rd Anniversary



On October 25, 2022, Prof. Dr. Anek Laothamatas, Minister of Higher Education, Science, Research, and Innovation of Thailand (MHESI), chaired the opening ceremony of the 63rd Anniversary of NRCT Foundation, themed ‘NRCT to drive a wisdom society and national development through research and innovation.’ Dr. Chutima Eamchotchawalit, Governor of TISTR, extended congratulations and donated supplies during the Royal Kathin Robe Offering by NRCT 2022 on this occasion.

As part of the celebration, Prof. Sirirug Songsivilai, Permanent Secretary of MHESI, and Dr. Wiparat De-ong, Executive Director of the National Research Council of Thailand (NRCT), visited TISTR's exhibition featuring Thailand's first learning center for alcohol production, named “Malai Wittaya Stan: a Wisdom Institution driving grassroots economy through ornamental flowers.” This exhibition, supported by NRCT, is part of the project aimed at developing BCG economy learning centers.

Dr. Apakorn Supunya, Deputy Governor of Strategies and Innovation Management at TISTR, along with TISTR's executives, researchers, and staff, warmly welcomed the guests and provided detailed insights into the project's implementation at the NRCT Office in Bangkok.

TISTR Showcases Medical Device Testing Services at CPHI Asia 2022.



From October 19 to 21, 2022, TISTR played a significant role in organizing CPHI Asia 2022, an exhibition dedicated to showcasing raw materials and components integral to the comprehensive production of drugs and medical devices. The event aimed to fortify the Thai pharmaceutical industry in adapting to global opportunities and challenges. The exhibition took place at Hall 8-9, providing a platform for both small and large entrepreneurs to explore new drug components, contributing to the advancement of the Thai pharmaceutical manufacturing industry.

During the opening ceremony, Mr. Sayan Tanpanich, Advisor on Product Development – from Research to Commercialization at TISTR, Mrs. Sirinan Thubthimthed, Director of the Expert Centre of Innovative Herbal Products (InnoHerb) at TISTR, and Mrs. Supaporn Jirakaikosol, Director of the Biochemical and Microbiological Laboratory (BML) under the Industrial Metrology and Testing Service Centre (MTC) at TISTR, alongside TISTR's researchers, actively participated in the event. Their presence highlighted TISTR's commitment to promoting advancements and innovation in the pharmaceutical and medical device sectors.

TISTR and Partners Sign MOU for Sustainable Growth Project in Nan Province and Commemorate National Father's Day with Tree Planting



On December 3, 2022, Dr. Chutima Eamchotchawalit, Governor of TISTR, formalized collaboration by signing an MOU for ‘the project of a cycle model of sustainable growth in Nan Province.’ The MOU involved key partners, including Lion (Thailand) Company Limited, Mahidol University, Community College in Nan Province, Joko Learning Center, and the Chamber of Commerce Nan Province. This strategic collaboration, aligned with national strategies and policies, aims to strengthen integrated efforts in research and development across economic, societal, natural resource, ecological development, and local herb and resource conservation/utilization domains.

The MOU signing ceremony took place at Ban Kiew Muang, Santisuk District, Nan Province. To mark the occasion and pay tribute to the birthday of King Rama IX on National Father's Day, TISTR and its partners engaged in a tree-planting activity. This symbolic gesture reflects the commitment to sustainable growth, environmental conservation, and the enduring legacy of King Rama IX.

TISTR Hosts Press Conference on the Results of the STI-driven Project to Boost Provincial Grassroots Economy



On December 13, 2022, Dr. Lattachit Meerak, Vice Minister of Higher Education, Science, Research, and Innovation of Thailand (MHESI), chaired a press conference revealing the outcomes of a project aimed at enhancing the agricultural economy at the local community level in eight target provinces: Chanthaburi, Chumphon, Pathum Thani, Phang Nga, Phetchabun, Sakon Nakhon, Samut Songkhram, and Udon Thani.

The initiative successfully disseminated knowledge to more than 5,500 farmers, led to the creation of over 30 innovative products, and generated economic, social, and environmental values exceeding 48 million Baht. The project's target groups encompassed the public sector, farmers, community enterprises involved in agricultural product processing, entrepreneurs, and the general public. These groups were categorized based on their involvement in agricultural technology: the agricultural technology and processing group for farmers, community enterprise operators processing agricultural products, individuals interested in farming, and the general public interested in innovative agricultural products.

The ultimate goal of the project is to contribute to elevating Thailand to the status of a high-income country. Mr. Wirot Nararak, Deputy Secretary-General of the National Economic and Social Development Council (NESDC), delivered a supportive speech, and Dr. Apakorn Supunya, Deputy Governor of Strategies and Innovation Management at TISTR, welcomed the attendees. The press conference took place at Rama Garden Hotel Bangkok.

TISTR Co-Organizes OTOP City 2022



From December 17 to 25, 2022, TISTR played a key role in the organization of OTOP City 2022, aligning with the theme of ‘sending happiness from wisdom, forwarding values by Thai skills.’ The event was hosted by the Department of Community Development, Ministry of Interior, at Challenger Buildings 1-3, IMPACT Muang Thong Thani, Nonthaburi Province. General Prayut Chan-o-cha, the Prime Minister, chaired the opening ceremony on December 19, 2022, and toured the exhibition and OTOP shops at TISTR’s exhibition area in Challenger Building 2. This provided an opportunity for TISTR to showcase how it utilizes Science, Technology, and Innovation (STI) to enhance and fortify the competitiveness of entrepreneurs.

During the event, Dr. Chutima Eamchotchawalit, Governor of TISTR, along with TISTR’s executives, entrepreneurs, and staff, collectively welcomed attendees and contributed to the success of the event.

TISTR Presents Flower Vases and Extends Blessings to HRH Princess Bajrakitiyabha



On December 19, 2022, Dr. Chutima Eamchotchawalit, Governor of TISTR, alongside TISTR's executives, offered flower vases and signed well wishes for the recovery and sustained good health of Her Royal Highness Princess Bajrakitiyabha. The presentation took place at Bhumisiri Mangkhalanusorn Building, Chulalongkorn Hospital, the Thai Red Cross Society, Bangkok.

TISTR Collaborates with Thai FDA for Integrated R&D and Establishment of Consulting Center for Innovative Health Products



On December 15, 2022, Dr. Chutima Eamchotchawalit, Governor of TISTR, and Dr. Paisarn Dunkum, Secretary-General of the Thai Food and Drug Administration (FDA), formalized a Memorandum of Understanding (MOU) to facilitate integrated collaboration in the research and development of innovative health products. The focus of this partnership includes the establishment of a consulting center aimed at promoting research, development, and incubation for innovative health products that adhere to the criteria set by the FDA. The collaboration extends to the development of testing and analytical laboratory standards for health product registration, the creation of a pilot plant functioning as a health product production learning center in accordance with Thai FDA standards, and the formulation of guidelines to advance Thai herbal products. The signing ceremony took place at the Chainat Narenthorn Meeting room, located at the Thai FDA Office.

TISTR, Dow Thailand Group, Plastic Institute of Thailand, and Local Authorities Collaborate to Address Community Waste Issues



On January 18, 2023, TISTR, in collaboration with the Dow Thailand Group, the Plastic Institute of Thailand, and local entities from Ban Chang District, Rayong Province, joined forces to address community waste challenges. Together, they inaugurated Thailand's inaugural and highly efficient Material Recovery Facility (MRF) pilot plant. With an investment exceeding 20 million baht, the initiative aims to leverage Science, Technology, and Innovation (STI) to enhance community value and generate income. The primary goal is to recycle and reuse approximately 1,000 – 2,000 tons of waste annually, encouraging waste separation, enhancing waste quality, and ultimately expanding the success of the waste pilot plant to other communities across Thailand. The launch event took place at Kantary Ban Chang, Rayong Province.

Minister of Higher Education, Science, Research and Innovation Visits TISTR and Shares Insights



On January 10, 2023, Prof. Dr. Anek Laothamatas, the Minister of Higher Education, Science, Research and Innovation of Thailand (MHESI), paid a visit to TISTR. During this visit, he delivered a special talk titled ‘Life is Research and Thinking Out of the Box.’ The purpose of the talk was to share his experiences, ideas, and suggestions that could prove beneficial for the daily activities and lives of TISTR’s researchers and staff. The engaging event took place at the conference room in the Administration Building, TISTR Technopolis, Pathum Thani Province.

TISTR and Innobio Introduce 'Innobio Probiotic GD' – a Dietary Supplement for Digestive Health



On January 29, 2023, TISTR collaborated with Innobio (Asia) Company Limited, a subsidiary of PTT Public Company Limited, to unveil a dietary supplement aimed at promoting digestive health – ‘Innobio Probiotic GD.’ This product, designed to balance intestinal tracts and enhance the body’s immunity, serves as a nutritional support for the well-being of the Thai population. The product launch event took place at the PTT Headquarters on Vibhavadi Rangsit Road, Bangkok.

‘TISTR and Friends 2023’: Empowering Thai Entrepreneurs through Science, Technology, and Innovation (STI)



From March 17 to 19, 2023, TISTR, in collaboration with public and private partners, along with MBK Shopping Center, organized the event ‘TISTR and Friends 2023’ at the Activity Area on the 4th floor, Zone D, MBK Shopping Center, Bangkok. Dr. Chutima Eamchotchawalit, Governor of TISTR, chaired the opening ceremony on March 17, 2023.

The event, themed ‘partner network collaboration to strengthen Thai entrepreneurs,’ featured Ms. Satakamol Worakul, Director of Corporate Communication at MBK Public Company Limited, Ms. Nitivadee Somboon, Director of SMEs Service Provider Network Coordination and Government Policy Promotion at the Offices of Small and Medium Enterprises Promotion (OSMEP), Ms. Wittaya Sabyen, Deputy Director of Marketing at the Ministry of Interior, and Mr. Mongkol Setthanupong, Manager of Entrepreneur Support and Development at Small and Medium Enterprise Development Bank of Thailand (SME Bank) at the opening ceremony.

Activities included special talk sessions, product shops showcasing successful entrepreneurs utilizing STI, and exhibitions by partner network alliances, along with presentations of product development by Thai entrepreneurs.

Preserving Thai Arts and Culture: TISTR's Gift of Colored Tiles to Wat Rajabopit Sathit Maha Simaram



On March 21, 2023, a delegation including Prof. Sirirung Songsivilai, Permanent Secretary of the Ministry of Higher Education, Science, Research and Innovation of Thailand (MHESI), Dr. Wiparat De-ong, Executive Director of the National Research Council of Thailand (NRCT), Dr. Chutima Eamchotchawalit, Governor of TISTR, Dr. Pratip Vongbandit, Deputy Governor Research and Development for Sustainable Development of TISTR, Dr. Sirporn Larпкиattaworn, Director of the Expert Centre of Innovative Materials (InnoMat) of TISTR, and researcher teams from Silpakorn University and Beger Company Limited, paid respectful homage and presented a set of colored tiles from Wat Rajabopit Sathit Maha Simaram to His Holiness the Supreme Patriarch.

These colored tiles are applied art works and product prototypes designed for various purposes including product, housing, and textile design. Supported by NRCT, this research aims to conserve Thai values and instill pride in Thai culture. TISTR, as one of the project research agencies, utilized Science, Technology, and Innovation (STI) to promote and sustainably conserve arts and culture. The presentation ceremony took place at Wat Rajabopit, Bangkok.

Advancing Sustainable Farming: TISTR/NRCT Visit Samui for 'Kick Off BCG Farming Center Project – Phase II



On May 5, 2023, Dr. Chutima Eamchotchawalit, Governor of TISTR, Dr. Rochana Tangkoonborigun, Director of the Expert Centre of Innovative Agriculture (InnoAg) of TISTR, and Dr. Boonnanida Sodha, Director of International Relations Division of TISTR, participated in the event 'Kick Off BCG Farming Center Project: A Sustainable Self-Reliant Community Model – Phase II' at Phawana Photikhun Vocational College, Kho Samai District, Surat Thani Province. Dr. Wiparat De-ong, Executive Director of the National Research Council of Thailand (NRCT), chaired the opening ceremony.

NRCT provided financial support to TISTR for the implementation of the project on Samui Island, utilizing Science, Technology, and Innovation (STI). The project aims to establish a comprehensive model encompassing production, processing, and market sectors for the benefit of local communities. It also serves as a BCG model center for study visits and technology transfer, contributing to the progress of other regions.

Fostering Excellence in STEM Education: TISTR Collaborates with Thailand Academy of Sciences (TAS)



On May 25, 2023, Prof. Dr. Anek Laothamatas, Minister of Higher Education, Science, Research and Innovation of Thailand (MHESI), presided over the event to launch and sign the Memorandum of Understanding (MOU) with the Thailand Academy of Sciences (TAS). The ceremony was attended by Prof. Sirirug Songsivilai, Permanent Secretary of MHESI, Mr. Samphan Yensamran, Advisor to the Minister of MHESI, Prof. Dr. Supachai Pathumnakul, Deputy Permanent Secretary of MHESI, Asso. Prof. Dr. Weerapong Paesuwan, Executive Director of Program Management Unit for Human Resources and Institutional Development, Research and Innovation (PMU-B), and Prof. Dr. Sompong Klaynongsruang, Director of PMU-B.

In this collaborative effort, Dr. Chutima Eamchotchawalit, Governor of TISTR, and executives from MHESI, educational institutions, and private agencies joined in signing the MOU. The ceremony took place at the press conference room on the 1st floor of the Offices of the Permanent Secretary for MHESI (Yo Thi Road), Bangkok. This strategic partnership aims to produce high-performance science and technology graduates, emphasizing the significance of advancing STEM education in Thailand.

TISTR Celebrates its 60th Anniversary: A Milestone in Sustainable Research, Technology, and Innovation



On May 25, 2023, Prof. Sirirug Songsivilai, Permanent Secretary of the Ministry of Higher Education, Science, Research and Innovation of Thailand (MHESI) and the Board Chairperson of TISTR, chaired the commemorative event marking the 60th Anniversary of TISTR Foundation, themed ‘Proud of TISTR: Step Up Together’. The occasion also included a certification ceremony where certifications were awarded to TISTR’s executives and staff.

During the event, Dr. Chutima Eamchotchawalit, Governor of TISTR, delivered a speech highlighting the organization’s achievements, and Dr. Jittra Chaivimol, Deputy Governor Administration, announced the list of TISTR’s executives and staff who have dedicated 30 and 20 years of service, presenting them with certifications. The purpose was to uplift morale, recognize their devoted performance, and commend their innovative contributions that have significantly benefited the organization and society.

The event was attended by distinguished figures such as Pol. Lt. Gen. Pornchai Suteerakune, Director of the National Institute of Metrology Thailand (NIMT), Mr. Somporn Mangmee, Board Member of TISTR, along with TISTR’s executives, staff, and representatives from partner organizations, celebrating six decades of excellence in research, technology, and innovation for sustainable development.

TISTR Collaborates with EGCO Group and Thai Rak Pa Foundation to Foster Sustainable Living in Harmony with Forests



On May 29, 2023, Dr. Chutima Eamchotchawalit, Governor of TISTR, and Mr. Thepparat Theppitak, President of EGCO Group and President of Thai Rak Pa Foundation, joined forces by signing a Memorandum of Understanding (MOU). The purpose of this collaboration is to enhance integrated research utilization for both social and commercial benefits.

The MOU encompasses the transfer of research findings and Science, Technology, and Innovation (STI) knowledge to communities residing in watershed forest areas. Additionally, the partnership aims to elevate the strength and quality of life for these communities, fostering sustainable coexistence with the forest. The agreement emphasizes the concrete application of forestry research for the conservation and restoration of watershed forest ecosystems. The signing ceremony took place at the conference room of EGCO headquarters in Bangkok.

On 29 May 2023, Dr. Chutima Eamchotchawalit, Governor of TISTR, and Mr. Thepparat Theppitak, President of EGCO Group and the President of Thai Rak Pa Foundation, signed the MOU to promote integrated collaboration in research utilization for social and commercial benefits, and research results and STI knowledge transfer to communities in the watershed forest areas, as well as, to promote strength and quality of living of the communities to live with the forest sustainably, and conservation and restoration for watershed forest ecosystem by applied forestry research concretely. The MOU signing ceremony was held at the conference room, EGCO headquarters, Bangkok.

TISTR Showcases Industry Research Services for Economic Advancement at ProPak Asia 2023



On June 14, 2023, Dr. Chutima Eamchotchawalit, Governor of TISTR, Dr. Pattria Maneesin, Deputy Governor Industrial Services of TISTR, and Mr. Sayan Tanpanich, Advisor on Product Development – from Research to Commercialization of TISTR, alongside TISTR’s executives, researchers, and staff, participated in the opening ceremony of ProPak Asia 2023. This event, held at the Bangkok International Trade and Exhibition Centre (BITEC) in Bangna, Bangkok, aimed to comprehensively drive the economy and fortify entrepreneurs through the application of Science, Technology, and Innovation (STI).

During the event, TISTR actively exhibited its research results and services at Booth FY101-11, providing a platform to showcase how STI can contribute to economic growth and development. The exhibition ran from June 14 to June 16, 2023.

TISTR Hosts the 8th Asian Packaging Federation (APF)



On June 15, 2023, Dr. Pattra Maneesin, Deputy Governor Industrial Services of TISTR and the Secretary-General of the Asian Packaging Federation (APF), along with APF board members and representatives from 15 countries in Asia, convened for the 8th APF Strategic Planning Meeting. The event took place at Amber 4 meeting room, Bangkok International Trade and Exhibition Centre (BITEC), Bangna, Bangkok, Thailand.

The APF Board Members collectively decided to hold the meeting in Bangkok, Thailand, from June 13 to June 16, 2023. As part of the activities during ProPak Asia 2023, TISTR was proposed to be a main host for organizing the meeting. Executives and researchers from Thai Packaging Centre (TISTR Bangkhen) were actively present and engaged in the meeting.

TISTR Collaborates with DTAM MOPH for Herbal Product R&D



On June 29, 2023, Dr. Chutima Eamchotchawalit, Governor of TISTR, and Dr. Thongchai Lertvilairattanapong, Director General of the Department of Thai Traditional and Alternative Medicine (DTAM) under the Ministry of Public Health (MOPH), formalized their collaboration by signing a Memorandum of Understanding (MOU). The MOU focuses on studying herbal product Research and Development (R&D), Thai traditional medicine, and alternative medicine. The aim is to maximize benefits at both policy and practice levels, ensuring positive and sustainable impacts on Science, Technology, and Innovation (STI) research and development. The project is set to span five years, and the signing ceremony took place at the main stage of the Thai Herbal Expo at IMPACT Muang Thong Thani, Nontaburi Province.

TISTR / EXIM Bank / CEA Hosts ‘SMEs Export Studio 2023’ to Boost Global Competitiveness



On July 13, 2023, Dr. Apakorn Supanya, Deputy Governor of Strategies and Innovation Management at TISTR, Dr. Benjarong Suwankiri, Vice President of the Export-Import Bank of Thailand (EXIM Bank), and Mr. Intaphan Buakaew, Vice Director of the Creative Economy Agency (Public Organization) (CEA), jointly presided over the opening ceremony of the ‘SMEs Export Studio 2023’ project. The event took place at the EXIM Bank Headquarters in Phayatai, Bangkok. This initiative aims to support Small and Medium-sized Enterprises (SMEs) by helping them establish a strong brand presence to effectively compete in the global market.

TISTR Plays a Key Role in Establishing Regional Drug Security at CPHI South East Asia 2023



From July 12 to 14, 2023, TISTR actively participated in CPHI South East Asia 2023, showcasing a wide array of research results and industrial services related to medicine, health products, analysis, testing services, pharmaceuticals, natural products, medical devices, equipment, and packaging. The event, held at Booth B-22 in Hall 1 of the Queen Sirikit National Convention Center (QSNCC), Bangkok, aimed to provide consultancy to entrepreneurs, empowering them with Science, Technology, and Innovation (STI) to fortify their businesses. On July 12, 2023, Mr. Anutin Charnvirakul, Deputy Prime Minister, and the Minister of Public Health, presided over the opening ceremony, where Dr. Chutima Eamchotchawalit, Governor of TISTR, and other TISTR executives were in attendance. This initiative by TISTR contributes significantly to the establishment of regional drug security.

TISTR and Wongpanit Group Join Forces for Circular Economy and Community Waste Management Technology Learning Center



On July 10, 2023, Dr. Chutima Eamchotchawalit, Governor of TISTR, and Dr. Somthai Wongcharoen, President of the Wongpanit Group, inked a Memorandum of Understanding (MOU) solidifying their collaboration. The partnership aims to leverage Science, Technology, and Innovation (STI) in establishing a learning center dedicated to community waste management technology. This initiative is designed to drive circular economy principles, generate employment opportunities, income, and address environmental challenges. The collaboration also seeks to minimize adverse environmental impacts and enhance the overall quality of life for communities. The MOU signing ceremony included Dr. Pratip Wongbundit, Deputy Governor R&D for Sustainable Development of TISTR, and Mr. Kanokpol Wongcharoen, Executive Director of Wongpanit Waste to Energy Company Limited, as witnesses. During the event, TISTR's executives and Dr. Rewadee Anuwattana, Research Expert of TISTR, were present at the certificate presentation ceremony, acknowledging the completion of an international training program titled 'Wasteology: Urban mining business with recycling' by participants from the Department of Public Health, Environment, and Wastewater Management of the Government of Ghana. The event took place at Wangchan River View Hotel, Phitsanulok Province, and included a visit to a waste recycle plant operated by the Wongpanit Group to study their waste collection, sorting systems, and product quality inspection.

TISTR Presents ‘Sakearat Model’ at Thailand Research Expo 2023



From August 7 to 11, 2023, TISTR showcased the “Sakearat Model: A learning model of forest restoration to a natural bank” at Thailand Research Expo 2023. The exhibition, held at Centara Grand at Centralworld Hotel Bangkok, was part of the overarching theme, ‘Thai research moves forward to drive the economy and society sustainably,’ organized by the National Research Council of Thailand (NRCT). Supported by NRCT, the model is geared towards utilizing Science, Technology, and Innovation (STI) to boost the economy, fortify communities, and address global environmental challenges. The model’s sustainable management framework is implemented within the Sakaerat Biosphere Reserve.

TISTR and Kalasin University Celebrate the 60th Year: Advancing Towards R&D for Sustainable Communities/Localities



On August 8, 2023, TISTR, in collaboration with Kalasin University, organized the event titled ‘The 60th Year of TISTR: The Next Step Toward R&D for Sustainable Communities/Localities.’ The initiative aimed to foster integrated collaboration among the public sector, private sector, research institutions, and educational institutions. The event, held at Phayak Mok meeting room in the Rector and Asset Management Building of Kalasin University, sought to promote practical utilization and development within the Kalasin Province.

TISTR Showcases 'BCG: Food for the Future' at the National Science and Technology Fair 2023



From August 11 to 20, 2023, TISTR proudly exhibited its research results and activities at the National Science and Technology Fair 2023, themed 'BCG: Food for the Future', hosted at Building 6, IMPACT Muang Thong Thani in Nonthaburi Province. The exhibition by TISTR was ingeniously structured across four distinct zones: 1) food innovation for the future, 2) machinery innovation for food production, 3) food testing and analysis, and 4) food infrastructure. The event's inauguration on August 11, 2023, witnessed the presence of Dr. Chutima Eamchotchawalit, Governor of TISTR, and various TISTR executives who actively participated in the event.

TISTR Showcases Innovation in Natural Color and Fabric at ‘Silpacheep Pratip Thai: OTOP All Heart for the King’ Event



On August 13, 2023, General Anupong Paochinda, the Minister of Interior, presided over the opening ceremony of the event ‘Silpacheep Pratip Thai: OTOP All Heart for the King’, organized by the Department of Community Development. The event was centered around the theme ‘Thai woven fabric – thread of mercy – sustainable career for people’. Dr. Chutima Eamchotchawalit, Governor of TISTR, along with TISTR’s executives and staff, actively participated in the opening ceremony. Notably, they extended a warm welcome to Mrs. Millicent Cruz-Paredes, Commercial Counsellor at the Philippines Trade and Investment Center – Bangkok, and her delegation. TISTR’s exhibition featured the ‘Innovation of Natural Color and Fabric by TISTR’, complemented by product shops from the university network and OTOP entrepreneurs across Thailand. This showcased how TISTR leverages science, technology, and innovation to support and enhance grassroots economies, fostering job creation and income generation for the public. The event took place at Challenger Building 1 – 3, IMPACT Muang Thong Thani, Nonthaburi Province, spanning from August 12 to 20, 2023.

TISTR Collaborates with NRCT to Promote Edible Ornamental Flowers in Phuket, Enhancing Southern Economy



On August 22, 2023, TISTR, in collaboration with the National Research Council of Thailand (NRCT), executed the project 'Development of Ornamental Flowers Cultivation System in a Safe Agricultural Environment for Consumption.' The initiative came to life through the event named 'Floral Delights: Edible Flower Showcase at Andaman,' held at the Plaza meeting room, Deevana Plaza Hotel Phuket, Phuket Province.

The primary objective of this event was to disseminate knowledge regarding the utilization of flowers while bringing attention to the aforementioned project. Dr. Wiparat De-ong, Executive Director of NRCT, assumed the role of the chairperson during the opening ceremony. Dr. Chutima Eamchotchawalit, Governor of TISTR, and Mr. Danai Sunantharod, Deputy Governor of Phuket Province, were present alongside executives, farmers, and entrepreneurs, collectively contributing to the success of the event. This collaboration sought to not only enrich local expertise but also add value to the Southern economy through the cultivation and consumption of safe and aesthetically pleasing ornamental flowers.

TISTR Collaborates with TV5 HD to Boost Markets and Empower Thai Entrepreneurs through STI



On August 28, 2023, Dr. Chutima Eamchotchawalit, Governor of TISTR, joined forces with General Visanti Srasrida, President of the Royal Thai Army Radio and Television (TV5), and the representative of the Royal Thai Army. Together, they signed a Memorandum of Understanding (MOU) to integrate their efforts in disseminating information, knowledge, and works related to Science, Technology, and Innovation (STI). The collaboration aimed to expand the utilization and application of STI, undertake marketing promotion initiatives, and contribute to the development and empowerment of entrepreneurs, communities, One Tambon One Product (OTOP) programs, small enterprises, and Small and Medium-sized Enterprises (SMEs). The MOU signing ceremony took place at the meeting room on the 26th floor of the TV5 HD Building. As part of the collaboration, TISTR and TV5 HD jointly organized the event ‘Good Product Market: The 60th Year of TISTR’ on the ground floor of the Benjarunsarit Building, TV5 HD, Sanam Pao District, Bangkok, from August 28 to August 30, 2023. This initiative aimed to showcase and promote quality products, leveraging the synergies between TISTR’s technological advancements and TV5 HD’s outreach capabilities.

TISTR Supports Kamphaengphet Rajabhat University with Biodiesel Production Machine for Energy and Environment Enhancement



On August 30, 2023, Dr. Chutima Eamchotchawalit, Governor of TISTR, and Assoc. Prof. Dr. Preeyanuch Promphasit, Acting Rector of Kamphaengphet Rajabhat University, joined hands in signing a Memorandum of Understanding (MOU). The MOU focused on promoting research and creative economy, outlining ways to collaborate with network partners under the university's transformation project plan for 2023.

As part of the collaboration, TISTR contributed to the academic environment by delivering a biodiesel production machine to Kamphaengphet Rajabhat University. This initiative aimed to facilitate the learning process of biodiesel production, aligning with academic cooperation in the fields of energy and environment. Dr. Pratip Vongbandit, Deputy Governor of TISTR for Research and Development for Sustainable Development, along with TISTR's executives and researchers, were present at the event. Representatives from local agencies, including Khlong Mae Lai Subdistrict Municipality Office, Community Development Office, Ang Thong Subdistrict Administrative Organization, Ang Thong Pattana School, Kanthi Pattana Community, and Kamphaengphet Province, also attended the event, which took place at Muk Munin Building, Palang Ngan Garden, Kamphaengphet Rajabhat University.

TISTR and ASEAN Allies Spearhead Urban Policy and Action Plan to Combat Air Pollution in Asia Pacific



On August 31, 2023, Dr. Chutima Eamchotchawalit, Governor of TISTR, presided over the TISTR International Conference themed ‘Air Pollutions: Perspective, Prediction, Prevention, and Control.’ The conference was held in conjunction with the ASEAN Sustainable Energy Week 2023 (ASEW 2023). As a key figure at the event, Dr. Preeti Soni, Head of the Asian and Pacific Centre for Transfer of Technology (APCTT) at the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), served as a keynote speaker, delivering insights on ‘Perspective on Air Pollution Management in the Asia-Pacific Region.’

Dr. Pratip Vongbandit, Deputy Governor for Research and Development for Sustainable Development at TISTR, extended a warm welcome to the participants and speakers, both Thai and international. Mr. Somporn Mangmee, Board Member of TISTR, and Dr. Suwit Auchariyamet, Director of the Expert Centre of Innovative Industrial Robotics and Automation (InnoRobot) at TISTR, were also in attendance at the MR-103 meeting room, Queen Sirikit National Convention Center (QSNCC). The conference aimed to drive collaborative efforts in developing urban policies and action plans, leveraging technology and innovation to control air pollution in the Asia Pacific region.

TISTR, Dow Thailand Group, and Partners Launch Pioneering Material Recovery Facility (MRF)



On September 6, 2023, Dr. Chutima Eamchotchawalit, Governor of TISTR, participated in the inauguration ceremony of the ‘Innovative Circular Economy Center for Recycled Materials Processing and Management,’ known as the Material Recovery Facility (MRF). The collaborative project involved TISTR, the Dow Thailand Group, Program Management Unit for Competitiveness (PMUC), the Plastic Institute, Ban Chang Subdistrict Municipality, Ban Chang District, and Rayong Province.

Located in Ban Chang District, Rayong Province, this facility marked Thailand’s inaugural pilot center dedicated to the processing and management of high-quality recycled materials. It was an extension of the success achieved with the Tan Diao Model, now branching into the private sector. The primary goal was to drive waste sorting at the community level, enhancing the quality of recycled materials through Thai innovation and technology. Operating as a ‘Community Enterprise,’ the facility addressed challenges related to used plastics and recycled materials in landfills.

The MRF aimed to process over 1,000 tons of recycled materials annually, contributing to a reduction of 2,400 tons of carbon dioxide equivalent in greenhouse gas emissions each year. This initiative played a vital role in promoting sustainability and circular economy practices within communities.

TISTR Collaborates with AEPW, Bangkok Metropolitan Administration, and PPP Plastic to Establish 'Smart Recycling Hub'



On September 7, 2023, Dr. Chutima Eamchotchawalit, Governor of TISTR, took part in an announcement ceremony marking a collaboration aimed at driving sustainable plastic and recycled material management. The event focused on the feasibility study for establishing an innovative circular economy center known as the 'Smart Recycling Hub.' The ceremony was held at True Digital Park in Bangkok.

The collaborative effort involved TISTR, the Dow Thailand Group, the Plastic Institute, Bangkok Metropolitan Administration, Alliance to End Plastic Waste (AEPW) in Thailand, and Public Private Partnership for Sustainable Plastic and Waste Management (PPP Plastics). Their shared objective was to create a prototype model in the Bangkok area, with plans to expand its success to the Eastern Economic Corridor (EEC).

The 'Smart Recycling Hub' was designed to serve as a mechanism for collecting, sorting, and processing used plastic into clean, high-quality recycled materials. The initiative aligned with circular economy concepts and the BCG (Bio-Circular-Green) economy model, contributing to a sustainable economy and society. The ultimate goal was to collect and reintegrate at least 50,000 tons of used plastic into the system annually. This project represented a significant step toward effective waste management and circular economy practices in urban settings.

Achievement Awards

1. TISTR has been certified as a unit for the certification of biodegradable plastic products according to ISO 17088:2012, marking the first and only certification of its kind in Thailand.



2. TISTR was honored with 'the 2022 Outstanding State Enterprise in the category of Strategic Collaborative Excellence for Outstanding Development,' as well as 'the Operational Excellence Award for Social and Environmental Initiatives.'



3. TISTR was awarded the Bronze Prize for the innovative food and herb dehydrator utilizing a co-system powered by wind and solar energy at the Seoul International Invention Fair 2022 (SIIF 2022).



4. TISTR was honored with the Silver Medal and Bronze Medal at the 48th International Exhibition of Inventions in Geneva, Switzerland, for the research and development of dietary supplements/cosmeceutics from germinated Jasmin rice peptide extract.



5. TISTR received Awards of Invention, Research, and Innovation for Thai herbal cosmeceutics at EUROINVENT 2023 in Romania.



6. TISTR received 2 prizes of the OAP Award from the Office of Atoms for Peace, Thailand.



7. TISTR received an award from the Thailand Digital Accessibility Award 2023 for compliance with the Web Content Accessibility Guidelines (WCAG).

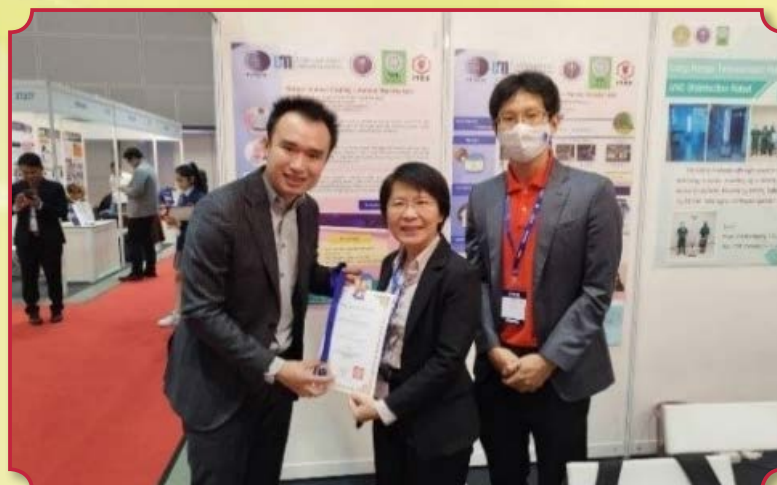


8. TISTR received the Sustainability Booth Design Award in the “Creativity” category at ProPak Asia 2023.



9. TISTR showcased its project on 'Natural Rubber Coating - Patient Transfer Belt' at the 34th International Invention, Innovation & Technology Exhibition (ITEX 2023) in Kuala Lumpur, Malaysia, earning three awards:

1. Gold Medal Award from ITEX 2023
2. JIPA Award for Best Invention in Green Technology from Japan
3. WIIPA Special Award from Taiwan



10. TISTR, in collaboration with the National Research Council of Thailand (NRCT), Kasetsart University, and Chulalongkorn University of Thailand, received the gold medal for De-BUGs, a pesticide processed from eggshells, at the Japan Design, Idea, and Invention Expo (JDIE) 2023 Invention Contest in Japan.



11. TISTR received the Sustainability Booth Design Award for outstanding booth design and arrangement at CPHI South East Asia 2022.



12. Dr. Pattra Maneesin, Deputy Governor of Industrial Services at TISTR, was awarded the commemorative pin and certificate of honor for the CHIEF INNOVATION OFFICER (CIO) by the National Innovation Agency (NIA). This recognition is in acknowledgment of her active role in driving innovation and her primary responsibility for innovation operations within the organization.



13. TISTR, represented by Ms. Ubon Rerk-um and Dr. Sarunya Laovitthayanggoon, Senior Research Officer at the Expert Centre of Innovative Herbal Products (InnoHerb), received the prize for the invention, research, and innovation of women scientists at the Korea International Women's Invention Exposition 2023 (KIWIE 2023). The event featured exhibitions displaying innovations and inventions from over 19 countries, with 324 inventors, and was promoted by the Association of Thai Innovation and Invention Promotion.



14. TISTR earned the Bronze Award at the Thailand Research Expo 2023 for the 'Sakaerat Model,' recognized as a showcase and learning model for forest restoration and natural resource conservation. Developed by the Expert Centre of Innovative Clean Energy and Environment (InnoEn) at TISTR in collaboration with Kasetsart University, GISTDA (Geo-Informatics and Space Technology Development Agency), and Suranaree University of Technology, the project comprises three sub-projects focused on Sakaerat Biosphere Reserve's area development, conservation and community adaptation, and survey/database development. This achievement underscores TISTR's commitment to environmental sustainability and innovative solutions in collaboration with key partners.



15. TISTR was honored with the Public Sector Excellence Award 2023 (PSEA 2023) in the 'Public Services' category for its outstanding efforts in capacity building for the development of the medical industry, aiming to transform into an international hub for medical and health centers. This prestigious award was conferred by the Office of the Public Sector Development Commission (OPDC).



16. TISTR was honored with the Sampao-Nawathong Award for the year 2023 for the development of its online one-stop-service platform, 'TISTR JUMP' (TISTR Joint Unit - Task Platform), designed to serve the business sector and the public in the category of department-level organizations. This prestigious award was presented by the Thai Chamber of Commerce and the Board of Trade of Thailand.



17. TISTR was awarded for its 'Outstanding Public Relations Committee' at the Thailand Labour Management Excellence Award 2023.



18. TISTR was honored with the title of 'Outstanding Human Rights Model Organization' in the state enterprises category at the Human Rights Award 2023. Notably, TISTR has received this prestigious award for three consecutive years.



19. TISTR was awarded the Best Practice of Networking by the Office of Small and Medium Enterprises Promotion (OSMEP) for its outstanding role as a business services provider in the project promoting entrepreneurs through the BDS system or 'SME, Pung Tung Dai Kuen.' This marks the second consecutive year that TISTR has received this esteemed award.



Flagship Projects

1. Capacity Development of the National Quality and Safety Infrastructure for Value-added in Agricultural Commodities and Food Products

The Industrial Metrology and Testing Service Centre (MTC) at TISTR is widely recognized for its comprehensive services encompassing analysis, testing, calibration, and packaging development, with a focus on certifying quality standards. Specifically, the MTC of TISTR has undertaken the initiative titled ‘Capacity Development of National Quality and Safety Infrastructure for Value-added in Agricultural Commodities and Food Products.’ This project aims to meet the increasing demand for value-added raw materials, fostering growth in food processing industries across communities, regions, and countries.

The primary objectives of the project include promoting and supporting food processing industries in adhering to standards that ensure consumer safety through rigorous testing of quality and safety at well-equipped laboratories. The project covers various aspects, including testing for identity and geographic identification, determination of active ingredient types and quantities, as well as authenticity and adulteration verification. Furthermore, it is dedicated to addressing the issue of adulteration in food and beverages, a critical concern for both domestic consumption and export in ASEAN Member States.

Additionally, the MTC actively works towards establishing acceptable criteria for tests and ensuring the stability of these methods, crucial for identifying adulteration. The systematic storage of this information in a national database contributes to a reliable repository of information, aiding in effective management and regulation.

Moreover, TISTR, through MTC, is prepared to provide analysis and testing services to entrepreneurs in the food industry, supporting business competitiveness through production innovations. This proactive strategy aligns with governmental policies outlined in the action plan for the development of the food processing industry, Phase 1 (2019 - 2027). By enhancing the country’s competitiveness, mitigating the trade deficit, and ensuring consumer safety, this approach not only contributes to profit-making for businesses but also boosts the nation’s gross domestic product (GDP).

2. Capability Development of Testing and Certification for Standards, Safety, Research, and Development for High-speed Rails

The Railway Transportation System Testing Center (RTTC) at TISTR has undertaken the project ‘Capability Development of Testing and Certification for Standards, Safety, Research, and Development for High-speed Rails,’ in alignment with the national policy, particularly emphasizing high-speed rails. The success of a high-speed rail system relies on stringent control, supervision, and the preparedness of infrastructure development, laboratories, personnel, and specialized knowledge in high-speed rail technology. This strategic initiative is essential for fostering domestic rail industry growth and transitioning from existing rail systems to future high-speed rail endeavors. Ultimately, this proactive

approach aims to contribute to long-term self-reliance and reduce dependence on the import of foreign high-speed rail technology.

In terms of intergovernmental cooperation, TISTR, under the Ministry of Higher Education, Science, Research, and Innovation (MHESI), Thailand, has collaborated with the Ministry of Science and Technology of China (MOST, China) and other Chinese high-speed railway agencies, including the China Academy of Railway Sciences (CARS) and CRRC Qigndao Sifang Co., Ltd. The collaboration is focused on establishing the Thailand - China Joint Research Center on High-Speed Rail System, facilitating the transfer of high-speed rail technology in Contract 2.3, and establishing standards for high-speed rail parts to develop local railway content. TISTR has identified 7 high-speed rail parts out of 26 items with potential for further technology transfer, including 1) Sleeper/bearer/Plinth 2) Rail & joints 3) Fastening system 4) Switch & crossing 5) Wheel axle and carbody 6) Brake system 7) OCS structure & Pantograph.

In 2023, TISTR through RTTC conducted 18 transportation infrastructure development projects supporting certification and testing, including the collaboration project between the Government of the Kingdom of Thailand and the Government of the People's Republic of China to develop the high-speed rail system connecting Thai provincial parts for the Bangkok - Nong Khai section (Contract work of 4-7, civil works for the Saraburi - Kaeng Khoi section). The project also involved testing of rail system products and high-speed rails, encompassing 8 items: 1) Concrete sleeper 2) Concrete bearer 3) Rail 4) Rail joint 5) Fastening system 6) Switch & crossing 7) Wheel 8) Bogie frame. TISTR remains committed to providing testing and certification services for materials and products in the railway transportation system, ensuring adherence to modern technology and international safety standards.

3. Capacity Development and Standardization of Production and Testing for Cosmetic Products at the Industrial Scale to Boost SME Competitiveness

TISTR, through the Expert Centre of Innovative Herbal Products (InnoHerb), has spearheaded the project on 'Capacity Development and Standardization of Production and Testing for Cosmetic Products at the Industrial Scale to Increase the Competitiveness of SMEs.' Notably, InnoHerb has played an active role in promoting product exports and providing crucial support to SMEs and OTOP local entrepreneurs, facilitating international exports of cosmetic products in alignment with ASEAN GMP standards and product safety requirements. Conforming to these standards is imperative for successful product registration, especially for cosmeceutical products, where preclinical and clinical safety assessments are essential to certify product efficacy and support claims. Therefore, comprehensive testing and evaluation for product safety, efficacy, and quality control are integral components of this initiative.

Acknowledging the private sector's preference for evaluation methods endorsed by national government agencies, TISTR has proactively promoted and prepared to assist entrepreneurs in the biological industry, tailoring support to meet their specific needs.

In 2023, TISTR, through InnoHerb, conducted development and enhancement programs benefiting 66 participants through hands-on training. The focus encompassed elevating the standards of herbal products and conducting workshops for the development of cosmetic products from bamboo. The outcome has been the successful commercialization of five cosmetic products available both domestically and internationally, including:

1. Bamboo Water Spray Product - Under the Santisuk Organic Farming Community Enterprise
2. Anti-wrinkle Serum Product - Under the 'Napat' brand
3. Production of Mulberry Extract at Commercial Scale - Under the 'Mon-mook' OTOP brand
4. Shower Gel Product
5. Pomelo Essential Oil Lotion Product - Under the Ban Bang Phlap Community Enterprise

Given TISTR's reputation as a reliable agency with competent personnel and advanced equipment, it has demonstrated the capability to support and advocate for manufacturers. This includes facilitating product registration and commercial distribution, with the overarching goal of enhancing the competitiveness of Thailand's biotechnology industry.

4. Strengthening Capabilities for One-Stop Packaging Services for Small and Medium Enterprises (SMEs)

TISTR, through the Thai Packaging Centre (TPC), has initiated the project 'Strengthening Capability for One-Stop Packaging Services for Small and Medium Enterprises (SMEs).' The primary objective is to facilitate market expansion both domestically and internationally by alleviating barriers and addressing packaging-related challenges. This is achieved through the application of science, technology, and innovation in designing and packaging testing services. Additionally, TPC provides training on product shelf life to enhance the overall proficiency of SMEs.

Recognizing the urgent needs of SMEs, TISTR has augmented the capabilities of the Thai Packaging Center (TPC) to comprehensively address the packaging requirements for food products. This enhancement enables TPC to promptly meet the demands of SMEs, ensuring the certification and elevation of food packaging standards for both domestic sales and exports. The initiative aims to foster the application of science and technology to consistently support SMEs in achieving sustainable growth and competitiveness.

In 2023, TISTR, through TPC, achieved significant milestones by developing packaging and graphic design prototypes for three product developments involving 10 entrepreneurs. Additionally, knowledge transfer on packaging was provided to 133 entrepreneurs through training programs, empowering them to create value-added products and strengthen their potential in comprehensive packaging services.

Furthermore, TISTR is committed to serving as the nation's primary agency for comprehensive packaging services. This involves conducting research and innovation in packaging, with a specific focus on developing standard packaging that helps maintain product quality, reduces product losses attributed

to subpar packaging, and promotes value-added packaging solutions. This multifaceted approach underscores TISTR's dedication to advancing packaging solutions and supporting the overall success of SMEs in the industry.

5. Product Enhancement and Capability Development in Biomechanics Medicine Testing to Support the Medical Hub

TISTR, through the Material Properties Analysis and Development Centre (MPAD), has actively spearheaded the project 'Product Enhancement and Capability Development of Biomechanics Medicine Test for Supporting Medical Hub.' This initiative arises from the strategic goal of reducing dependence on imported materials, equipment, medical products, prosthetic organs, and medical substitute materials primarily sourced from foreign countries. The project addresses challenges in manufacturing and testing processes, ensuring efficiency and safety in alignment with globally recognized medical standards. It aims to overcome issues such as the lack of consultation in product quality development, deficiencies in standard biomedical laboratory testing facilities within the country, and the inability to meet the comprehensive needs of manufacturers for the analysis and testing of materials, equipment, and medical products. Notably, this includes the capacity to fully comply with the requirements for production or import authorization of medical devices as specified by the Thai Industrial Standards Institute (TISI) under the globally accepted ISO 13485 Quality Management System for the Medical Device Industry.

Recognizing TISTR's pivotal role in driving economic growth and fostering sustainable development in Thailand, the initiative leverages knowledge and service expertise in analysis, testing, inspection, and consultation. TISTR collaborates both domestically and internationally and integrates its internal organizational resources to support and promote industries and SMEs, thereby reducing the expenses associated with testing abroad. The use of 3D imaging technology (CT scan) and 3D printing (3D printer) is emphasized, particularly in the production of intricate prototype pieces tailored to individual needs. The forecast suggests that 3D printing technology will play a crucial role in the medical field, with an estimated market value of up to 6 billion USD by 2025, particularly for the repair or replacement of damaged tissues.

In 2023, TISTR, through MPAD, expanded the scope of ISO 17025 to include torsional testing of metal bone screws for medical use according to ASTM F543 ANNEX 2. Additionally, TISTR provided testing services in the field of medical biomechanics, covering materials, equipment, medical products, prosthetic organs, and medical substitute materials. This included two specific areas of focus:

1. The study of mechanical properties of post-reinforced hip bones using cement-type bone substitute materials.
2. Tensile testing of tendons.

Completed Research and Development Projects

TISTR undertakes comprehensive Research and Development (R&D) initiatives aligned with the new economic paradigm ‘Bio-Circular-Green: BCG,’ in line with the sufficiency economy philosophy. Our commitment to leaving no one behind contributes to the sustainable development of the nation. The BCG model encompasses Bioeconomy, emphasizing the efficient use of resources; Circular Economy, maximizing material reuse; and Green Economy, addressing pollution issues. In the fiscal year 2023, 92 R&D projects were successfully completed through the collaborative efforts of innovative expert centres, the biodiversity research centre, and the technology and innovation management office, as outlined below:

1. Expert Centre of Innovative Agriculture (InnoAg)

InnoAg strives for excellence in community agriculture technology by integrating research and development (R&D), technology, and innovation to address the real challenges faced by the country, catering to both social and commercial applications. Additionally, InnoAgr focuses on technology transfer and infrastructural development to serve the economic and social sectors. The organization excels in various domains, including organic agriculture, R&D, and the promotion of cultivation for herbs, indigenous plants, and new economically viable plants. Specialized areas of expertise include strain improvement of mushrooms, factors influencing plant production, biocontrol fertilizer technology, microorganisms and bio-products for agriculture, post-harvest technology, plant improvement and tissue culture, plant genetic conservation, and plant protection.

In the fiscal year 2023, a total of 21 projects were successfully completed, outlined as follows:

- 1.1 Development of value-added technology for pre-cut mushrooms and enhancement of the mushroom production process to support the cosmeceuticals and food supplement industries
- 1.2 Development of culturing materials and hygiene management in an industrial cultivation system
- 1.3 Research and development of asparagus cultivation for achieving high productivity and nutritional value
- 1.4 Research and development of suitable postharvest technology for asparagus production processes and byproducts
- 1.5 Research and development of byproducts from the asparagus production process as a contributing factor in agricultural production
- 1.6 Research and development of technology for enhancing bioactive compounds in vegetable crops and herbs using LED light

- 1.7 Collection and enhancement of vegetable crops and herbs to optimize active compounds
- 1.8 Development of technology for plant nutrient management to enhance active compounds in vegetable crops and herbs
- 1.9 Research and development of slow-release field crop fertilizer for sloping areas
- 1.10 Classification and evaluation of active compounds in the cannabis plant for targeted plant improvement
- 1.11 Development of cannabis plant propagation techniques through tissue culture and induction to enhance active compounds
- 1.12 Study of molecular control mechanisms of cannabinoid genesis in the cannabis plant
- 1.13 Quantification of cannabinoids through nondestructive testing methods
- 1.14 Establishment of a soil zinc database for enhanced zinc supplementation in plant production
- 1.15 Research and development of zinc-supplement fertilizer for plant cultivation.
- 1.16 Development of vegetable crops, herbs, and fruits enriched with zinc for enhanced nutritional health.
- 1.17 Production of zinc-supplemented rice through
- 1.18 Utilizing plant genetic resources and innovative agricultural technology for enhancing cashew productivity and quality
- 1.19 Research and development of nutrients to improve cashew (*Anacardium occidentale* L.) productivity and quality
- 1.20 Utilization of herbal essential oil for controlling sawtoothed grain beetle in cashew seeds
- 1.21 Development of production technology for vitamin-type functional active compounds and polysaccharides from jelly ear mushrooms and gill mushrooms

2. Expert Centre of Innovative Health Food (InnoFood)

InnoFood is dedicated to research and development, emphasizing the enhancement of value in domestic raw materials, functional foods, and dietary supplements. Our focus extends to fostering innovation in health food and related products, coupled with infrastructure services aimed at assisting Thai entrepreneurs in effectively translating research outcomes into commercial ventures, ensuring competitiveness in the global market. InnoFood specializes in functional food and beverage products, dietary supplements, natural substances in food, as well as the design of instruments and machinery for food production.

In the fiscal year 2023, a total of 19 projects were successfully completed, as outlined below:

- 2.1 Exploration of *in vitro* and *in vivo* pharmacokinetics of Thai bio-based extracts to enhance bone and joint health

2.2 Examination of acute and subchronic toxicity in experimental animals exposed to Thai bio-based extracts, focusing on promoting health in the bones and joints system

2.3 Research and development of protein extracts and functional peptides derived from crickets for applications in health food products

2.4 Development of functional food ingredients with blood cholesterol-lowering properties derived from bioactive fatty acids sourced from crickets

2.5 Development of functional products derived from cricket protein and fatty acids

2.6 Development of technology for the production of peptides and protein derivatives from Thai bio-based plants

2.7 Developing alternative fish-type protein from protein and protein derivatives obtained from Thai bio-based plants

2.8 Research on innovative protein and polypeptide products derived from Thai bio-based plants for promoting microbiome bacteria in the large intestine

2.9 Research on innovative protein and polypeptide products derived from Thai bio-based plants for rat aorta artery health

2.10 Research and development of protein hydrolysate production from asparagus residual waste for application in the health food industry

2.11 Research and development of Fructooligosaccharide from byproducts of the asparagus production process

2.12 Development of machinery set for active compound preparation from extraction of asparagus and byproduct for commercialization

2.13 Development of fermented cashew milk tablet product supplemented with probiotic microorganisms

2.14 Research and development of value-added processed food product from cashew (*Anacardium occidentale* L.)

2.15 Research and development of biopolymer for probiotic microorganism protection

2.16 Development of functional food product for working-age population and elderly from high-potential functional active compounds from target microorganisms

2.17 Development of functional food product for school-age population from high-potential functional active compounds from target microorganisms

2.18 Development of functional food product for the exercise population from high-potential functional active compounds from target microorganisms

2.19 Development of food industry potential for creating business opportunities through open innovation utilization in innovative technology development to commercialization

3. Expert Centre of Innovative Herbal Products (InnoHerb)

InnoHerb focuses on expertise in cosmeceutical and pharmaceutical products derived from herbs. As an integrated center for research, development, and services, InnoHerb is dedicated to creating innovative health products from herbs that comply with international standards. The aim is to utilize research findings to enhance the value of products for successful commercialization. InnoHerb specializes in the extraction technology of active natural substances from herbs and conducts research in pharmacology and toxicology.

In the fiscal year 2023, 13 projects were completed as follows:

3.1 Research and development of functional active extracts in protein and glycosaminoglycan groups from commercial mushrooms on an industrial scale

3.2 Research and development of medicinal active compound extraction process from cannabis plant

3.3 Study of appropriate analgesic effects for non-psychotic symptom relief using cannabis plant extracts

3.4 Study of chronic toxicity evaluation of cannabis plant extracts

3.5 Research and development of cholesterol-lowering food supplement from cashew (*Anacardium occidentale* L.) leaves and seeds for commercial

3.6 Research and development of probiotic microorganisms and functional active compounds to promote cattle health

3.7 Research and development of efficacy and safety tests of functional active compounds to promote the immune system in cattle

3.8 Verification of Anti-Mutagenic and Cancer Risk Properties, and Safety Evaluation of Functional Active Compounds from Target Microorganisms

3.9 Verification of Blood Sugar Level Lowering Property and Safety Evaluation of Functional Active Compounds from Target Microorganisms

3.10 Verification of Blood Cholesterol Lowering and Hypertension Properties, and Safety Evaluation of Functional Active Compounds from Target Microorganisms

3.11 Verification of Skin Health Properties and Safety Evaluation of Functional Active Compounds from Target Microorganisms

3.12 Development of functional product for skin health and beauty from high-potential functional active compounds from target microorganisms

3.13 Research and development of economic potential, innovative herbal extract standards to enhance and drive the herbal product industry

4. Expert Centre of Innovative Clean Energy and Environment (InnoEn)

InnoEn aims for excellence in renewable energy and environmental management, contributing to sustainable integration into the country's economy and promoting a green society. We focus on

infrastructure development for the transfer of knowledge, technology, and innovation. InnoEn specializes in clean energy from biomass, environmental management, projects related to energy resources, climate change, biodiversity, and regulations/mechanisms in carbon footprint and water footprint.

In the fiscal year 2023, 15 projects were completed as follows:

- 4.1 Development of a biomass boiler to reduce production
- 4.2 Development of solid fuel production technology from palm waste material through a thermochemical process for use as fuel in combination with coal
- 4.3 High-value carbon material from biomass waste in the palm oil industry: production process for comprehensive utilization
- 4.4 Synthetic gas production from carbon dioxide gas in the biogas production process using the plasma methanation method
- 4.5 Study on the removal of hydrogen sulfide contaminated in biogas using dielectric barrier discharge plasma
- 4.6 Research and development of PHAs production process from wastewater treatment excess sludge as a starter for bioplastics production
- 4.7 Value addition of carbon dioxide gas for household LPG products
- 4.8 Production of purified hydrogen gas through electrolysis
- 4.9 Research and development of biohydrogen production from molasses for upscale applications
- 4.10 Preliminary Economic Feasibility of Hydrogen Gas Production from Electrochemical and Biological Processes
- 4.11 Development of high-quality biomass pellets from sugarcane residue and leaves through Torrefaction Technique
- 4.12 Development of a high-value biochemical compound production process from ethanol
- 4.13 Development of a high-purity ester compound production process prototype from fusel oil
- 4.14 Development of carbon material from sugarcane factory wastewater
- 4.15 Development of carbon nanotubes from carbon dioxide waste in the ethanol industry

5. Expert Centre of Innovative Materials (InnoMat)

InnoMat is dedicated to conducting research and development in innovative materials, as well as transferring technology and innovation to foster and support industrial development. Our mission is to create jobs and generate sustainable incomes for the local community. InnoMat specializes in R&D related to technology and innovation in health materials, energy and environmental materials, and natural materials. Our goal is to enhance the value and standards of products through our expertise.

In the fiscal year 2023, six projects were successfully completed as follows:

- 5.1 Development of BCG-Based nanofibers in pilot scale for air filtration applications
- 5.2 Development of BCG-Based nanofiber wound dressing in pilot scale for healthcare
- 5.3 Development of composite materials from industrial palm oil waste
- 5.4 Eco-Friendly packaging from Polyhydroxyalkanoate composite material
- 5.5 Material development for cathode and permeable membrane in lithium-sulfur battery from industrial sugar waste
- 5.6 Research and development of bioplastics from flour for eco-friendly food products

6. Biodiversity Research Centre (BRC)

BRC serves as the national center for the collection, conservation, and R&D focused on the sustainable utilization of bio-resources. Our mission is to enhance national competitiveness in the bio-industry and bio-economy, contributing to both regional and global levels. BRC specializes in the collection, preservation, and management of biodiversity information, including microorganisms, plants, and animals. Additionally, we engage in R&D activities related to science, technology, and innovative bio-substances and bio-products.

In the fiscal year 2023, 17 projects were successfully completed as follows:

- 6.1 Research on biological factor resistance in insect species and the development of an inbreeding avoidance management system in insect farming to support high-quality food industry
- 6.2 Development of ruminant feed from agricultural waste materials
- 6.3 Research and development of alcoholic beverage from corn
- 6.4 Development of Slow-Release Fertilizer Sticks from Agricultural Waste Materials
- 6.5 Database development for geographical indication of cashew in the northern region: representative province
- 6.6 Research and development of beverage from cashew pseudocarp
- 6.7 Research and development of active compounds using encapsulation technique for cosmeceutical products from cashew
- 6.8 Research and development of prebiotics to promote cattle health
- 6.9 Development of high-nutrition fermented food to promote cattle health and production
- 6.10 Effects of yeast (or fungi) biosynthesizing chelate mineral supplement on the overall health, milk productivity, milk quality, and reproductive performance of dairy cattle under heat stress conditions
- 6.11 Development of production technology for functional active compounds from probiotic *Bifidobacterium* and lactic acid bacteria
- 6.12 Development of production technology for purple pigment-type functional active compounds from soil bacteria

6.13 Development of Production Technology for Amino Acid-Type Functional Active Compounds from Yeast of the *Galactomyces* Genus

6.14 Development of production technology for carotenoid-type functional active compounds from small-sized marine algae

6.15 Development of Molecular Microbial Strains for Commercial Utilization

6.16 Development of Microorganism Database System and Bioinformatics for the Culture Collection Centre

6.17 Enhancing the Culture Collection Center in Alignment with International Standards ISO/IEC 17025 and ISO 20387 (ISO TC/276)

7. Technology and Innovation Management Office (TIMO)

TIMO serves as a driving force in translating research results into commercial and social applications. It incorporates coupling mechanisms for fostering business innovation, encompassing feasibility analysis and market opportunity assessments for commercial research.

In the fiscal year 2023, one project was successfully completed as follows:

7.1 Research and Business Plan Development, along with High-Quality Product Adoption from Insects, to Enhance Competitiveness in the Creative Economy

Patents and Petty Patents

Total 63 Items

Note: TISTR's patents and petty patents are registered in Thailand, and the names are not provided in foreign languages during the registration process. Consequently, the names of these patents and petty patents only include specific terms or technical terms used by the applicants in foreign languages.

1. PATENTS - 5 ITEMS

No.	Title
1.	Process for the production of bioactive peptide hydrolysate from rice bran and defatted rice bran
2.	Preparation process for two-phases calcium phosphate granules from fish scales
3.	Box Design (thick wall, upright plant container)
4.	Box Design (horizontal plant container)
5.	Lid Design (easy-to-open, pills bottle lid for seniors)

2. PETTY PATENTS - 58 ITEMS

No.	Title
1	Formulation and production process of women's sanitary products made from Ma-khwaen and Fa-rang-khi-nok Extract in microemulsion form
2	Formulation and Production Process of Toothpaste Made from Ma-khwaen and Fa-rang-khi-nok Extract in emulsion form
3	Formulation and production process of mouth spray made from Ma-khwaen and Fa-rang-khi-nok extract in emulsion form
4	Formulation and production process of mouthwash made from Ma-khwaen and Fa-rang-khi-nok extract in emulsion form
5	Formulation and production process of dietary supplement product maintaining blood pressure with peptide hydrolysate extracted from Mali fragrant rice and black fragrant rice
6	Formulation of heating material for moist hot pack
7	Formulation of polysulfone membrane (sheet type) for carbon dioxide and methane separation

No.	Title
8	Product formulation of ready to drink, cider vinegar from Ceylon oak (Ta-kraw)
9	Formulation and production process of non-sugar, sterilized coconut drink
10	The production process for banana with turmeric drink and its product
11	Formulation and production process of Reishi extract drink enriched with vitamin B complex and vitamin D3
12	Formulation and production process of almond yoghurt with <i>Lactocaseibacillus paracasei</i>
13	Formulation and production process of skin care product made of durian flesh extract
14	Formulation and preparation of mixed fiber sheet from plant and palm oil
15	Fiber cement ceramic composed of Perlite and natural fiber coated with para-rubber latex
16	Wine production process from cherry coffee peels
17	Non-dairy plant drink with cashew apple juice and its production process
18	The production process of spray-dried, cricket protein hydrolysate from protease digestion
19	Formulation and production process of serum with small seaweed extract
20	Growth medium and cultivation process of the bacterium <i>Bacillus siamensis</i> TISTR010
21	Growth medium and cultivation process of the bacterium <i>Janthinobacterium lividum</i> TISTR2937
22	Formulation and production process of serum spray from <i>Nymphaea lotus</i> L.
23	Formulation and production process of dietary supplement products from pearl extract
24	Formulation and production process of refuse-derived fuel (RDF) composed of carbon and multilayer plastic
25	Automatic oven for sundried banana
26	Formulation and production process of gel product with Cannabis oil
27	Formulation and packaging molding of coconut coir dust by microwave
28	The production process of hiding material for crickets from plant tissue
29	Formulation and production process of slow-release fertilizer with zeolite and minerals

No.	Title
30	Formulation and production process of edible film enriched with probiotic for food applications
31	The production process of health-enhanced synbiotic from edible mushroom
32	The production process of powdered, water-soluble fiber from asparagus waste
33	Formulation and production process of concentrated asparagus syrup mixed with fructan extracted from Asparagus root
34	Formulation and production process of body slimming product with lipid nanoparticles containing Trikatuk extract
35	Formulation and production process of meat analogue from cricket powder
36	The extraction process for unsaturated fatty acid-rich oil from cricket
37	Formulation and production process of enriched branch-chain amino acid mineral drink mixed with eryngii mushroom extract
38	Formulation and production process of composite bioplastic pellet with starch
39	Formulation and production process of asparagus protein hydrolysate jelly
40	Formulation and production process of mixed polyhydroxyalkanoate plastic pellet for injection molding
41	Formulation and production process of serum, with nanoethosome particles containing Cardanol, from cashew apple extract
42	Formulation and production process of cosmetics from functionally active purple pigment from soil bacteria
43	Formulation and production process of facial essence product from a functionally active amino acid in Galactomyces yeast
44	Ready to eat jelly with probiotic beads and its production process
45	Growth medium and cultivation process of <i>Lactobacillus acidophilus</i> TISTR2734 in vacuum freeze-dried form
46	The production process of collagen hydrolysate from fish scale using acid and protease enzyme
47	The production process of lotus seed extract for functional food applications
48	The production process of Kombucha from pure microorganism inoculum (bacteria and yeast)

No.	Title
49	The production process of burned ashes gel for physiotherapy purposes
50	Formulation and production process of antibacterial air filters
51	The preparation of antibacterial nanoparticles with chitosan and para rubber seed extract
52	Formulation and production process of yoghurt from non-dairy cashew nut drink enriched with probiotic
53	Formulation and production process of essential red galangal gel for moth and insect control
54	Formulation and production process of soft gel containing cashew nut oil, fingerroot extract, and black ginger extract
55	Formulation and production process of serum from cashew nut leaf extract
56	Formulation and production process of distilled spirits from maize with sweet corn aroma
57	Bioplastic waste shredder
58	Cashew nut sheller using pneumatics system

National and International Publications

Total 91 Articles

1. NATIONAL PUBLICATIONS – 19 ARTICLES

No.	Article Title	Journals
1	Phytochemical and antioxidant activities in crude extract of <i>Antidesma thwaitesianum</i> Mull. Arg <i>in situ</i>	Khon Kaen Agriculture Journal 50(6) (2022), pp. 1643-1654
2	Spraying doses bio-extract from trimmed Asparagus waste on growth and yield of Thai Eggplant (<i>Solanum virginianum</i> L.)	Agricultural Science Journal 53(3) (September - December 2022), pp. 127-140
3	Effects of soil steaming of Chrysanthemum stock cultivating plots on soil microorganisms	Wichcha Journal Nakhon Si Thammarat Rajabhat University 41(2) (July - December 2022), pp. 114-126
4	The growth and yield of Asiatic Pennywort from 5 accessions in a hydroponic system	Wichcha Journal Nakhon Si Thammarat Rajabhat University 41(2) (July -December 2022), pp. 127-140)
No.	Article Title	Journals
5	The effect of light intensity on the growth and carotenoid production of <i>Chlorococcum</i> sp. TISTR 8266	Wichcha Journal Nakhon Si Thammarat Rajabhat University 42(1) (January – June 2023), pp. 120-134)
6	Impact of using Blue Crab Shell Powder (BCSP) on alteration of EC, pH, leaf greenness, and growth of <i>Cucumis melo</i> var. Hamigua TA215 Seedlings	ASEAN Journal of Scientific and Technological Reports 25(4) (October - December 2022), pp. 79-85
7	Evaluation of anti-oral pathogen activity and safety of <i>Lacticaseibacillus paracasei</i> TISTR 2688, Isolated from Fermented Termite Comb.	Srinakharinwirot University Dental Journal 16(1) (2023), pp. 78-88
8	Factors influencing mycelial growth, yield, quality and β -glucan content of Hed Taen Rad (<i>Macrocybe crassa</i>)	Journal of Science and Technology, Ubon Ratchathani University 25(2) (May-August 2023), pp. 78-88

No.	Article Title	Journals
9	The development of pigments reflects infrared radiation from Gravel (Lateritic) soils	Progress in Applied Science and Technology 13(1) (January - April 2023), pp. 19-25
10	Effect of zinc foliar application on yield and zinc concentration of galangal	Wichcha Journal Nakhon Si Thammarat Rajabhat University 42(1) (January - June 2023), pp.14-23
11	Total amount of phenolic compounds and antioxidant activities of crude extracts from Cherry coffee peels Arabica Cultivars	Udon Thani Rajabhat University Journal of Sciences and Technology 11(2) (May–August 2023), pp. 83-99)
12	Effects of leachate recirculation on biogas production by using two stages Leach Bed Reactor with Anaerobic baffled Reactor (LBR-ABR)	The 22 nd National Environmental conference, May 17-18, 2023 at Jomtien Palm beach Hotel and resort, Pattaya, Thailand, pp. 245-250
13	Effect of natural plant extracts as an alternative method on flocculation of marine microalgae	The 15 th National academic conference for supporting personnel in the universities, March 13-15, 2023. At the Student Union building, Udon Thani Rajabhat University, pp. 451-463
14	Anti-acne activity of violacein extracted from <i>Chromobacterium</i> sp.	The 15 th National academic conference for supporting personnel in the universities, March 13-15, 2023. At the Student Union building, Udon Thani Rajabhat University, pp. 655-667
15	Study on the fermentation conditions for Kombucha made by pure culture	The 15 th National academic conference for supporting personnel in the universities, March 13-15, 2023. At the Student Union building, Udon Thani Rajabhat University, pp. 693-707
16	Apply of bio-ethanol wastein cricket feed to reduce production cost	The 15 th National academic conference for supporting personnel in the universities, March 13-15, 2023. At the Student Union building, Udon Thani Rajabhat University, pp. 1057-1065
17	Effect of methyl viologen on production of astaxanthin and fatty acids in <i>Chlorella zofingiensis</i>	The 10 th National Conference on Algae and Plankton (NCAP 2023)

No.	Article Title	Journals
18	Safety assessment of <i>Lactobacillus</i> Sup-1 isolated from healthy woman's breast milk two days after vaginal delivery	The 34 th National Conference and The 1 st International Conference on ASEAN Sustainable Development (ICASD 2023)
19	Nutritional value and antioxidant properties of <i>Nostoc commune</i> Vaucher TISTR 8160	The 34 th National Conference and The 1 st International Conference on ASEAN Sustainable Development (ICASD 2023)

2. INTERNATIONAL PUBLICATIONS - 72 ARTICLES

No.	Article Title	Journals
1.	Bioactive composition and modulatory effects of Hed-Tea-Rad Mushroom, <i>Macrocybe crassa</i> on gut microbiota	3 Biotech 12(11), (November 2022), pp. 1-12
2.	The effect of auxins on root production and stemona alkaloid accumulation in <i>Stemona curtisii</i> Hook.f. <i>in vitro</i> culture	Acta Horticulturae pp. 267-273, 1358.ISHS 2023. DOI:10.17660/ActaHortic.2023.1358.35
3.	Effect of plant growth regulators on <i>in vitro</i> seedling growth of <i>Papilionanthe hookeriana</i> (Rchb.f.) Schltr.	Acta Horticulturae pp. 57-64, 1359.ISHS 2023. DOI:10.17660/ActaHortic.2023.1359.6
4.	Morphological and phylogenetic diversity of <i>Pythium</i> and related genera (<i>Pythiaceae</i> , <i>Pythiales</i>) from some areas in eastern Thailand	Agriculture and Natural Resources 56(5), (September - October 2022), pp. 945 - 956
5.	Influence of sucrose feeding on sugar metabolism and invertase activity in cut <i>Dendrobium</i> flowers	Agriculture and Natural Resources 56(5), (September - October 2022), pp. 1051-1058
6.	1-Methylcyclopropene inhibits ethylene production and post-pollination changes of <i>Dendrobium</i> flowers	Agriculture and Natural Resources 56(5), (September - October 2022), pp. 1059-1068
7.	Ethylene regulates peel spotting in fruit of cv. Sucrier banana (<i>Musa acuminata</i> , AA Group): Dependence on ripening stage	Agriculture and Natural Resources 57(1), (January - February 2023), pp. 117 - 124

No.	Article Title	Journals
8.	Production of bio-paraffin from solvent-free deoxygenation of palm biodiesel over ZrO ₂ -supported nickel phosphide catalysts	Applied Catalysis A: General 648(25), (November 2022), pp.1-10
9.	The effect of substrates on the production of tropical mushroom <i>Macrocybe crassa</i>	Asia-Pacific Journal of Science and Technology 28(01), (January-February 2023), pp. 1-8
10.	Ambient nanoparticles (PM0.1) mapping in Thailand	Atmosphere 14(1), (January 2023), pp. 1-15
11.	Legacy effects of canopy gaps on liana abundance 25 years later in a seasonal tropical evergreen forest in Northeastern Thailand	Biotropica 55(3), (May 2023), pp. 674-679
12.	Development of expanded perlite board for thermal insulation	Chiang Mai Journal of Science 49(6), (November 2022), pp. 1644-1652
13.	Conversion of empty fruit bunches (EFBs) by hydrothermal carbonization towards hydrochar production	Energy Reports 8(16), (December 2022), pp. 242-248
14.	Air atmospheric pressure plasma jet to improve fruiting body production and enhance bioactive phytochemicals from Mutant <i>Cordyceps militaris</i> (White Cordy-ceps <i>militaris</i>)	Food and Bioprocess Technology 16(9), (September 2023) pp. 1976 - 1991
15.	<i>Sporolactobacillus mangiferae</i> sp. nov., a spore-forming lactic acid bacterium isolated from tree bark in Thailand	International Journal of Systematic and Evolutionary Microbiology 73(7), 2023, pp. 1-10
16.	<i>In situ</i> formation of fatty acid methyl esters via thermally assisted methylation by lignin during torrefaction of oil palm biomass	Journal of Analytical and Applied Pyrolysis 168 (November 2022), 105720, pp. 1-9
17.	Protective effect of soybean powder as a cryoprotectant and encapsulating material on the survival of <i>Lactobacillus fermentum</i> SK54 during freeze drying, storage and exposure to simulated gastrointestinal conditions	Journal of Food Science and Agricultural Technology 7(Special Issue) (2023), pp. 20-25

No.	Article Title	Journals
18.	The efficiency of lutein and zeaxanthin in <i>Zea mays</i> Linn. on protecting human corneal epithelial cells from photo-oxidative damage	Journal of Food Science and Agricultural Technology 7(Special Issue) (2023), pp. 26-30
19.	Encapsulation maltodextrin with spray drying affecting on Shiitake (<i>Lentinula edodes</i>) protein hydrolysate properties	Journal of Food Science and Agricultural Technology 6(Special Issue) (2022), pp. 78-84
20.	Chemical characterization of <i>Passiflora edulis</i> extracts and their in vitro antioxidant, anti-inflammatory, anti-lipid activities, and ex-vivo vasodilation effect	Journal of King Saud University – Science 35(1) (January 2023), 102431, pp. 1-8
21.	Antiproliferative and apoptotic effect of tuna blood on human lung cancer A549 cells via p38 MAPKs and Akt pathway	Journal of King Saud University – Science 35(5) (July 2023), 102667 pp. 1-8
22.	Fabrication of glass-ceramics composite by infiltration of lithium tetraborate glass into porous magnesium aluminate spinel ceramic	Journal of Metals, Materials and Minerals 33(1) (March 2023), pp. 89-94
23.	Production of epoxidized rubber seed oil via lipase-catalyzed epoxidation	Key Engineering Materials 944, (April 2023), pp. 135-150
24.	Physically cross-linked cryogels of linear polyethyleneimine: influence of cooling temperature and solvent composition	Macromolecules 55(21) (8 November 2022), pp. 9537-9546
25.	Antidyslipidemic, antioxidant, and anti-inflammatory effects of jelly drink containing polyphenol-Rich <i>Roselle Calyces</i> extract and passion fruit juice with pulp in Adults with Dyslipidemia: A randomized, double-blind, placebo-controlled trial	Oxidative Medicine and Cellular Longevity 2022, Article ID 4631983, pp. 1-12
26.	Synthesis and evaluation of poly (3-hydroxypropyl ethylene-imine) and its blends with chitosan forming novel elastic films for delivery of haloperidol	Pharmaceutics 14(12), (December 2022), pp. 1-21

No.	Article Title	Journals
27.	Enhanced fruiting body production and bioactive phytochemicals from white cordyceps <i>militaris</i> by blending <i>cordyceps militaris</i> and using cold plasma jet	Plasma Chemistry and Plasma Processing 43(1), (January 2023), pp. 139 - 162
28.	Purification of lipase from <i>Burkholderia metallica</i> fermentation broth in a column chromatography using polymer impregnated resins	Preparative Biochemistry & Biotechnology Published Online: 03 Jan 2023, pp. 1-8
29.	Probiotic characterization and <i>in vitro</i> functional properties of lactic acid bacteria isolated in Thailand	ScienceAsia 49(1), (February 2023), pp. 29-37
30.	Titanium dioxide nanoparticles affect growth and antibacterial activity of <i>Chrysanthemum indicum</i> cuttings <i>in vitro</i> culture	South African Journal of Botany 156, (May 2023), pp. 72-78
31.	Fabrication of porous polymer particles containing BiVO_4 and Fe_3O_4 nanoparticles using block copolymer as porogen for effective dye removal	Surfaces and Interfaces 37, (April 2023), 102738, pp. 1-14
32.	Sapwood density underlies xylem hydraulics and stored carbohydrates across 13 deciduous tree species in a seasonally dry tropical forest in Thailand	Trees - Structure and Function 37(2), (April 2023), pp. 485 - 495
33.	Influence of dietary supplementation with new <i>Lactobacillus</i> strains on hematology, serum biochemistry, nutritional status, digestibility, enzyme activities, and immunity in dogs	Veterinary World 16(4), (April 2023), pp. 834-843
34.	Preparation of keratin metal complexes derived from different treatments of chicken feather waste	Waste and Biomass Valorization Published: 08 May 2023 DOI : https://doi.org/10.1007/s12649-023-02154-z
35.	Current opinion on the regulation of small intestinal magnesium absorption	World Journal of Gastroenterology 29(2), (14 January 2023), pp. 332-342

No.	Article Title	Journals
36.	Synthesis of SiC nanowires on biochar surfaces by a simple direct method	Journal of Metals, Materials and Minerals 33(3), (September 2023), pp. 1-7
37.	Comparison of molasses conversion to biomethanol by biohydrogen pathway with biogas route in engineering and cost assessment: Thailand case	International Journal of Sustainable Energy 42(1), (2023), pp. 490-502
38.	Improving biomethanol synthesis via the addition of extra hydrogen to biohydrogen using a reverse water-gas shift reaction compared with direct methanol synthesis	Processes 11(8), (August 2023), pp. 1-15
39.	Anticancer and antimutagenic properties of <i>Pogonatherum paniceum</i> on colorectal Cancer cells	World Journal of Oncology 14(4), (August 2023), pp. 266-276
40.	Safety and effects of <i>Lactobacillus paracasei</i> TISTR 2593 supplementation on improving cholesterol metabolism and atherosclerosis-related parameters in subjects with hypercholesterolemia: A randomized, double-blind, placebo-controlled clinical trial	Nutrients 15(3), (1 February 2023), pp. 1-13
41.	Phytochemical analysis and impact of <i>Citrus hystrix</i> peel water extract on proliferation and migration of skin keratinocytes by activating FAK/Src/MAPK/Akt pathway	Journal of Herbal Medicine 41, (September 2023), pp. 1-9, 100699
42.	<i>In vitro</i> antioxidant activity and cytotoxicity evaluation of <i>Anacardium occidentale</i> L.	Proceeding of 38 th International Annual Meeting in Pharmaceutical Sciences (IAMPS38) March 23-24, 2023 at Pathumwan Princess Hotel, Bangkok Thailand, pp. 1-5
43.	Production of polyhydroxyalkanoates (PHA) by excess sludge from bakery industry wastewater treatment plant	Proceeding of The 11 th Asia-Pacific Landfill Symposium (APLAS Bangkok 2022) November 8-10 (Tue.-Thu.), 2022 at Grande Centre Point Hotel Terminal 21, Bangkok, Thailand, pp. 230-234 Hybrid (Online and Onsite) Conference

No.	Article Title	Journals
44.	Greenhouse gases evaluation and reduction from biogas to generate electricity by a modified two stage anaerobic baffled reactor combined with membrane bio-reactor	Proceeding of The 11 th Asia-Pacific Landfill Symposium (APLAS Bangkok 2022) November 8-10 (Tue.-Thu.), 2022 at Grande Centre Point Hotel Terminal 21, Bangkok, Thailand, pp. 235-239 Hybrid (Online and Onsite) Conference
45.	Torrefaction of sugarcane leaves for carbon-enriched solid biofuel	Proceeding of The 32 nd Thai Institute of Chemical Engineering and Applied Chemistry Conference (TICe 2023) March 16-17, 2023 at Mida Grande Hotel Dhavaravati Nakhon Pathom, Thailand, pp. 1-6
46.	Assessment of antioxidant activities of probiotic lactic acid bacteria	Proceeding of The 34 th Annual Meeting of the Thai Society for Biotechnology and International Conference (TSB 2022) November 24-25, 2022 Ambassador Hotel, Bangkok, Thailand, pp. 1-8
47.	Antioxidant activities of <i>Probiotic Bacillus</i> sp.	Proceeding of The 34 th Annual Meeting of the Thai Society for Biotechnology and International Conference (TSB 2022) November 24-25, 2022 Ambassador Hotel, Bangkok, Thailand, pp. 1-10
48.	Fabrication and characterization of eco-friendly ethyl cellulose nanofibers for use as air filtration	Proceeding of The 4 th International Conference on Informatics, Agriculture, Management, Business administration, Engineering, Science and Technology May 24–26, 2023, at King Mongkut's Institute of Technology Ladkrabang Prince of Chumphon Campus, Chumphon, Thailand, pp. 215-218

No.	Article Title	Journals
49.	The ultrasonic assisted extraction to maximize antioxidant and tyrosinase inhibition activities from <i>Zingiber Officinale</i> Roscoe	Proceeding of the 7 th TICC International Conference 2023 February 4 – 5, 2023 at Centara Riverside Hotel, Chiang Mai, Thailand, pp. 160-166
50.	Effect of banana fiber and palm oil fuel ash on the properties of fiber cement pipes	Proceeding of The International Conference on Traditional and Advanced Ceramics November 30 – December 2, 2022 at Impact, Muang Thong Thani, Bangkok, Thailand, pp. 11-16
51.	Surface-modified silica from palm oil fuel ash blended with vinyl ester resin to increase water flow	Proceeding of The International Conference on Traditional and Advanced Ceramics November 30 – December 2, 2022 at Impact, Muang Thong Thani, Bangkok, Thailand, pp. 21-25
52.	Direct synthesis of liquefied petroleum gas from carbon dioxide over bifunctional catalyst, CuZnAl/ various zeolite type supporting tandem reaction	Proceeding of The Pure and Applied Chemistry International Conference 2023 (PACCON 2023) January 20 - 21, 2023 at General Sampao Chusri Building: E4, Mae Fah Luang University, Chiang Rai, Thailand, pp. 301-307
53.	Methane synthesis via carbon dioxide plasma methanation in dielectric barrier discharge plasma reactor	Proceeding of The Pure and Applied Chemistry International Conference 2023 (PACCON 2023) January 20 - 21, 2023 at General Sampao Chusri Building: E4, Mae Fah Luang University, Chiang Rai, Thailand, pp. 332-337
54.	The Investigation of natural insulating fluid of chemically modified palm oil ester via 2-stage transesterification	Proceeding of The Pure and Applied Chemistry International Conference 2023 (PACCON 2023) January 20 - 21, 2023 at General Sampao Chusri Building: E4, Mae Fah Luang University, Chiang Rai, Thailand, pp. 338-344
55.	Removal of hydrogen sulfide from biogas via a simple dielectric barrier discharge	Proceeding of The Pure and Applied Chemistry International Conference 2023 (PACCON 2023) January 20 - 21, 2023 at General Sampao Chusri Building: E4, Mae Fah Luang University, Chiang Rai, Thailand, pp. 345-350

No.	Article Title	Journals
56.	Optimum stainless electrodes on hydrogen production by alkali electrolysis	Proceeding of The Pure and Applied Chemistry International Conference 2023 (PACCON 2023) January 20 - 21, 2023 at General Sampao Chusri Building: E4, Mae Fah Luang University, Chiang Rai, Thailand, pp. 368-371
57.	Improvement of biohydrogen production from molasses using <i>Enterobacter aerogenes</i> by adding trace elements	Proceeding of The Pure and Applied Chemistry International Conference 2023 (PACCON 2023) January 20 - 21, 2023 at General Sampao Chusri Building: E4, Mae Fah Luang University, Chiang Rai, Thailand, pp. 372-377
58.	Economic cost estimation of hydrogen generator by alkali water electrolysis skid like battery module	Proceeding of The Pure and Applied Chemistry International Conference 2023 (PACCON 2023) January 20 - 21, 2023 at General Sampao Chusri Building: E4, Mae Fah Luang University, Chiang Rai, Thailand, pp. 421-425
59.	Re-utilization of wastewater discarded from hydrothermal carbonization process	Proceeding of The Pure and Applied Chemistry International Conference 2023 (PACCON 2023) January 20 - 21, 2023 at General Sampao Chusri Building: E4, Mae Fah Luang University, Chiang Rai, Thailand, pp. 437-441
60.	Conversion of food waste to fertilizer in a week	Proceeding of The Pure and Applied Chemistry International Conference 2023 (PACCON 2023) January 20 - 21, 2023 at General Sampao Chusri Building: E4, Mae Fah Luang University, Chiang Rai, Thailand, pp. 519-522
61.	Modification of polysulfone flat sheet membrane using graphene oxide for CO ₂ /CH ₄ separation	Proceeding of The Pure and Applied Chemistry International Conference 2023 (PACCON 2023) January 20 - 21, 2023 at General Sampao Chusri Building: E4, Mae Fah Luang University, Chiang Rai, Thailand, pp. 648-653

No.	Article Title	Journals
62.	The isolation and HPLC determination of imperatorin from <i>Aegle marmelos</i> (L.) Corr	Proceeding of The Pure and Applied Chemistry International Conference 2023 (PACCON 2023) January 20 - 21, 2023 at General Sampao Chusri Building: E4, Mae Fah Luang University, Chiang Rai, Thailand, pp. 691-694
63.	Effect of vinyl acetate/ethylene copolymer on properties of TPS/PLA blend at high starch content	Proceeding of The Pure and Applied Chemistry International Conference 2023 (PACCON 2023) January 20 - 21, 2023 at General Sampao Chusri Building: E4, Mae Fah Luang University, Chiang Rai, Thailand, pp. 940-945
64.	Improvement of mechanical properties of pineapple leaves with water hyacinth for paper packaging	Proceeding of The Pure and Applied Chemistry International Conference 2023 (PACCON 2023) January 20 - 21, 2023 at General Sampao Chusri Building: E4, Mae Fah Luang University, Chiang Rai, Thailand, pp. 946-949
65.	Preparation, characterization, and antimicrobial properties of linoleic acid-grafted chitosan coating on cellulose acetate nanofibers	Proceeding of The Pure and Applied Chemistry International Conference 2023 (PACCON 2023) January 20 - 21, 2023 at General Sampao Chusri Building: E4, Mae Fah Luang University, Chiang Rai, Thailand, pp. 950-955
66	The effect of nucleating agents on morphology and thermal properties of poly (3-hydroxybutyrate-co-3-hydroxyvalerate) composites	Proceeding of The Pure and Applied Chemistry International Conference 2023 (PACCON 2023) January 20 - 21, 2023 at General Sampao Chusri Building: E4, Mae Fah Luang University, Chiang Rai, Thailand, pp. 956-961
67	Cytoprotective Effect of TISTR Probiotic Strains on Streptozotocin-exposed Pancreatic β Cell Line (RIN-5F) by MTT Assay	Proceedings of 11 th International Conference on Nutrition and Physical Activity in ageing, obesity and cancer (NAPA 2022) December 15-17, 2022, The Empress Chaingmai Hotel, Chaingmai, Thailand, pp. 57-59 Hybrid Conference

No.	Article Title	Journals
68	Protective effect of <i>Ganoderma lucidum</i> extract Against Aflatoxin B1 (AFB1) induced genotoxicity evaluated using 3D hepatocyte spheroid model	Proceedings of 11 th International Conference on Nutrition and Physical Activity in ageing, obesity and cancer (NAPA 2022) December 15-17, 2022, The Empress Chaingmai Hotel, Chaingmai, Thailand, pp. 60-64 Hybrid Conference
69	<i>In vitro</i> DNA protection and non-cytotoxic activities of Thai probiotics: <i>Lactocaseibacillus paracasei</i> (TISTR2688) and <i>Lactocaseibacillus rhamnosus</i> (TISTR2716)	Proceedings of 11 th International Conference on Nutrition and Physical Activity in ageing, obesity and cancer (NAPA 2022) December 15-17, 2022, The Empress Chaingmai Hotel, Chaingmai, Thailand, pp. 65-69 Hybrid Conference
70	Preclinical <i>in vitro</i> and <i>in vivo</i> studies of probiotic compounds promising for health product	Proceedings of Second International Conference on TU Health Science (ICTUHS) March 16-17, 2023, Pathum Thani, Thailand, pp. 237-244
71	Effects of ethanolic extract of <i>Ganoderma Lucidum</i> cultivated In Thailand on adipogenesis in 3T3-L1 cells	Proceedings of Second International Conference on TU Health Science (ICTUHS) March 16-17, 2023, Pathum Thani, Thailand, pp. 288-294
72	Effects of time on oil products from contaminated plastic wastes using a batch pyrolyzer	The Proceeding of 7 th ASEAN Bioenergy and Bioeconomy Conference August 31 st , 2023, Room: MR 109CD, 109H, Queen Sirikit National Convention Centre (QSNCC), Bangkok, Thailand, pp. 156-164

Technology Transfer for Commercialisation

TISTR is an innovative organization that addresses the country's needs under the TISTR 4.0 policy by focusing on conducting research and development (R&D) and generating diverse outputs in science, technology, and innovation (STI). In the fiscal year 2023, TISTR executed a total of 117 projects in R&D services and consultancy services. Notably, significant outcomes were achieved in four key areas, outlined as follows:

Research and Development Group for Bio-industries

★ **Project on the Production of Leavening Agent Microorganisms for Probiotic Food Supplement Aimed at Reducing Blood LDL-Cholesterol, Delivered to Innobic (Asia) Company Limited, Executed by the Biodiversity Research Center (BRC)**

Innobic (Asia) Company Limited, a subsidiary of the Petroleum Authority of Thailand Public Company Limited, is dedicated to innovating health products, including medical supplies, food and beverage, food supplements, herbal products, etc. The company places a special emphasis on developing the market for probiotic food supplements. TISTR, through the Innovative Centre for Production of Industrially Used Microorganisms (ICPIM), possesses the scientific and technological capabilities, including experienced researchers in probiotic microorganism technology, research and development (RDIM), innovation, and manufacturing. As the foremost center for probiotic microorganisms in Thailand, ICPIM offers its expertise to both government and private sectors. It boasts a repository of potential local prebiotic microorganisms compliant with FAO standards, with over 24 strains certified through R&D efforts conducted by our research team in laboratories, animals, and human testing. Additionally, ICPIM adheres to plant-scale production processes in line with Good Hygienic Practices (GHPs) and Hazard Analysis and Critical Control Points (HACCP) standards. Building upon previous technology transfer regarding a probiotic food supplement recipe for reducing blood LDL-cholesterol, Innobic (Asia) Company Limited sought additional services for the production of leavening agent microorganisms for diverse commercial applications.

Research and Development Group for Sustainable Development

★ **Project on Enhancing Bran Sampling Machine from a Single Probe to Three Probes in Automatic Type, Provided to CPF (Thailand) Public Company Limited, Executed by the Expert Center of Innovative Clean Energy and Environment (InnoEn)**

Currently, CPF (Thailand) Public Company Limited employs a gantry-type sampling machine with an automatic system utilizing a single probe for collecting bran samples, which serves as a raw material in animal food production. However, the existing machine's efficiency is hindered by the numerous sampling points designated for collection. Recognizing this limitation, the company sought a contract research

project to enhance the current bran sampling machine. The proposed improvement involves increasing the number of probes to three while maintaining other functional aspects of the sampling process. This modification aims to significantly reduce sampling time, thereby enhancing the accuracy and efficiency of the machine's operation.

The project involves applying knowledge, technology, and innovation acquired from previous R&D endeavors to design and improve the machine. This approach is geared towards fostering sustainable development in response to energy challenges, mitigating foreign currency loss, and building the capabilities, knowledge, and expertise of relevant personnel. Ultimately, the project contributes to the sustainable strength of the Thai industry.

Industrial Services Group

★ Project on Engineering Consultancy Services for the Development and Testing of Wind Deflector for Heavy Trucks in Logistics Operations, Provided to Hino Motors Asia Limited, Executed by the Railway Transportation System Testing Center (RTTC)

Hino Motors Asia Limited, a manufacturer specializing in designing and producing truck head equipment and wind deflector sets, required real-time vibration testing for evaluating the strength and lifespan of their equipment. This necessitated the adoption of testing instruments and the adjustment of complex testing conditions to facilitate real-time operating tests. Quality evaluation and durability assessment for truck head equipment and wind deflector sets under real-time operating vibration conditions are essential for verifying design integrity and evaluating equipment lifespan.

Recognizing the need to apply real-time operating vibration environment criteria to testing procedures, TISTR, as a government agency equipped with state-of-the-art analysis and testing instruments, brings extensive skills and experience in providing analysis testing services for evaluating the lifespan quality of automotive engineering and structural components. This consultancy project involves the design and setup of equipment for testing and simulating analyses in accordance with operating conditions, ensuring evaluation adherence to relevant academic principles.

Strategies and Innovation Management Group

★ Project on Premium Product Development for Six Products, Assigned to the Bank for Agriculture and Agricultural Cooperatives, Executed by the Innovative Business Service Division, Technology and Innovation Management Office

Commencing with the Memorandum of Collaboration Agreement aimed at enhancing capacity and supporting small and medium-sized entrepreneurs (SMEs), and the Memorandum of Understanding for academic collaboration and technology transfer between the Thailand Institute of Scientific and Technological Research (TISTR) and the Bank for Agriculture and Agricultural Cooperatives (BAAC), the collaboration has expanded to foster the development of Thai enterprises. This extension is

manifested in the ‘A Product Premium Development for 6 Products’ project, where joint integration is established with three partners, including a financial institution, a research agency, and SMEs enterprises. The collaborative effort is designed to enhance business capacity and augment commercial distribution. Several qualified SMEs enterprises are actively participating in the project, covering a diverse range of six businesses, which include:

No.	Project	Entrepreneur
1	Project on Quality and Active Ingredient Evaluation in Pennyworth Leaf Tea Product	Ban Mom Chaem Community Enterprise Group, Nonthaburi Province
2	Project on the Development of Pineapple Flavored Baked Crispy Brown Rice Product	Kurk Rice Mill Company Limited, Chiang Rai Province
3	Project on Research and Development of Recipe and Production Process for Sugar-Free Mulberry Beverage for Health	Monmai Product Processing Group, Mae Hong Son Province
4	Consultancy Project for Readiness Preparation of Food Safety Production Standards (GHPs and HACCP)	New Theory Farmer Housewives Group Community Enterprise, Phetchabun Province
5	Project on Research and Development of Shower Gel Infused with Pomelo Peels/Flowers Extracts and Commercial Product Prototype	Ban Bang Phlap Community Enterprise Group, Samut Songkhram Province
6	Project on Mango Transport Packaging Development for Export and Labeling Development for Mango Jelly	Pathumthip Garden, Lamphun Province

Furthermore, TISTR has established a network and integrated collaboration with government sectors, state-enterprise agencies, and the private sector to facilitate the utilization of R&D results in science. This initiative aims to transfer technology with high quality and international standards, fostering the capacity building of SMEs entrepreneurs for practical applications. Additionally, TISTR is committed to developing action plans and systematically driving mechanisms, tools, and facilities. In terms of technology transfer and the commercialization of STI results, a total of 14 projects have been undertaken, as outlined below:

No.	Project	Recipient of Technology Transfer
1	Technology Transfer for the Production of Anti-Inflammatory Acne Cosmetic Product from Jasmine Rice	Odee Style Company Limited
2	Technology Transfer for the Production of Oral Cavity and Feminine Hygiene Product from Herbs	
3	Technology Transfer for the Production of Cosmeceutical Product from Nymphaea Lotus Flower	
4	Authorization for the Use of Bacterial Strains in the Production of Vibrio Control Product in Water	Thai Union Feedmill Company Limited
5	Authorization for the Use of Bacterial Strains in the Production of Ammonia, Nitrite, Nitrate Removal Product in Aquaculture Pond	
6	Authorization for the Use of Bacterial Strains in the Production of Organic Matter Degradation Product in Aquaculture Pond	
7	Technology Transfer for the Production of Food Supplement Product Aimed at Reducing the Risk of Heart and Coronary Artery Disease from Hypertension, Utilizing Rice Peptide Hydrolysate	OD Innovacoamax Company Limited
8	Technology Transfer for the Production of Food Supplement Product for Strengthening Bones and Joints, Utilizing Calcium Extract from Pearl	
9	Technology Transfer for the Production of Food Supplement Product from Gelatin Hydrolysate Extracted from Jellyfish	
10	Authorization for the Use of Yeast Strain as an Ingredient in the Production of Animal Food Products	Bioman Company Limited
11	Technology Transfer for the Production of Continuous Plastic Garbage Bag Washing Machine	A.M.N System Services and Supply Company Limited
12	Technology Transfer for the Production of Vitamin B-Complex Beverage Product	Flourish Company Limited

No.	Project	Recipient of Technology Transfer
13	Technology transfer of production of anti-wrinkle cosmetic product from durian fruit extract	Four Laboratories Company Limited
14	Authorization for the Use of Probiotic Microorganism Strain in the Development of Probiotic Food Supplement Product with Blood Cholesterol Lowering Property	Innobic (Asia) Company Limited

Industrial Services Group

(Analysis, Testing, Calibration, Quality System Certification, Training, and Consultancy Services)

In addition to research and development, TISTR provides a comprehensive suite of services encompassing analysis, testing, calibration, quality system certification, training, and consultancy. These services are geared towards elevating standards and enhancing the competitiveness of the industrial sector, a crucial mission of TISTR. The Industrial Services Group, as the core responsibility, delivers scientific and technological services across a spectrum of industries, ranging from large-scale industrial sectors to small-scale enterprises, including community enterprises. The group focuses on the development of product quality and manufacturing processes within the industrial sector.

The Industrial Services Group undertakes various significant tasks, including analysis, testing, and calibration services with a laboratory management system accredited to international standards. Moreover, it provides evaluation and certification services adhering to international standards, aiming to support manufacturing endeavors and instill trust in the Thai industry.

In the fiscal year 2023, the major tasks of the Industrial Services Group include the study and evaluation of biodegradation through a specialized biodegradation testing laboratory. The Material Properties Analysis and Development Center, a part of this group, is actively expanding its services in biodegradation testing. The laboratory conducts analyses according to the international standard ISO 17088, aligning with the Thai industrial standard ISO 17088-2555. Notably, this laboratory has received accreditation from the main agency in Germany. The services offered by this laboratory present an alternative for Thai enterprises seeking to produce eco-friendly plastics. This becomes advantageous for businesses dealing with foreign partners who are increasingly conscious of environmental impacts. Additionally, it proves beneficial for manufacturers or distributors requiring environmental labels on products, contributing to increased exports to foreign markets and enhancing competitiveness globally. Moreover, by conducting such testing locally, Thai enterprises can realize cost savings of more than 50 percent compared to sending samples to overseas laboratories.

TISTR is actively engaged in a research contract and consultancy service project for the evaluation of preliminary biodegradation tests. This project is undertaken in collaboration with SCG Chemicals Public Company Limited, a leading company specializing in polymer compounds, chemical supply, and main products. SCG Chemicals has sought testing and evaluation of preliminary biodegradation in fermented compost and seawater, aligning with its commitment to sustainable business development. The focus is on the development of innovative and eco-friendly plastic products.

The Industrial Services division of TISTR plays a pivotal role in directly enhancing the competitiveness of the Thai industry and, indirectly, contributing to environmental sustainability. By providing specialized services for the evaluation of biodegradation tests, TISTR supports companies like SCG Chemicals in their efforts to create environmentally friendly plastic products, fostering sustainable practices in the industry.

Commercial Technology Transfer in Collaboration with an Integrated Network Involving Government and Private Sectors

Facilitating the transfer of technology and innovation to the industrial sector and community enterprises, while accelerating economic, social, and environmental benefits, is a crucial mission of TISTR. This is achieved through commercial technology transfer in collaboration with an integrated network involving government agencies and private sectors. In the year 2023, TISTR has demonstrated concrete performance that is effective at both the grassroots economy level and the macro level economy, aligning with the principles of the Bio-Circular-Green (BCG) model.

One noteworthy performance is TISTR's collaboration through a Memorandum of Understanding on the prototype of a sustainable concomitant growth cycle in the Nan province area. This collaboration involves private partners such as Lion (Thailand) Company Limited, educational institutions both inside and outside the area, Mahidol University and Nan Community College, as well as public and business sectors in Nan province. The collaboration aims to develop a resource utilization ecosystem, scientific and technological innovations, and value addition of local herbs in the Nan province area. The scope encompasses upstream-scale production, promotion of preliminary processing technology at the local level, value addition to extracts on a semi-industrial scale, and the production of commercial herbal products on an industrial scale for utilization by the main private sector, Lion (Thailand) Company Limited.

The project also benefits the environment, with the company intending to supplement income by selling carbon credits to the community or Nan province area in the future. This involves evaluating the amount of carbon dioxide emission and adsorption from herbal plants to facilitate area development, career development, and the conservation of local resources and the environment

using key local herbs such as Chebolic myrobalan, Beleric myrobalan, Indian gooseberry, and Moroheiya.

The collaborative operations involve five agencies in the areas of Ban Kew Muang, Tambon Du Phong, Amphoe Santisuk, and Tha Li community, Tambon Lai Nan, Amphoe Wiang Sa, Nan province. The benefits and outcomes of the project contribute to short-term and long-term gains for businesses, farmers, and the public sector. Lion (Thailand) Company Limited expresses its commitment to purchasing herbal produce and carbon credits at an agreed-upon fair price from farmer groups, thereby fostering sustainable development.

Technology Transfer for Social Benefit

Technology Transfer for Social Benefit is another crucial mission of TISTR, involving the dissemination of technology and innovation to society, particularly benefiting community enterprises. The aim is to enhance grassroots economies and foster positive social and environmental impacts. In the year 2023, TISTR secured an area-based grant from the Program Management Unit on Area-Based Development (PMU A). This initiative focuses on bringing research and development results and appropriate technology to uplift targeted impoverished communities in economically challenged provinces. By operating in designated areas, TISTR seeks to achieve tangible outcomes and uplift entire production supply chains. The goal is to apply Science, Technology, and Innovation (STI) to address poverty issues in a manner tailored to the specific context of the area, as exemplified in the Su-ngai Padi area.

In the Amphoe Su-ngai Padi area of Narathiwat province, TISTR collaborates with local agencies such as Princess of Naradhiwas University and local functional agencies. One of the collaborative efforts involves working with a freshwater fish processing group (pickled fish) known as Bue-nae Ya Mu Aquatic Animal Processing Group in Tambon To Deng, Amphoe Su-ngai Padi, Narathiwat province. The project focuses on the development of production technology using microorganisms to reduce fermentation time for pickled fish. This includes activities such as nutrition value testing analysis, production technology transfer, and product satisfaction testing with a production manual to enhance the pickled fish production process by leveraging microorganism technology to shorten production time.

TISTR conducted visits to the area to collect samples for analyzing microbials and shelf life. Additionally, TISTR provided microbial cultures to the faculty member in charge to conduct fermentation trials of pickled fish for the community enterprise group, studying the impact on fermentation time. The results showed that TISTR's microbial cultures helped reduce fermentation time from the previous 30 days to 20 days while maintaining the taste. This reduction in time proved beneficial by increasing productivity, enabling efficient product supply to the market, facilitating production planning, and contributing to the development of processing facilities in compliance with Good Manufacturing Practice (GMP) standards. Information about operational challenges was shared with the provincial public health office to assist in improving the pickled fish production area building according to compliance standards.

Furthermore, TISTR conducted Training of the Trainer sessions to mentors and local educational institutions, focusing on knowledge transfer related to the implementation of production housing standards (GMP), food processing, and shelf-life extension of food products through online sessions held on March 28, 2023. Faculty members in charge of the project, representatives from the fisheries provincial office, and members of the community enterprise group attended the talk event. These initiatives elevated the knowledge capacity of entrepreneurs, provided them access to innovation and

modern technology, facilitated standard product production, and created new market opportunities beyond the local region. This not only expanded distribution locally but also leveraged local resources, fostering opportunities for the circulation of the local economic system. As a result, these efforts contributed to the development of social and life quality in the local community of Tambon To Deng, Amphoe Su-ngai Padi, Narathiwat province, ensuring the steadfast career development of the area.

Science and Technology Services

TISTR focuses on science and technology services, via its Industrial Services Group (IDS), and promotes the quality of the domestic industries to international standards. Apart from servicing with modern international standard equipment, the IDS offers equipment design for testing or designing test methods suitable for our customer's desirable product and material used. IDS also supports and strengthen the National Quality Infrastructure (NQI) to enhance the competitiveness of Thai entrepreneurs in the global arena.

Moreover, TISTR also works as part of the government and private sectors, both Thai and overseas, capability enhancement by organizing seminars to transfer various technology as well as specific topics for SMEs and Start-ups. This helps develop human capital in all aspects such as new skill, re-skill, and up-skill. Examples of the curriculum are the upskill in quality systems, packaging, food, metal, and inspection. These include non-degree curriculum and "Train-the-Trainer" courses to create new skills for lecturers, undergraduate and graduate students as well as university personnel in practical, academic, and advanced knowledge both online and on-site. This is capability building in science, technology, and innovation (STI) which corresponds with MHESI's strategy of producing a higher amount of quality workforce to support the competitiveness of Thai industries. Moreover, TISTR has been enlisted as a network institution of the Council of Engineers, this enables TISTR to organize engineering courses and evaluate the professional development unit for engineers (PDU). From an announcement of the Ministry of Industry, TISTR has been listed as an examining institution for boiler controllers by the Department of Industrial Works (DIW). Those who pass the exam will receive a certificate for boiler controller according to the DIW criteria. TISTR also acts as an approved Proficiency Testing Provider (ISO/IEC 17043) in the areas of temperature, electricity, and chemistry.

Performance in 2023, there were a total of 2,447 businesses receiving services from TISTR, covering MSTQ 192,885 items which generated revenue of 130 million baht. There were 530 quality accredited entrepreneurs. Personnel from industrial and government sectors have been developed in STI skills via 63 courses for 1,564 persons. The training courses were publicized through the BDS system to increase more communication channels for customers. The consultation in engineering, academic, and laboratory quality accreditation according to the ISO/IEC 17025 system, was provided to 20 government and private sectors.

In the 2023 fiscal year, TISTR achieved 5 new, internationally accredited services to respond to our customers' needs as follows

- Calibration of air-conduction audiometer in conjunction with the supra-aural earphone
- Calibration of air velocity meter, Anemometer
- Testing of disposable face mask (difference in pressure)

- Testing of solid food additives (drying weight loss)
- Testing of emulsion paint (water resistance, alkaline resistance, accelerated weathering conditions)
- Testing for Chlorpyrifos residue left in rice
- Tensile testing for metallic material according to ISO 6892-1: 2019 (E)
- Standard testing for flexural properties of unreinforced and reinforced plastics and electrical insulating materials according to ASTM D790-17
- Torsional testing of metallic medical bone screws according to Annex2

Analytical services and testing of raw materials, product, packaging and calibration of measuring tools

TISTR provides services to government and industrial sectors in analytical testing of raw materials, products, packaging, and calibration of measuring tools according to ISO/IEC 17025 in the following areas.

- Analytical and testing services for food products, drinks, and cosmetics covering the list announced by the Ministry of Public Health for FDA registration. For example, active ingredients analysis, contamination, and nutritional evaluation as well as safety testing. Also, testing for herbs and herbal products such as hemp, cannabis, Kariyat, and Kratom.
- Analytical and testing services for other industrial products such as paint and vanishing standards, plastic and PVC pipes, and light bulbs. IDS has also been registered as an auditor for industrial products in Article 5 of the Thai Industrial Standards Institute. Examples of Thai Industrial Standard are 17-2561, 982-2556, and 2321-2564.
- IDS has been appointed as an accredited inspection body in ISO/IEC 17020 for the area of electric light equipment, electrical power, electrical equipment, and electronics equipment. Inspection and evaluation of the remaining service life of boilers. Evaluation of damage to vessel and boiler on-site of the power plant.
- Testing services in the transportation systems: rail, road, and water as well as electric vehicles.
- Research, analytical, and testing services of raw material or environmental-friendly products biodegradation. Bioremediation of dangerous residue in the environment.
- Calibration services for the whole range of industrial measuring tools such as electric, frequency, sound, light, temperature, humidity, capacity, strength, tensile, mass, pressure, dimension, flow, and velocity. Testing and calibration of medical devices (such as medical masks, medical supplies cabinet, plasma cabinet, blood storage cabinet) and air quality measurement for negative and positive pressure rooms in hospitals.

- Analytical and testing services for material and packaging covering paper and plastic, retailing packaging, packaging for transportation, and packaging for dangerous goods. Consultation in research and development in packaging as well as shelf-life studies for food products and packaging design are also provided.

Quality system accreditation, product accreditation, and international standards services are provided, as TISTR is a certification body working under the global standards for government, private, community enterprises, and the general public, transparently and neutrally. System certifications according to ISO/IEC 17021-1, ISO/IEC 17065, and ISO/TS 22003 covering the audition and accreditation in the following areas

- Evaluation services and accreditation of international systems such as ISO 9001, ISO 14001, ISO 45001, ISO 22000, GHPs, and HACCP
- Evaluation of food producers as TISTR is a certification body enlisted with the Thai FDA
- Evaluation services and accreditation of Thai Agricultural Standards (TAS) in general such as TAS9023, TAS9024, TAS9047, etc., and compulsory standards such as TAS 1004, TAS9035, TAS6401, TAS9046. Also, offering evaluation services for plant product factories registered with the Department of Agriculture to enhance the Thai entrepreneurs' potential in exporting agricultural goods such as durian and longan.
- Verification and testing services for the reduction of greenhouse gases as a verification body of the organization for carbon footprint.
- Product and service accreditation (by auditing and accrediting of both products and services) such as GAP for edible plant according to TAS9001, organic agriculture according to TAS9000 book 1, biodegradable plastic according to ISO 17088 and TIS 17088 standards. Evaluation for the tax benefit of companies and partnership using biodegradable plastics.
- Evaluation and accreditation of tourist attractions and tourism activities. At present, TISTR is the only certifying body approved by Thai Industrial Standards Institute.

Key Achievements

- The project to establish a material testing laboratory for aircraft parts and repair industries

This project was funded by the supporting fund for science, research, and innovation to develop the infrastructure in the analysis/testing side of the R&D in the aircraft industry of Thailand. The laboratory was certified with AS9100D Quality systems (Aerospace standard) and ready to provide analytical and testing services in material and parts of aircraft, ground service parts, forest fire extinguish and air rescue equipment, military equipment parts, and explosives for local entrepreneurs as well as Thai government agencies. This shows TISTR's capabilities to drive and promote aircraft and aerospace industries as well as the air defense of the country at the international level. This also builds the trust of the investors to use Thailand as a business platform in aircraft, aerospace, and air defense.



- Inspection and evaluation for the remaining working life of boilers in the petrochemical industry and inspection and evaluation of the damage of boiler pipe in the power plant under the ISO/IEC 17020 biomechanics medical test provides analysis and testing in pelvic bones strengthening with cement, hydroxyapatite bones, the fatigue test of tibial try prosthesis surface according to ASTM F1800 standards. The enhancement of biomechanics medical testing services capability by extending the laboratory ISO/IEC 17025 standard under the topic of Axial and Torsion testing of metallic medical bone screws according to ASTM F543-17 Annex2.



● Development project for biodegradation product testing to international standards. This project was funded by the supporting fund for science, research, and innovation from the fiscal year 2020 to 2024, to develop a test method according to OECD 301(A-F) standards for environmental-friendly chemicals such as surface cleaning products, body care products, and lubricants. This is an extension of the success of the establishment of the Biodegradable Testing Centre, BioD.



In 2023, IDS via the material biodegradation testing laboratory succeeded in

1. An adoption of biodegradation OECD 301 test under sub-topics A, B, and F.
2. Laboratory accreditation under the ISO/IEC 17025 standard from the Thai Industrial Standards Institute (TISI) in subtopic A of OECD 301 on the 24th of April 2023.
3. Being awarded a “Certificate of Excellent” in an oral presentation from the 14th National Conference “Science Research”, 25-26 May 2023 at Payao University.
4. Published 2 articles in the national level journals.
5. Received “Lerd-Rath” award in 2023 under the category government service at the level “good” (service development) from the office of the public sector development commission (OPDC). The awarded work was “Capability enhancement in the medical industry to reach the international medical hub” which focused on the participation medical parts and devices product development to international standard. This helps both manufacturers and exporters in reducing time and cost in sending their products for overseas tests. It also promotes medical industry in Thailand to achieve international standards. The economic and social impact can be estimated at 470.30 million baht.

International Collaboration

TISTR has successfully implemented numerous impactful international projects, with the primary objective of disseminating scientific knowledge and showcasing research achievements to a global audience through collaborative efforts with foreign partner organizations. These initiatives align with the pursuit of Sustainable Development Goals (SDGs). The international collaboration not only fosters the exchange of knowledge but also enhances personnel skills and prepares individuals for research, development, and service-related endeavors. This commitment further solidifies TISTR's position as a comprehensive Science, Technology, and Innovation (STI) Total Solutions Provider, guided by the principles of the Bio-Circular-Green Economy Model (BCG Model).

● Collaborative Project on Policies and Technologies for Air Pollution Control

TISTR played a pivotal role as a Thai partner institution in executing the project titled "Enhanced Capacities to Adopt Innovative Technologies for City Air Pollution Control in Select Countries of the Asia-Pacific." This collaboration was carried out in partnership with the Asian and Pacific Centre for Transfer of Technology (APCTT), the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), and with support from the Ministry of Higher Education, Science, Research and Innovation of Thailand, serving as the National Focal Point of APCTT. Funding for the project was provided by the Korea-ESCAP Cooperation Fund (KECF). The project's core objective was to bolster the capacity of key stakeholders while enhancing the accessibility of technical knowledge related to innovative technologies, best practices, and a deeper comprehension of technology needs and gaps. The initiative specifically targeted three cities: Dhaka (Bangladesh), Gurugram (India), and Bangkok (Thailand).

The responsibilities undertaken by TISTR encompassed the following key tasks:

(1) Facilitating and providing pertinent information to the National Consultant, Assoc. Prof. Dr. Ekbordin Winijkul, a Professor from the School of Environment, Resources, and Development at the Asian Institute of Technology (AIT). This collaboration aimed to compile a comprehensive report outlining best practices and recommendations for the effective adoption of innovative technologies in controlling city-level air pollution.

(2) Offering support in orchestrating a multi-stakeholder consultation workshop. This platform was designed to deliberate upon assessment outcomes and collaboratively formulate recommendations based on the findings.

(3) Organizing a specialized training workshop tailored for city officials and relevant stakeholders. The workshop's objective was to equip participants with the necessary knowledge for the successful adoption and implementation of the recommendations, thereby fortifying city-level action plans.

TISTR took the lead in hosting the KECF Air Pollution Control Inception Meeting – Sharing Session: Perspectives towards Air Pollution Control for the Good Quality of Life on April 25, 2023. This event marked the initiation of activities under the project. Notable representatives from relevant organizations, including the Pollution Control Department, Department of Environment, Bangkok Metropolitan Administration (BMA), Department of Industrial Works, Thai Meteorological Department, Automotive Engineering Bureau, Department of Land Transport, Electricity Generating Authority of Thailand (EGAT), and King Mongkut's University of Technology Thonburi (KMUTT), were invited to share their insights and missions pertaining to air pollution control, addressing both policy and technology dimensions.

Additionally, TISTR collaborated with APCTT to organize the KECF Air Pollution Control Multi-stakeholder Consultation Workshop on October 26, 2023. The workshop aimed to deliberate on assessment study outcomes and formulate recommendations to enhance city-level action plans. Discussions covered the adoption of enabling mechanisms for innovative technologies, as well as the exchange of perspectives on air pollution issues, policies, strategy options, technologies, and best practices. During the workshop, Assoc. Prof. Dr. Ekbordin Winijkul presented on the topic of “Strengths and challenges of a city-level action plan for adopting technologies for air pollution control in Bangkok.”

Another notable event was the KECF Air Pollution Control Training Workshop, jointly organized by TISTR, APCTT, Hub of Talents on Air Pollution and Climate (HTAPC), and the National Research Council of Thailand on November 27, 2023. The workshop aimed to enhance the knowledge and comprehension of Bangkok city officials and relevant stakeholders regarding the adoption and implementation of enabling mechanisms for innovative air pollution control technologies. It also aimed to foster stronger cooperation among participating organizations.

This training workshop featured presentations by esteemed experts:

(1) Dr. Worradorn Phairuang, Assistant Professor at the Faculty of Geosciences and Civil Engineering, Institute of Science and Engineering, Kanazawa University, Japan, presented “A Recent Study of Atmospheric Ultrafine Particles (PM_{0.1}) Toward Low Carbon Societies in Upper Southeast Asia; Case Study in Bangkok, Thailand.”

(2) Dr. Supat Wangwongwatana, Director of HTAPC, provided insights into “Review of the Air Pollution Problem in Bangkok.”

(3) Mr. Kantachai Pajityotee from HTAPC delivered an illustration on “Air Quality (PM_{2.5}) Forecast for Bangkok and Districts.”

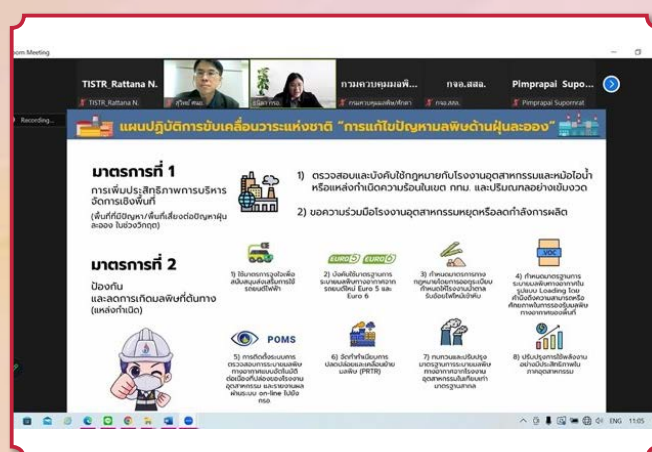
(4) Assoc. Prof. Dr. Ekbordin Winijkul, Professor from the School of Environment, Resources, and Development at the Asian Institute of Technology (AIT), presented “Air Pollution Reduction Technology Assessment for Bangkok.”

(5) Assoc. Prof. Dr. Sirima Panyametheekul from the Department of Environmental Engineering, Faculty of Engineering, Chulalongkorn University, addressed “Frequently Asked Questions During High PM2.5 Season.”

This workshop provided a valuable platform for pertinent organizations and stakeholders to exchange knowledge, perspectives, and experiences regarding policies and technologies for air pollution control, all aimed at fostering better lives and ensuring a sustainable environment.



Meeting Discussion on the Implementation of the KECF Air Pollution Control Project Among APCTT, Assoc. Prof. Dr. Ekbordin (National Consultant), and TISTR



KECF Air Pollution Control Inception Meeting – Sharing Session:
Perspectives on Air Pollution Control for Quality Living, April 25, 2023

- Collaboration on Plastic Waste Management

Following the official visit of the TISTR delegation to the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Australia in December 2022, led by Prof. Dr. Sirirung Songsivilai, Permanent Secretary of the Ministry of Higher Education, Science, Research and Innovation (MHESI), Dr. Chutima Eamchotchawalit, Governor, and the TISTR team, both parties engaged in discussions on fostering a sustainable plastic waste management ecosystem. During the visit, CSIRO introduced the Indo-Pacific Plastics Innovation Network (IPPIN) initiative. Subsequently, Dr. Chutima Eamchotchawalit was invited to join the Plastics Innovation Hub Thailand (PIHT) Advisory Group.

As part of the IPPIN collaboration, TISTR actively participated in the CSIRO Ending Plastic Waste Symposium and IPPIN Strategy Workshop held in Sydney, Australia. The objectives of these events were to explore avenues for IPPIN network development, discuss projects focused on incubating innovative ideas for plastic waste stakeholders, and present research proposals under the IPPIN Incubator Programme. These initiatives specifically aimed to enable researchers and entrepreneurs to share best practices in plastic waste management, drawing from experiences in Thailand.



The TISTR delegation visited CSIRO in December 2022.



TISTR participated in the CSIRO Ending Plastic Waste Symposium and IPPIN Strategy Workshop in Sydney, Australia.



TISTR and the PIHT Advisory Group deliberated on research proposals within the IPPIN Incubator Programme.

- **Technical Cooperation for Research and Development and Implementation of Railway Inspection and Monitoring Technology**

The Railway Transportation System Testing Center (RTTC) at TISTR successfully executed the project titled “Technical Cooperation for Research and Development and Implementation of Railway Inspection and Monitoring Technology.” The primary objective of the project was to enhance the safety of rail system operations in the ASEAN region through research on railway infrastructure inspection and monitoring technology, aimed at improving safety standards. Funding for the project was provided by the United Nations Development Programme (UNDP) under the Perez-Guerrero Trust Fund for South-South Cooperation (PGTF) and the Thailand International Cooperation Agency (TICA).

In 2023, RTTC developed a cutting-edge Train Weight Device (TWD) capable of accurately measuring dynamic train weight while in motion on the tracks. This system promised to enhance the efficiency and safety of both rail and road transport, while also supporting the production of local content within the rail system, benefiting Thai entrepreneurs engaged in rail transport operations technology.

TISTR’s plan involved installing the TWD in Thailand, Malaysia, and Indonesia. The RTTC team actively participated in operational meetings with railway agencies, undertaking site visits in Indonesia and Malaysia during May-June 2023, fostering collaboration with partners such as the University of Sumatera Utara, PT Kereta Api Indonesia (KAI), Construction Research Institute of Malaysia (CREAM), and Universiti Teknologi MARA (UiTM). Furthermore, the RTTC team aimed to demonstrate, install, test, and provide training for the utilization of the TWD in both Indonesia and Malaysia.



Development of a Train Weight Device (TWD) by RTTC for Dynamic Measurement of Train Wheel Weight



Discussion between Representatives of TISTR, University of Sumatera Utara, and PT Kereta Api Indonesia (KAI), Indonesia



Discussion between Representatives of TISTR and CREAM, and UiTM, Malaysia

As a result, international cooperation has provided invaluable opportunities for TISTR to showcase its research and development potential on global science, technology, and innovation platforms, as well as within multilateral cooperation networks. This engagement has not only garnered recognition and acceptance from the global society but also positioned TISTR as a key player in addressing international challenges. The ongoing collaboration is poised to further enhance researchers' capabilities, fostering breakthroughs in research and development that align with global standards. Through the integration of scientific knowledge and expertise from TISTR and its partner researchers across diverse disciplines, this collaboration is well-positioned to contribute to sustainable economic growth, social development, and environmental conservation on a global scale.

