Annual Report 2024

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 2024, Thailand's economy has grown significantly compared to the previous year, especially in the tourism sector, which has been a major driving force. This can be seen in the increase in the number of international tourists, largely due to the government's policy of offering visa-free entry to travelers from 93 countries/territories, up from the previous 57. This has stimulated the domestic economy in various areas, including production, consumption, and the service industry.

However, global circumstances remain volatile, particularly with the intensifying conflict in the Gaza Strip, which has reached its most severe level in years, causing significant loss of life and property. This has contributed to fluctuations in oil prices. Additionally, global climate change has led to natural disasters in many regions, further impacting the global economy.

Over the past year, TISTR has prioritized driving the application of research, technology, and innovation for commercial use and improving the quality of life for people across all regions of the country. The organization has advanced towards becoming a digital organization through the enhancement of the JUMP platform, offering comprehensive services to external clients. These include automated invoice issuance via email and digital signing of announcements and training certificates, providing end-to-end services that have significantly increased customer satisfaction. Additionally, internal processes have been improved through the implementation of the

Human Resource Information System (HRIS), enhancing efficiency and reducing workflow steps for employees.

TISTR's research achievements that bring great pride include the development of technologies and innovations for community waste management and value creation based on circular economy principles. A pilot project was implemented in Tan Diao District, Saraburi Province, with successful expansion to other provinces through strong collaboration with private sector partners. Notable examples include partnerships with Dow Thailand Group, the Program Management Unit for Competitiveness (PMUC), the Plastics Institute of Thailand, Ban Chang Subdistrict Municipality, and Rayong Province. These efforts earned prestigious awards such as the Award for Outstanding Innovation "Prize of Hong Kong Delegation," the NRTC Special Award for Excellent Invention, and the Gold Medal at The 49th International Exhibition of Inventions Geneva and The 7th China (Shanghai) International Invention & Innovation Expo 2024 in Switzerland.

Additionally, significant innovations in herbal product development have been achieved, including Nano Hair Tonic from safflower extract, Rusiren dietary supplements for improved sleep and snoring relief, anti-stretch mark gel for abdominal skin using goat peptide extract, Rusium Plus dietary supplements for bone and joint health derived from hydrolyzed gelatin, and anti-melasma products from lotus extract. These technologies have been successfully transferred to the private sector and have also received international recognition and awards in global competitions.

In addition, TISTR has placed great emphasis on promoting the transfer of technology for mushroom cultivation and agricultural bioproducts to support sustainable agriculture in line with Royal Project and Royal Initiative guidelines. Efforts have been made to enhance the production, cultivation, and value addition of ornamental plants and flowers, as well as to promote safe agriculture in communities surrounding the Technopolis at Khlong Ha. This enables local farmers to utilize bioproducts as substitutes for chemical inputs.

TISTR has also transferred knowledge to create livelihood opportunities for communities near its regional research stations, such as utilizing herbal plants and cultivating vegetables in greenhouses. Moreover, TISTR initiated the establishment of the "TISTR Waste-Free Club," which disseminates knowledge on waste segregation and value creation based on circular economy principles to TISTR personnel and stakeholders.

As a result of these efforts, TISTR successfully collected 4,557 kilograms of recyclable materials, valued at 15,570 baht, and reduced greenhouse gas emissions by 11,676 kilograms of CO_2 equivalent. This initiative marks a significant starting point for comprehensive waste management at the TISTR Technopolis.

In the area of scientific services, TISTR has been appointed by the Department of Industrial Works, Ministry of Industry, as the authorized organization for Remaining Life Assessment (RLA) of boilers under the Department's 2023 Announcement on Authorized RLA Organizations. TISTR is the first organization in Thailand to receive this designation and has provided inspection and remaining life assessment services for the domestic petrochemical and power generation industries.

Furthermore, TISTR has been registered by the Department of Industrial Works as the organization responsible for conducting certification exams for boiler or thermal fluid heater operators. Successful candidates receive operator certification in accordance with the Department's criteria. Additionally, TISTR serves as a Proficiency Testing Provider accredited under the ISO/IEC 17043 standard in the fields of temperature, electricity, and chemistry.

TISTR also continues to support the industrial sector by offering services in material analysis, product and packaging testing, instrument calibration, and international standard quality certification. In 2023, TISTR certified 2,314 clients and conducted 216,274 MSTQ tests, generating service revenue of 148.34 million baht.

In the realm of international engagement and academic collaboration with foreign network organizations, TISTR has initiated tangible activities aligned with the BCG (Bio-Circular-Green) Economic Model. Examples include:

• **Collaboration on eco-friendly packaging:** The Thai Packaging Centre (TPC) at TISTR, in partnership with the Department of Trade and Industry (DTI) in the Philippines, organized training programs in both Thailand and the Philippines to enhance knowledge for entrepreneurs.

• **Partnerships on plastic waste management:** This initiative is being carried out in collaboration with the Commonwealth Scientific and Industrial Research Organisation (CSIRO) of Australia.

• **Cooperation in food technology:** Joint efforts are underway with the National Research and Innovation Agency (BRIN) in Indonesia.

• **Collaboration on railway transport structural monitoring technology:** This project is supported 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). The project has been ongoing since 2023 and continues to date.

The results of TISTR's operations in 2024 have generated significant economic, social, and environmental impacts, with a total value of 20,906.17 million baht. The return on investment from these operations is calculated at 21.37 times the allocated budget.

It can be said that 2024 marks another significant milestone for TISTR, as it continues to prioritize the development of research and technology transfer services. These efforts are designed to support research and provide services to businesses and the public, strengthening the nation and improving the quality of life. TISTR's contributions have helped Thailand achieve sustainable growth across economic, social, and environmental dimensions, fostering resilience, stability, prosperity, and sustainability.

Dr. Chutima Eamchotichawalit

Governor

Key Risks of Business Operations

The Governance, Risk Management, and Compliance (GRC) Integration Policy

The Board of the Thailand Institute of Scientific and Technological Research (TISTR) recognizes the importance of supporting the involvement of the board, executives, employees, and staff of TISTR in applying the principles of good governance in connection with their work. This is in line with risk management principles and relevant laws, regulations, and standards. The aim is to enhance organizational management, promote transparency, sustainability, and create value, thereby increasing the credibility and acceptance of TISTR's operations among stakeholders, communities, and society. Therefore, the **Governance, Risk Management, and Compliance (GRC) Integration Policy** is hereby declared as follows:

1. Define the objectives and goals of operations that create and enhance value for TISTR, aligning with its context and the expectations of stakeholders, with an analysis of risks, opportunities, and limitations, as well as relevant laws, rules, and regulations.

2. Operate to achieve the objectives and goals effectively and efficiently within the scope of applicable laws, rules, regulations, contracts, agreements, risk management, internal controls, and business continuity management, as well as ethics and code of conduct. This includes providing relevant, reliable, and timely information to external stakeholders, such as regulatory bodies, government agencies, partners and collaborators, customers, suppliers, communities, society, the media, and competitors.

3. Create an atmosphere and culture where the board, management, employees, and staff of TISTR recognize the importance of operating according to the principles of good governance, risk management, and compliance with laws and regulations. Promote knowledge and understanding of the implementation of GRC policies and ensure they are appropriately and sufficiently applied as part of their operations in line with their responsibilities.

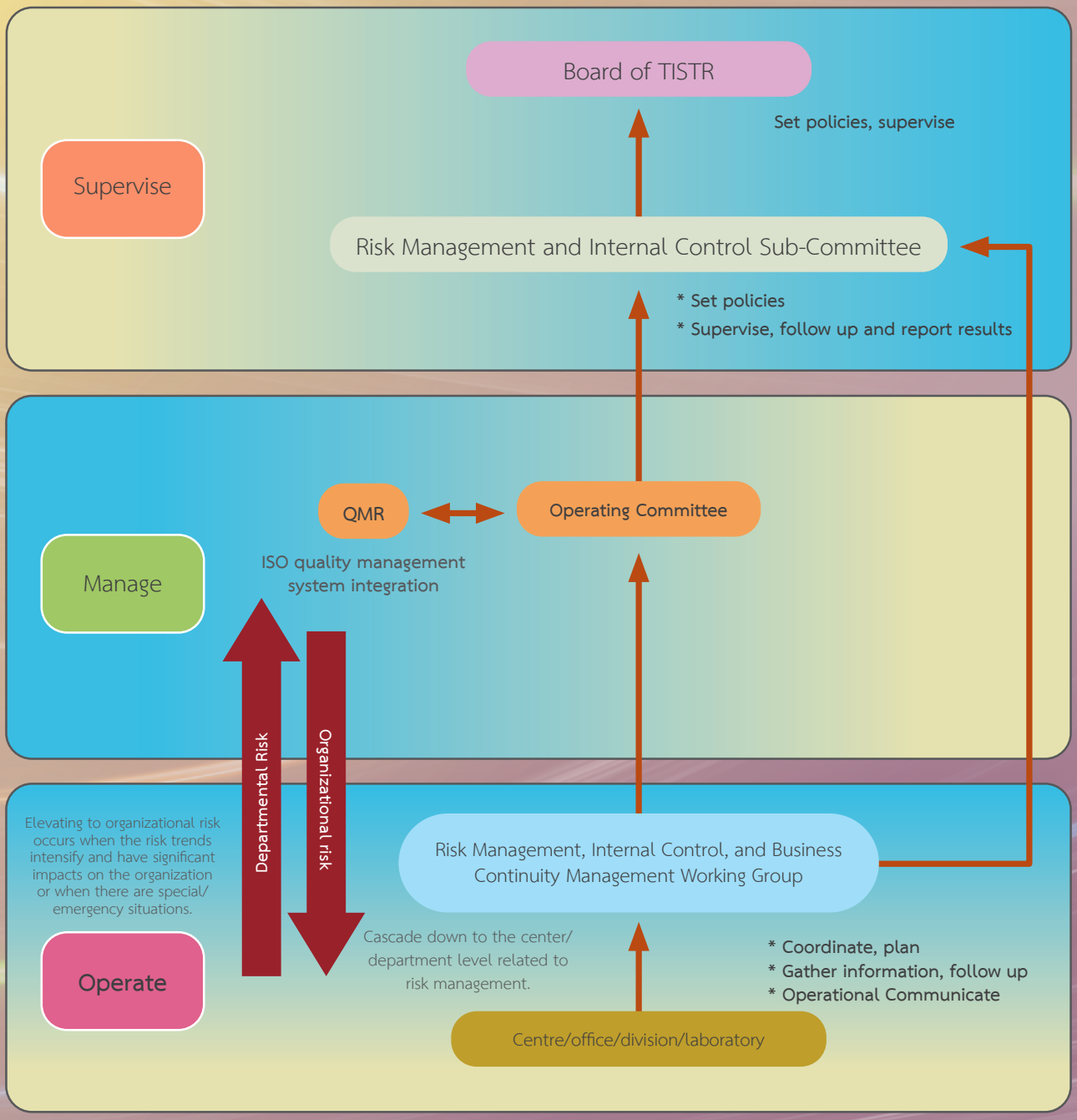
4. Establish a comprehensive risk management system and internal controls at all levels, fostering awareness and understanding of risk management among all personnel.

5. Continuously monitor and evaluate operations and performance to provide input for reviewing, revising, improving, and developing systems and work processes. This will enhance efficiency, appropriateness, and adaptability to changes in both internal and external environments.

6. Promote the use of information technology systems to support operations more effectively and efficiently by overseeing the management of information technology systems in a systematic and governance-compliant manner. This includes ensuring confidentiality, accuracy, completeness, availability, and reliability.

Risk Management Structure of TISTR

TISTR has established a risk management and internal control structure, with a subcommittee for risk management and internal control responsible for setting policies, overseeing, monitoring results, and reporting to the Board of TISTR At the agency level, TISTR has appointed a working group for risk management, internal control, and business continuity management. This group coordinates and drives operations with various centers, departments, divisions, and business units, along with representatives from the management team (QMR). The Quality Management System (ISO 9001) integrates risk management and internal control to comply with ISO requirements.



TISTR categorizes risks into four types: Strategic Risk (S), Operational Risk (O), Financial Risk (F), and Compliance Risk (C). These include the main risks and risk management approaches for the year 2024, along with the performance results, as follows:

Risk factors	Causes of risk	Impact	Management approach	Monitoring of performance
SR-01: The evaluation results based on Core Business Enablers do not meet the targets.	• Lack of integration in the development of strategies and master plans for each area. • Operations by category are still not in line with the criteria.	It affects the overall annual organizational performance assessment (PA) score.	• Develop a gap closure plan for each category and implement the plan thoroughly. • Promote knowledge and understanding in the implementation of the criteria.	• The gap closure plan for the 8 Core Business Enablers in 2024 will be monitored and evaluated by internal auditors. • Organize seminars to provide knowledge and promote participation in the State Enterprise Networking Knowledge Sharing for the responsible individuals in each area of TISTR.
SR-02: The commercialization of research outcomes and/or intellectual property has not met the targets.	• The research outcomes have not reached the target customer groups. • There is a lack of information on the needs of target customers, both in the public and private sectors.	The performance according to the memorandum of agreement does not meet the Level 5 criteria.	• Promote the commercialization of research and development results through marketing and public relations mechanisms. • Develop key marketing databases.	• A total of 23 technologies have been commercialized from the research results. • The intellectual property database system has been activated and made available for use through the WII's Intranet system.

Risk factors	Causes of risk	Impact	Management approach	Monitoring of performance
OR-01: The implementation of research projects (Fundamental Fund ; FF) may not be completed within the specified timeframe.	• Uncertainty of the 2024 budget situation, which was not approved in time for the start of the fiscal year. • Inability to disburse the budget within the specified timeframe.	This caused the project to extend its timeline, impacting the delivery of the outputs.	• Define guidelines/ criteria to address cases of delayed fund allocation and ensure continuity across fiscal years, as well as a spending plan for each FF project to manage and monitor on a quarterly basis. • Develop a system for reviewing and canceling PRs, as well as notifying remaining balances from PRs and loan funds under supervision.	• Establish guidelines for preparing investment budgets by notifying relevant parties to make preparations before the procurement process, and requesting approval for draft terms of reference, as well as during the procurement process to ensure readiness once the budget is approved. • The system is fully operational, and no issues were encountered in using the procurement process on the Web PR page.
OR-02: The implementation of the Digital Transformation plan may not meet the specified timeline.	• The development of the system according to the Digital Transformation plan may not meet the specified timeline. • The development of personnel is not aligned with Digital Transformation.	It impacts the transformation of the organization into a digital entity as per the strategic position in 2025-2026 Digital Transformation.	• Development of the system according to the organization's EA (Enterprise Architecture). • Evaluating the Digital Competency Gap and planning development to close the gap for operational-level personnel involved.	• Development of the system according to the organization's EA (Enterprise Architecture). • Evaluating the Digital Competency Gap and planning development to close the gap for operational-level personnel involved.
FR-01: The ratio of expenses to revenue does not meet the target set.	• Public utility expenses and operating costs have increased, leading to additional contributions of capital.	The funding status of the organization has decreased.	• Prepare a cost- saving plan at the center/ department level, specifying the amount of money that can be reduced in the areas of expenses, materials, utilities, and the budget for additional funding contributions to the organization.	• Implement the cost-saving plan for the categories of expenses and utilities.

Risk factors	Causes of risk	Impact	Management approach	Monitoring of performance
FR-02: Research service income does not meet the target.	• Research/services do not meet customer needs. • The number of clients has decreased due to economic challenges.	The performance according to the memorandum of agreement does not meet the Level 5 measurement criteria.	• Organize marketing activities to generate additional revenue. • Research services targeting specific customer groups. • Expand new services and the scope of testing according to international standards.	• Organize activities to promote SMEs and community enterprises by developing products and packaging from TISTR. • Host events: online/on-ground to promote marketing. • The scope of internationally recognized standards has increased by 5 areas.
CR-01: The new working system of TISTR may not be in compliance with existing laws.	• The development of the new work system/information system may not comply with the relevant laws.	It may lead to lawsuits, such as violations of personal data.	• Develop assessment forms to support the operations of each department in compliance with the law. • Create a linkage diagram of users and those responsible for collecting/updating the laws of each department, with the Legal Department serving as the central hub for connecting data within the organization.	• Submit the assessment form for compliance with laws, regulations, and rules related to operations for the year 2024, covering a total of 10 departments. The assessment found that there is compliance with the relevant laws.

Business Overview, Plans, and Strategies

TISTR operates in alignment with national policies to drive the country's progress by enhancing the competitiveness of industries and SMEs through research, development, and testing services. These efforts aim to add value to products, reduce waste in production processes, and build consumer confidence both domestically and internationally.

TISTR also continuously invests in scientific, technological, and innovation infrastructure while developing specialized personnel in areas such as microbiology, herbal products, safe agriculture, food, extracts, energy, and the environment. Additionally, the organization fosters an environment and management systems that enable knowledge to be transformed into tangible outcomes, addressing national development goals through science, technology, and innovation.

The business initiatives implemented by TISTR under the Science, Research, and Innovation (SRI) Action Plan for Fiscal Year 2024 align with the four key strategies of the SRI framework as follows:

1. Promoting Sustainable Development: TISTR promotes the utilization of infrastructure to support the sustainable development of entrepreneurs, including innovations related to agriculture, food, the environment, tourism, and community lifestyles. This includes developing infrastructure and support systems for research and development at both the central and local levels.

2. Collaborative Research and Technology Transfer: TISTR collaborates with a wide network of public and private sector organizations, universities, and communities (Quadruple Helix) across the value chain—upstream, midstream, and downstream—to advance research and transfer technologies to targeted areas and groups. This includes enhancing local wisdom in the form of community-based "Innovative Identity" initiatives and providing benefits to TISTR's target customers.

3. Scaling Research Outputs: TISTR has developed infrastructure to scale research outputs into production, aligning with Strategy 1 of the SRI Action Plan, which focuses on developing Thailand's economy through value-based and creative economies to achieve competitiveness, self-reliance, and sustainable future readiness.

4. BCG Economy Model: TISTR promotes the development of research that aligns with the BCG Economy Model, a new economic theory integrating the development of three key areas: Bio Economy, Circular Economy, and Green Economy. This model aims to achieve sustainable development in both society and the economy while concurrently protecting the environment.

Examples of such research include initiatives to improve the quality of life in communities, research on renewable energy, innovations for driving low-carbon cities, platforms for assessing carbon storage in economic crops, innovations to reduce greenhouse gas emissions, air pollution control technologies at the city level, waste-to-wealth innovations, waste management to drive a circular

economy, and projects focused on developing model organizations for waste management and climate change mitigation.

5. Developing New Business and Service Offerings: TISTR continuously develops new business and service offerings, including research and innovation initiatives that drive economic and social progress. It expands the scope of its industrial service offerings, ensuring they meet international standards to cover a wide range of industries.

6. Digital Transformation: As an organization transitioning to a digital future, TISTR has improved its service delivery to reduce business operation barriers, resulting in tangible outcomes. It has developed digital systems to facilitate service use and information retrieval for both external customers and internal staff. These systems also serve as a data repository for analysis, forecasting, and proactive work, enhancing efficiency and creating value. Examples include improvements in service delivery, product presentation, and targeted promotional programs that positively impact specific customer groups. This approach helps define clear plans and has led to increasingly tangible outcomes.

7. Developing Skilled Workforce: TISTR recognizes the importance of developing a skilled workforce by enhancing the knowledge and expertise of its personnel in various modern research fields. This enables them to apply their skills in practice and integrate solutions in a comprehensive (Total solution) manner, distinguishing TISTR's services from competitors. TISTR's research development focuses on technology advancement and expanding services in line with the needs of target industries, including those promoted by government policies at different times.

Additionally, TISTR contributes to enhancing the capabilities of farmers and entrepreneurs through the Quick Win Regional project: Up-Skill Re-Skill, which aims to develop high-performance human resources for the Ministry of Higher Education, Science, Research and Innovation (MHESI). It is also involved in driving the high-performance doctoral graduate program in science, research, and innovation (SRI), which aligns with Strategy 4 of the SRI Action Plan. This strategy focuses on developing skilled human resources, higher education institutions, and research agencies as a foundation to drive the country's economic and social development in a sustainable and accelerated manner.

Key Achievements of 2024

TISTR has leveraged its expertise in science, technology, and innovation to meet the needs of people development, address critical issues such as poverty alleviation, and enhance national economic competitiveness. These efforts have garnered both domestic and international recognition. Moreover, TISTR has driven the Bio-Circular-Green (BCG) Economy Model to boost the national economy, increase GDP, distribute income to local communities, and foster environmentally sustainable and resilient societies. The organization has propelled progress in three economic pillars:

1. Bio Economy – A bio-based economic system that emphasizes the efficient utilization of biological resources.

2. Circular Economy – A system that maximizes the reuse of materials and resources to minimize waste.

3. Green Economy – An environmentally sustainable economic system designed to address and mitigate global challenges.

Through these integrated efforts, TISTR aims to create long-lasting solutions that support sustainable development and environmental well-being.

1. TISTR Showcases Innovations and Earns Prestigious Awards TISTR achieved significant recognition at "The 49th International Exhibition of Inventions Geneva" and "The 7th China (Shanghai) International Invention & Innovation Expo 2024," winning a total of 10 awards. These accolades highlight TISTR's expertise in leveraging science, technology, and innovation to address challenges and foster tangible, beneficial national development.

Awards Received:

- **Technology/Innovation for Waste Management and Value-Added Circular Economy**
  - Award for Outstanding Innovation "Prize of Hong Kong Delegation"
  - NRTC Special Award for Excellent Invention
  - Gold Medal
- **Nano Hair Tonic from Safflower Extract:** Utilizing microemulsion technology for Safflomin A to stimulate hair growth and reduce hair loss.
  - Silver Medal
- **RuZiren Dietary Supplement:** Sleep aid and snoring relief product.
  - Distinguished Innovation Award from King Abdulaziz University
  - Bronze Medal

- **Gelling Product to Reduce Abdominal Stretch Marks:** Using goat peptide extract and a serum containing mushroom extract encapsulated in a phytosome delivery system to inhibit abnormal melanin production.
  - Bronze Medal
- **De-BUGs Organic Plus:** An innovative bioinsecticide product from eggshells, a collaborative project by TISTR, Kasetsart University, and Chulalongkorn University.
  - Gold Medal
  - Leading Innovation Award

2. Herbal Innovations Recognition at iENA 2023 The Expert Centre of Innovative Herbal Products (InnoHerb) of TISTR received three awards at the International Trade Fair - Ideas, Inventions, and New Products (iENA 2023) in Nuremberg, Germany. These awards were selected by the National Research Council of Thailand (NRCT) for two products:

- **RuZium Plus Dietary Supplement:** Bone and joint care from gelatin hydrolysis.
  - Bronze Medal
  - Special Award from the Association of Polish Inventors and Rationalizers, Republic of Poland
- **Lotus Extract for Melasma Treatment**
  - Special Award from the Taiwan Prominent Inventor League, Taiwan

These innovations and technologies have been successfully transferred to companies including OD Style Co., Kururo Infinite Co., and Clara Innovation Co.

3. "Tan Diao Model": Comprehensive Community Waste Management in Saraburi Province, Expanding Nationwide Through Public-Private Partnerships TISTR, through the Expert Centre of Innovative Clean Energy and Environment (InnoEn), has driven the "Tan Diao Model" project as a prototype for community waste management. This initiative received the Public Sector Excellence Award (Lert-Rat) in 2021 for outstanding service innovation from the Office of the Public Sector Development Commission (OPDC). Following its success in Saraburi, the project has expanded to cover waste management and environmental impact solutions across other regions of Thailand through collaboration with both domestic and international public and private sector partners, including:

- **Wongpanit Group:** Integrates research, technology, and innovation to establish a learning center for community waste management, focusing on training programs for source-based waste segregation to drive a circular economy.
- **Dow Thailand Group:** In collaboration with the Program Management Unit for Competitiveness (PMUC), the Plastic Institute of Thailand, Ban Chang Municipality, and Rayong Province, has launched the "Material Recovery Facility (MRF)," Thailand's first prototype for a Circular Economy Innovation Centre.

o **Dow Thailand Group:** In partnership with the Plastic Institute of Thailand, Bangkok Metropolitan Administration, Alliance to End Plastic Waste (AEPW) member companies in Thailand, and the Public Private Partnership for Sustainable Plastic and Waste Management (PPP Plastics), has established the "Smart Recycling Hub," piloting in Bangkok and set to expand to the Eastern Economic Corridor (EEC).

4. TISTR Collaborates with Partners for Innovative Agriculture and Sustainable Floriculture Industry The Expert Centre of Innovative Agriculture (InnoAg) of TISTR has successfully developed technologies to support the production sector in alignment with the floriculture value chain. Key initiatives include:

o Developing a foundational database of locally distinctive ornamental plants for commercial use.

o Developing good practices for ornamental plant production.

o Enhancing ornamental plant cultivation with precision agriculture.

o Innovating post-harvest and packaging technologies to facilitate widespread application.

In collaboration with Siam Kubota Corporation Co., Ltd. (KUBOTA), TISTR has undertaken the project "Technology Development for Cut Flower Cultivation Using Agricultural Machinery." This project integrates advanced cultivation techniques with agricultural machinery, creating a new dimension in ornamental plant production. The initiative operates at Kubota Farm in Chonburi, a hub for knowledge dissemination to farmers, organizations, and interested stakeholders. The farm showcases advanced agricultural machinery technologies aligned with modern cultivation processes and offers diverse agricultural solutions.

The collaborative data and insights generated from this project are expected to serve as a foundation for further research, drawing farmers and investors to industrial-scale floriculture production. These developments could extend into high-value sectors such as functional foods, cosmeceuticals, and dietary supplements, contributing to significant market opportunities. Ultimately, the initiative aims to increase farmers' incomes and enhance their quality of life in the context of current societal changes.

Awards of Achievement

TISTR earned prestigious awards for its remarkable achievements on both national and global platforms throughout 2024:

1. Compliance Award

Dr. Chutima Eamchotchawalit, Governor of TISTR, received the Compliance Award under the Government Platform for PDPA Compliance (GPPC) initiative for 2023. This recognition highlighted TISTR's adherence to the Personal Data Protection Act (PDPA). The award ceremony took place on 15 December 2023, at the Auditorium, 2nd Floor, Centara Life Government Complex Hotel & Convention Centre, Chaeng Watthana, Nonthaburi.

2. Certificate of Compliance with ISO/IEC 27001:2022 Information Security Management System Standards

Dr. Chutima Eamchotchawalit, Governor of TISTR, received the Certificate of Compliance with ISO/IEC 27001:2022 Information Security Management System Standards from BSI Group (Thailand) Co., Ltd. BSI Group (Thailand) Co., Ltd. is the Thai branch of BSI Group, a globally recognized organization specializing in industrial standards development. The certification ceremony was held on 27 February 2024, at the Conference Hall, 5th Floor, Admin Building, TISTR Technopolis, Pathum Thani.

3. Princess Health Award

Dr. Pattra Maneesin, Deputy Governor for Administration, represented TISTR in receiving the Princess Health Award for Excellence in Organizational Health Promotion and Environmental Hygiene, Health Region 4, fiscal year 2024. The award was presented during the "2nd Workshop on Health Literacy for New Normal Well-Being in Health Region 4 (HI FORUM)" on 4 July 2024, at Cholapruek Resort, Ban Na District, Nakhon Nayok Province.

4. Award of Outstanding Workplace and State Enterprise Award for Organizational Well-being

Dr. Pattra Maneesin, Deputy Governor for Administration, along with Mrs. Pariyada Visutthipat, a representative of TISTR's Organizational Health Promotion Task Force, received the Award of Outstanding Workplace and State Enterprise for Organizational Well-being for 2024. It was the highest level of excellence in this category. The ceremony took place on 8 August 2024, at the Asawin Grand Ballroom, 4th Floor, Asawin Grand Convention Hotel, Bangkok.

5. "Sampao Nawa Thong" Award

Dr. Chutima Eamchotchawalit, Governor of TISTR, received the "Sampao Nawa Thong" Award for outstanding services in assessment and certification by the Office of Certification Body (OCB) of TISTR through the customer service platform, "TISTR Joint Unit Multi-Task Platform or TISTR Jump." The award was presented by the Thai Chamber of Commerce and Board of Trade of Thailand, recognizing TISTR as an organization that successfully transitioned to a digital platform, improving service delivery and reducing business barriers with tangible results. The award was presented on 19 August 2024, at the University of the Thai Chamber of Commerce (UTCC), Bangkok.

6. National G-Green Logo Award

Dr. Jittra Chaivimol, Deputy Governor for Industrial Services, along with representatives from various departments of TISTR, received two National G-Green Logo Awards for the year 2023:

- Gold Award for the Admin Building of TISTR
- Silver Award for the Algal Excellent Centre (ALEC) of TISTR

The awards were presented on 29 August 2024, at the Rama Gardens Hotel, Bangkok.

7. Outstanding Research Poster Presentation Award

Dr. Rewadee Anuwattana, a Research Expert of the Research and Development Group for Sustainable Development of TISTR, presented her expertise in plastic waste management at the "Ending Plastic Waste Symposium 2024." During the event, TISTR's academic poster won the CRC Award for the most prominent work in driving circular economy initiatives in plastic waste. The award was presented on 7 August 2024, in Melbourne, Australia.

8. Certificate of Honour from the Thai Red Cross Society

Dr. Apakorn Supanya, Deputy Governor for Strategies and Innovation Management, represented TISTR in receiving the Certificate of Honor from the Thai Red Cross Society. This recognition was awarded for TISTR's ongoing collaboration in encouraging regular blood donation, collecting over 1,356 units of blood to help others. The award was presented on 5 September 2024, at the Grand Diamond Ballroom, Impact Forum, Muang Thong Thani, Nonthaburi Province.

9. Certification for "Carbon Footprint for Organization 2024" from the Thailand Greenhouse Gas Management Organization (TGO)

Dr. Chutima Eamchotchawalit, Governor of TISTR, received the certificate for "Carbon Footprint for Organization 2024" from Mr. Pongpanu Svetarundra, Chairman of the Board of Directors of the TGO. The award was presented on 17 September 2024, at the TGO Training Room, Government Complex, Chaeng Watthana, Nonthaburi Province.

Flagship Projects 2024

1. Testing and Development Centre for Transportation and High-speed Rail Technology

The Railway Transportation System Testing Centre (RTTC) of TISTR, accredited with ISO/IEC 17025 for railway system testing, is equipped with experienced personnel and capable testing facilities, making it a leader in Thailand and the ASEAN region. RTTC has executed the project “Testing and Development Centre for Transportation and High-speed Rail Technology” under the national plan for transportation and logistics system development. RTTC supports the testing and certification of railway products to ensure safety and compliance with international standards. The centre accommodates railway technologies from various providers, including systems from China, Japan, Germany, and South Korea.

TISTR recognizes the importance of developing its infrastructure and testing laboratories in accordance with ISO/IEC 17025, as well as enhancing the capabilities of existing rail system testing laboratories in local academic institutions to meet international standards. This will enable the expansion of standardized testing services, guarantee reliable test results, and lead to high-quality research to support the country's rail transportation system. The key objectives are to ensure quality control and safety during the construction and maintenance of rail systems, support the extension of rail system construction projects both domestically and across the ASEAN region, and develop local content product development by transferring knowledge, experience, and specialized expertise to university staff. This aims to create a high-skilled workforce, reduce reliance on imported rail system products, and enhance readiness and expertise in rail system and logistics standards.

In 2024, TISTR successfully trained 50 professionals in advanced skills related to local railway content and remains committed to further long-term professional development.

2. Development of Capabilities and Standards in the Production, Analysis, and Testing of Cosmetic Products at the Industrial Level to Strengthen the Competitiveness of SMEs

The Expert Centre of Innovative Herbal Products (InnoHerb) of TISTR has implemented a project to enhance the capabilities and standards of cosmetic product manufacturing, analysis, and testing at the industrial level to increase the competitiveness of SMEs. This project focuses on production services, testing, and analysis for product registration in compliance with standards, with an emphasis on export promotion.

TISTR recognizes the urgent need to support and enhance the capabilities of SMEs and OTOP entrepreneurs in exporting cosmetic products to global markets. This includes providing consultation on production standards, ensuring compliance with ASEAN GMP standards for cosmetic manufacturing facilities, and meeting essential product safety requirements for product registration and export. For cosmeceuticals, pre-clinical and clinical safety and efficacy data are required to

validate product effectiveness and claims. Therefore, product testing, safety and efficacy evaluations, and quality control are mandatory, particularly when provided by credible government agencies.

TISTR supports the readiness of bio-industry entrepreneurs to meet market demands and facilitates the registration of new herbal cosmeceutical products. As a trusted government organization with expert researchers and state-of-the-art equipment, TISTR assists producers in obtaining product registration and commercialization for both domestic and international markets. This effort bolsters the competitiveness of Thailand's bio-industry while ensuring compliance with international standards.

In 2024, TISTR successfully trained 108 entrepreneurs through programs focused on product development and adherence to international standards. Moreover, 10 cosmetic products were developed for commercial production and distribution domestically and internationally. These products included:

1. Ginger Extract
2. Leanlux Products
3. Lotion from Damask Rose Extract
4. Parrium Goat Milk Soap
5. NanaGlow Absolute Glow Sunscreen
6. Mangosteen and Lucuma Anti-acne Serum
7. Anya Hair Tonic Spray
8. Lotion from Bamboo Water
9. Herbal Soap
10. Care Plus Beta Glucan Glow Serum

Additionally, TISTR operates laboratories certified under OECD GLP (Good Laboratory Practice) standards for evaluating the safety of cosmetic and herbal products. These laboratories comply with OECD guidelines for product safety testing and offer the following four testing services:

1. Skin Irritation Testing following OECD TG 439: In Vitro Skin Irritation: Reconstructed Human Epidermis Test Method
2. Eye Irritation Testing following OECD TG 492: In Vitro Eye Irritation: Reconstructed Human Cornea-like Epithelium (RhCE) Test Method
3. Skin Sensitisation Testing following OECD Test No. 442E: In Vitro Skin Sensitisation: The Interleukin-8 Reporter Gene Assay (IL-8 Luc Assay)
4. UV-Induced Cell Toxicity Testing following OECD Guideline 432: In Vitro 3T3 NRU Phototoxicity Test (OECD TG 432)

3. Product Enhancement and Development of Medical Biomechanics Testing Capabilities to Support the Comprehensive Medical Industry

The Material Properties Analysis and Development Centre (MPAD) of TISTR has conducted a project to enhance product quality and develop medical biomechanics testing capabilities to

support the comprehensive medical industry. This initiative is part of the integrated development plan for future industries and services. The project aims to reduce reliance on imported medical materials, equipment, medical products, prosthetic components, and alternative medical materials from abroad. It addresses key challenges in manufacturing processes, testing efficiency, and safety in compliance with international medical standards. The project also mitigates issues such as the lack of consultants for product quality development and insufficient domestic biomechanical testing laboratories, which hinder the ability to fully meet the needs of entrepreneurs for comprehensive analysis and testing services for materials, equipment, and medical products. This is particularly critical for obtaining production or import permits for medical devices in compliance with standards set by the Thai Industrial Standards Institute (TISI). Globally, the ISO 13485 quality management system is widely recognized as a key standard for the medical device industry.

TISTR recognizes the importance of fostering economic growth and sustainable development in Thailand. With its expertise and experience in analysis, testing, inspection, and consultancy services, TISTR is dedicated to supporting the industrial sector and SMEs, aiming to reduce the significant costs associated with overseas testing. Furthermore, the production of complex prototypes, which require customization to individual anatomical specifications, relies on advanced technologies such as 3D imaging (CT Scanning) and 3D printing.

In 2024, TISTR expanded the scope of its ISO 17025 certification to encompass torque testing for metallic bone screws in accordance with ASTM F543 Annex 3. MPAD now provides medical biomechanics testing services for medical materials, equipment, products, prosthetic components, and alternative medical materials, including:

1. Single Cycle Bend Testing of Metallic Bone Plates following ASTM F382 A1
2. Torsional Properties, Driving Torque, and Axial Pullout Strength Testing of Metallic Bone Screws following ASTM F543 A1, A2, and A3
3. Torsion Testing of Implant Fixtures in compliance with ISO 13498
4. Static Braking Testing of Implant Fixtures in compliance with ISO 14801
5. Corrosion Resistance Testing of Delivery Cables in compliance with ISO 10555-1:2023 (E) Annex A

Customer satisfaction with these services has been rated as good to very good, achieving a 100% satisfaction rate.

Important Events

TISTR Engages in Networking and STI Exchange at STS Forum 2023 in Japan

Dr. Chutima Eamchotchawalit, Governor of TISTR, Dr. Boonnanida Sodha, Director of the International Relations Division, and Dr. Waraporn Sorndech, Research Officer of the Expert Centre of Innovative Health Food (InnoFood), attended the opening ceremony of the 20th Annual Meeting of the Science and Technology in Society Forum (STS Forum 2023). They also participated in the closing session titled "Science and Technology for the Future of Humankind."

On this occasion, Dr. Wiparat De-ong, Executive Director of the National Research Council of Thailand (NRCT), and MHESI Executives joined the ceremony on October 3, 2023, at the Kyoto International Conference Centre (ICC Kyoto) in Kyoto, Japan.

TISTR Showcases Innovations for Low-Carbon Cities to Deputy Prime Minister Anutin Charnvirakul

Mr. Anutin Charnvirakul, Deputy Prime Minister and Minister of Interior, visited the Ministry of Higher Education, Science, Research and Innovation (MHESI) to deliver government policies. He was welcomed by Ms. Supamas Isarabhakdi, Minister of Higher Education, Science, Research and Innovation, Mr. Permsuk Sutchaphiwat, Permanent Secretary of MHESI, and other MHESI executives.

During the visit, Dr. Chutima Eamchotchawalit, Governor of TISTR, Dr. Pratip Vongbandit, Deputy Governor for R&D for Sustainable Development of TISTR, along with TISTR executives and researchers, presented innovations for low-carbon cities. These innovations included research on ornamental plants, an innovative centre for the circular economy, recycled material and processing technologies, and a study project on microorganisms for waste treatment and germ elimination. The event took place on November 3, 2023, at the MHESI Office on Yothi Road, Bangkok.

TISTR Showcases Agricultural Productivity Technologies to Alleviate Poverty in Upper Northeastern Region

Ms. Supamas Isarabhakdi, Minister of Higher Education, Science, Research and Innovation (MHESI), visited the TISTR exhibition, where she was welcomed by Dr. Chutima Eamchotchawalit, Governor of TISTR. TISTR showcased its innovative agricultural productivity technologies, including methods to increase off-season mango yields by 1-2 times and the development of value-added products from the local red lotus, an identity flower of Udon Thani Province, for cosmetic applications. These initiatives are part of MHESI-driven projects aimed at alleviating poverty, reducing inequality, and fostering community development through an area-based approach.

The exhibition was part of the Minister's official site visit and the Cabinet Meeting Off-site 1/2023 in the upper Northeastern region (covering Bung Kan, Loei, Nong Khai, Nong Bua Lamphu, and Udon Thani Provinces) on December 3, 2023, at Udon Thani Rajabhat University, Udon Thani Province.

TISTR Enhances Thai Entrepreneurs' Competitiveness at OTOP City 2023

TISTR boosted Thai entrepreneurs' competitiveness through Science, Technology, and Innovation (STI) at OTOP City 2023, organized by the Community Development Department, Ministry of Interior. Mr. Anutin Charnvirakul, Deputy Prime Minister and Minister of Interior, presided over the opening ceremony. Accompanied by Ms. Supamas Isarabhakdi, Minister of Higher Education, Science, Research and Innovation (MHESI), and Dr. Chutima Eamchotchawalit, Governor of TISTR, he visited TISTR's exhibitions and OTOP entrepreneur booths showcasing the applications of STI to enhance capabilities and strengthen businesses.

The event was held on December 18, 2023, at Impact Muang Thong Thani, Nonthaburi Province.

China-ASEAN High Speed Railway Forum for Knowledge Exchange and Cooperation

TISTR, in collaboration with NSTDA and CRRC, organized the China-ASEAN High Speed Railway Technical Development Forum to facilitate knowledge exchange and foster cooperation in railway system research and development.

Dr. Chutima Eamchotchawalit, Governor of TISTR, inaugurated the forum, which was organized by the Railway Transportation System Testing Centre (RTTC) of TISTR, the National Science and Technology Development Agency (NSTDA), and CRRC Qingdao Sifang Co., Ltd., from the People's Republic of China. The event aimed to promote knowledge exchange and networking in railway system research among ASEAN countries, under the cooperation of the China-Thailand Belt and Road Joint Laboratory on Rail Transit. The forum took place on December 21, 2023, at the Aswin Grand Convention Hotel, Lak Si, Bangkok.

TISTR Participates in Government Lottery Drawing on January 17, 2024

Dr. Chutima Eamchotchawalit, Governor of TISTR, was appointed as the chair for the Government Lottery Drawing on January 17, 2024. She was accompanied by Ms. Kanjana Dummananda, Director of the Office of the Governor, Dr. Rochana Tangkoonboribun, Director of the Expert Centre of Innovative Agriculture (InnoAg), Ms. Thanomchit Wanawattanakul, Director of Treasury Management, Dr. Sitthipong Soradech, Research Officer of the Expert Centre of Innovative Herbal Products (InnoHerb), Dr. Nuttapon Vachiroroj, Research Officer of the Biodiversity Research Centre, and Mr. Apinan Chantra, Public Relations Officer of the Public Relations Division, Organizational Communication Office. The TISTR team drew the 4th and 5th lotto prizes at the Government Lottery Office in Nonthaburi Province.

TISTR Presents “Green Station: From Waste-to-Wealth Innovation” at Science Avenue 2024

Ms. Supamas Isarabhakdi, Minister of Higher Education, Science, Research and Innovation (MHESI), inaugurated Science Avenue on National Children’s Day 2024. Dr. Chutima Eamchotchawalit, Governor of TISTR, along with TISTR staff, attended the event on January 12, 2024, at the MHESI Office in Bangkok. TISTR hosted activities focused on environmentally friendly innovations aimed at enhancing children’s awareness of global conservation efforts.

One of the highlights was the “Green Station: TISTR Innovation from Waste to Wealth,” which included a demonstration of the “Smart Machine,” an automated waste collection, sorting, and recycling machine. Activities also featured games that encouraged children to think before discarding waste, sort waste properly, and understand decomposition times.

TISTR at ProPak Philippines 2024: Enhancing Entrepreneurs' Competitiveness through Packaging Seminar

Dr. Chutima Eamchotchawalit, Governor of TISTR, had the honor of participating in the opening ceremony of ProPak Philippines 2024. The event was chaired by HON. RENATO U. SOLIDUM JR., Secretary of the Department of Science and Technology (DOST) of the Philippines. Also in attendance were Dr. Pattra Maneesin, Deputy Governor for Administration of TISTR, Ms. Rachaneepen Pensit, Director of the Thai Packaging Center (TPC), and Dr. Supoj Pratheepthinthong, Senior Technical Officer of TPC. The ceremony took place on January 31, 2024, at the World Trade Center Metro Manila, Pasay City, Philippines.

TISTR Hosts the 46th State Enterprise Sports Golf Tournament

TISTR hosted the 46th State Enterprise Sports Golf Tournament on February 9, 2024, at Windsor Park and Golf Club in Bangkok.

TISTR at Thailand Inventors' Day 2024

Her Royal Highness Princess Maha Chakri Sirindhorn graciously presided over the opening ceremony of Thailand Inventors' Day 2024, organized by the National Research Council of Thailand (NRCT). The event, held from February 2-6, 2024, at the Bangkok International Trade and Exhibition Centre (BITEC), Bangkok, was themed "Inventions and Innovations Leading the Country."

During the event, the Thailand Institute of Scientific and Technological Research (TISTR) conducted a seminar on various quality management systems, including ISO 9001 (Quality Management), ISO 14001 (Environmental Management), and ISO/IEC 17025 (Laboratory Quality Systems for Organizational Potential Development). The seminar was presented by Dr. Jittra Chaivimol, Deputy Governor for Industrial Services of TISTR.

Additionally, the Expert Centre of Innovative Agriculture (InnoAg) of TISTR showcased its research project on ornamental plants, highlighting new disease-free Chrysanthemum varieties. This project, supported by the NRCT, aims to advance agricultural innovation.

TISTR Supports Safe Driving During Songkran Festival with Rest Stop Initiative

To promote safe driving and reduce road accidents during the Songkran Festival, TISTR supported the government's initiative and traditional culture by providing a 'Rest Stop' at its Lam Takhong Research Station in Nakhon Ratchasima. From April 8-14, 2024, this rest stop served travelers on Mittraphap Road, offering them a place to pause and take a break during their long journeys home. This initiative aimed to enhance safety and comfort for all travelers during the festive period.

TISTR Participates in Launch of “MHESI for AI” Policy

On November 29, 2024, Ms. Supamas Isarabhakdi, Minister of Higher Education, Science, Research and Innovation (MHESI), launched the “MHESI for AI” policy at the Auditorium, Sirindhorn Science Home, Thailand Science Park, Khlong Luang, Pathum Thani Province. This policy aims to equip Thais with AI skills for national development and transform universities through AI integration.

The policy includes three significant plans:

1. Promoting AI for lifelong learning.
2. Creating 30,000 AI-skilled workers within three years.
3. Leveraging AI in the business sector to boost the Thai economy.

The event was attended by Mr. Permsuk Sutchaphiwat, Permanent Secretary of MHESI, Dr. Chutima Eamchotchawalit, Governor of TISTR, MHESI executives, and leading international public and private agencies. They presented their initiatives to support this transformative policy.

TISTR Welcomes Minister of MHESI in Phetchaburi Province

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On May 13, 2024, Ms. Supamas Isarabhakdi, Minister of Higher Education, Science, Research and Innovation (MHESI), along with Ms. Suchada Thaensap, Secretary to the Minister, Prof. Dr. Supachai Pathumnakul, Deputy Permanent Secretary of MHESI, and other MHESI executives, conducted an on-site visit and Cabinet Meeting in the Lower Central Part 2 region, covering Prachuap Khiri Khan, Phetchaburi, Samut Sakhon, and Samut Songkhram Provinces. The visit aimed to follow up on MHESI operations. During this occasion, Assoc. Prof. Dr. Pasit Lorterapong, Board Chairman of TISTR, Dr. Chalermsak Lertwongsatien, Board Member of TISTR, Dr. Chutima Eamchotchawalit, Governor of TISTR, along with TISTR executives and researchers, welcomed the delegation and showcased their exhibitions focused on driving the BCG Economy Model.

One of the highlights was the product showcase from Lemon Gold Part Ltd. (L.M.G), an entrepreneur specializing in frozen lemon juice and essential oil production from lemon peels. This project, which aims to develop lemon products and establish standards for essential oils in the lemon juice industry, received financial support from the Agricultural Research Development Agency (Public Organization) (ARDA). The event took place at Uncle Thanom's Palm Garden in Tham Rong, Ban Lat, Phetchaburi Province.

TISTR Participates in Video Recording to Bless Her Majesty Queen Suthida Bajrasudhabimalalakshana

On May 8, 2024, Dr. Chutima Eamchotchawalit, Governor of TISTR, along with TISTR executives, participated in a video recording to offer blessings to Her Majesty Queen Suthida Bajrasudhabimalalakshana. This special recording was made in honor of Her Majesty's birthday anniversary, reflecting TISTR's respect and admiration for the Queen.

TISTR Showcases Research and STI Services for Low-Carbon Society at ProPak Asia 2024

On May 21, 2024, Dr. Chutima Eamchotchawalit, Governor of TISTR, along with representatives from partner agencies such as the Federation of Thai Industries, the Thai Chamber of Commerce, and Informa Markets (Thailand), participated in a press conference for ProPak Asia 2024. This premier expo event in Asia focuses on manufacturing, processing, and packaging.

The theme of the event was “Power of Success in Sustainable Manufacturing and Packaging through Creativity, Innovation, and Investment.” The press conference took place at the Siam Kempinski Hotel in Pathumwan, Bangkok, highlighting the collaborative efforts and innovative approaches driving sustainable practices in the industry.

TISTR Joins 5th Anniversary Celebration of MHESI Establishment

On May 2, 2024, Ms. Supamas Isarabhakdi, Minister of Higher Education, Science, Research and Innovation (MHESI), led Buddhist ceremonies to mark the 5th anniversary of MHESI. The event included offerings to monks and a tribute to the King Rama IV Monument, celebrating Thailand's progress in higher education and science over the past five years.

Attendees included Mr. Permsuk Suchaphiwat, Permanent Secretary, Ms. Pechdau Tohmeena, Advisor to the Minister, Ms. Suchada Thaensap, Secretary to the Minister, Dr. Chutima Eamchotchawalit, Governor of TISTR, Dr. Pattra Maneesin, Deputy Governor of TISTR, along with TISTR executives and researchers. The ceremony was held at the MHESI Office in Bangkok.

TISTR Participates in Video Recording to Bless His Majesty King Rama X

On June 26, 2024, Dr. Chutima Eamchotchawalit, Governor of TISTR, along with TISTR executives, participated in a video recording to offer blessings to His Majesty King Maha Vajiralongkorn Bodindradebayavarangkun (King Rama X). This recording was made in honor of His Majesty's birthday on July 28, to express loyalty and commemorate His Majesty's great kindness towards the Thai people. The event took place at the National Broadcasting Service of Thailand (NBT) (Channel 11) in Din Daeng, Bangkok.

TISTR Joins Press Conference for IGNITE THAILAND: Future Workforce for Future Industry

On June 17, 2024, Mr. Anutin Charnvirakul, Deputy Prime Minister and Minister of Interior, discussed “Workforce Development for Future Industry” at the IGNITE THAILAND: Future Workforce for Future Industry press conference, organized by the Ministry of Higher Education, Science, Research, and Innovation (MHESI). Ms. Supamas Isarabhakdi, MHESI Minister, provided guidelines on this initiative.

Dr. Chutima Eamchotchawalit, Governor of TISTR, along with executives from MHESI and partner agencies, attended the event held at the Santi Maitri Building, Government House, Bangkok. The conference focused on preparing the Thai workforce for future industries through advanced training and education, ensuring Thailand's competitiveness in the global market.

MHESI Minister Celebrates 61st Anniversary of TISTR

On June 12, 2024, Ms. Supamas Isarabhakdi, Minister of Higher Education, Science, Research and Innovation (MHESI), chaired the opening ceremony for the 61st anniversary of TISTR at TISTR Technopolis, Khlong 5, Pathum Thani Province. The event was attended by Mr. Passakorn Boonyaluck, Governor of Pathum Thani Province, along with MHESI executives, TISTR executives, and staff who warmly welcomed the guests.

The celebration included several key activities:

- A press conference on the "MHESI Policy to Support TISTR" as a premier research organization in product development for the aging society and medical sciences.
- The launch of FODMAP food certification for irritable bowel syndrome.
- Presentation of certificates to contributors of TISTR.
- A signing ceremony for a partnership in the Thai ATMP industry for cell therapy, aiming to establish an international medical hub with Kluay Nam Thai Hospital Co. Ltd., AGEMBIO PTE LTD Singapore, and Vega Wellness Co. Ltd.
- Opening ceremonies for the new '60th Anniversary TISTR Building,' which will serve as a center for technology transfer, providing services and benefits to entrepreneurs.

TISTR Joins Opening Ceremony of MHESI Operations Center – 'Colonel Wit'

On July 8, 2024, Ms. Supamas Isarabhakdi, Minister of Higher Education, Science, Research, and Innovation (MHESI), chaired the launch of the MHESI Operations Center named 'Colonel Wit.' This center aims to utilize science, technology, and innovation to improve people's quality of life, promote the economy, address environmental issues, and respond promptly to problems and needs. It also seeks to expand its network nationwide.

The Department of Science Service (DSS) serves as the host and main operating agency. People or agencies can contact the center via a 24-hour hotline at 1313, as well as through social media platforms such as Facebook and Line OA.

The event took place at the press conference room in the Phra Chom Klao Building, Office of the Permanent Secretary of MHESI, Yothi Road, Thung Phaya Thai, Ratchathewi, Bangkok.

TISTR, RMUTT, and NRCT Collaborate to Produce STI-Skilled Graduates

On July 9, 2024, TISTR, in collaboration with Rajamangala University of Technology Thanyaburi (RMUTT) and supported by the National Research Council of Thailand (NRCT), organized a seminar at Rama Gardens Hotel, Bangkok. The seminar, titled “Development of a Prototype of High-Competence Doctoral Graduates in STI to Support the BCG Economy Model,” aimed to produce doctoral graduates with advanced research skills and social competencies. The goal is to advance research to production and commercialization, fostering sustainable economic, social, and environmental value.

TISTR's Tribute to Her Majesty Queen Sirikit, the Queen Mother

Dr. Chutima Eamchotchawalit, Governor of TISTR, along with TISTR Executives, participated in a video recording to honor Her Majesty Queen Sirikit, the Queen Mother on the auspicious occasion of her birthday anniversary on August 12th. This event took place on July 19, 2024, at the National Broadcasting Service of Thailand (NBT) in Din Daeng, Bangkok.

Launch of "Microorganisms BioD I" to Address Rice Stubble Burning

Dr. Chutima Eamchotchawalit, Governor of TISTR, and Mr. Komsan Yanawattana, Deputy Governor of Pathum Thani Province, along with AAPICO Hitech Public Company Limited, launched the "Microorganisms BioD I" initiative. This project aims to decompose rice stubble and enhance nutrients in rice fields.

The launch event, part of the "Campaign to Stop Burning in Agricultural Areas for a Smoke-Free Pathum Thani City," took place on July 17, 2024, at Wat Tra Pang and a rice demonstration field in Moo 5, Chiang Rak Yai, Sam Khok, Pathum Thani Province. The event also showcased "TISTR technologies to upgrade Pathum's agriculture," highlighting innovative solutions for sustainable farming practices.

TISTR Showcases "TISTR for Well-being and Longevity" at MHESI Fair 2024

At the MHESI Fair 2024: SCI Power for Future Thailand, the Thailand Institute of Scientific and Technological Research (TISTR) showcased its multidisciplinary research. The exhibition highlighted Thailand's potential for economic development through higher education, science, research, and innovation. It also emphasized fostering trust in innovative businesses and startups to enhance Thailand's global standing.

The TISTR exhibition, themed "TISTR for Well-being and Longevity," was located in Zone E: Science for All Well-being. The event took place from July 22-28, 2024, at the Queen Sirikit National Convention Center in Bangkok.

TISTR and Partner Agencies Honor His Majesty King Rama X with Forest Planting Event

To celebrate His Majesty King Maha Vajiralongkorn Bodindradebayavarangkun (King Rama X) on the auspicious occasion of his 72nd birthday anniversary, TISTR and Thailand Science Research and Innovation (TSRI) organized a forest planting event. The ceremony took place on July 27, 2024, at the Sakaerat Environmental Research Station of TISTR in Nakhon Ratchasima Province.

Dr. Pratip Vongbandit, Deputy Governor for R&D Group for Sustainable Development of TISTR, led the event, accompanied by Dr. Jittra Chaivimol, Deputy Governor for Industrial Services, Mr. Chalermchai Jeerapan, Director of the Expert Centre of Innovative Clean Energy and Environment (InnoEn), Dr. Surachit Waengsothorn, Director of the Sakaerat Environmental Research Station (SERS), and other TISTR staff.

This initiative underscores TISTR's commitment to environmental conservation and honors the legacy of His Majesty King Rama X through meaningful and impactful activities.

TISTR, NRCT, and Saraburi Province Launch Waste Management Prototype for a Sustainable Low-Carbon Society

In collaboration with Saraburi Province and the Saraburi Sandbox network, TISTR has launched a kick-off project to develop a waste management prototype for agricultural and urban areas. Funded by the National Research Council of Thailand (NRCT), this initiative aims to reduce carbon emissions and promote a sustainable low-carbon society.

The launch event took place on August 20, 2024, in Saraburi Province. This project is a significant step towards innovative waste management solutions that benefit both the environment and local communities.

TISTR Showcases "TISTR Inspiring Science for the Next Gen" at National Science and Technology Fair 2024

On August 17, 2024, Ms. Supamas Isarabhakdi, Acting Minister of Higher Education, Science, Research and Innovation (MHESI), along with other executives, chaired the opening ceremony of the "TISTR Inspiring Science for the Next Gen" exhibition at Hall 9, IMPACT Muang Thong Thani, Nonthaburi Province.

The exhibition featured:

1. Development of High-Competence Doctoral Graduates in STI for the BCG Economy Model: Also known as the Thailand Academy of Science, this project is supported by the National Research Council of Thailand (NRCT).

2. Functional Food/FODMAP & Healthy: Highlighting trends for health enthusiasts.

3. Games and Activities: Designed to build happiness, fun, and relationships within families and teams.

This event was part of the National Science and Technology Fair 2024, held from August 16-25, aiming to inspire and engage the next generation in science and technology.

TISTR Showcases "Innovation Driving a Low-Carbon Society" at Thailand Research Expo 2024

The Thailand Institute of Scientific and Technological Research (TISTR) presented groundbreaking research and innovations aimed at addressing environmental challenges and driving a low-carbon society at the Thailand Research Expo 2024. The event took place from August 26-30, 2024, from 9 a.m. to 5 p.m., on the 22nd floor of the Centara Grand Hotel at CentralWorld, Bangkok.

The exhibition featured three key projects:

1. CO_2 Utilization for Algae Cultivation: Showcasing how CO_2 can be effectively used to support algae growth in the industrial sector.

2. CO_2 Capture and Utilization for Bio Methanol Production: Highlighting advanced technology for capturing CO_2 and converting it into bio methanol.

3. Biomass Database for Carbon Capture and CO_2 Absorption: Presenting data on carbon capture and CO_2 absorption in the forest ecosystem at the Sakaerat Environmental Research Station.

These projects demonstrate TISTR's commitment to developing sustainable solutions that mitigate environmental impact and promote a greener future for Thailand.

TISTR Presents STI Research for Food Industry at Food Ingredients Asia 2024, Indonesia

Dr. Chutima Eamchotchawalit, Governor of TISTR, delivered a congratulatory speech at Food Ingredients Asia 2024 (FiAsia 2024), hosted by Informa Markets (Thailand), held from September 4-6, 2024, at Jakarta International Expo (JIExpo), Indonesia.

During the event, Dr. Chutima and Dr. Waraporn Sorndech were invited as speakers to discuss the "Role of Research and Innovation in Today's Food Trends." Additionally, Dr. Krittiya Thisayakorn, Director of the Expert Centre of Innovative Herbal Products (InnoHerb), and Dr. Sarunya Laovitthayanggoon, Senior Research Officer of InnoHerb, participated in the event. They showcased TISTR's cutting-edge research and technology in food and beverage production at an industrial level.

This participation highlights TISTR's commitment to advancing the food industry through research and innovation.

TISTR Joins MHESI's Caravan to Aid Flood Victims

On September 13, 2024, Ms. Supamas Isarabhakdi, Minister of Higher Education, Science, Research and Innovation (MHESI), chaired and launched a MHESI caravan to deliver supplies and necessities to flood victims in affected areas. The event took place at the MHESI Office on Yothi Road, Thung Phaya Thai, Ratchathewi, Bangkok.

Key participants included Mr. Permsuk Sutchaphiwat, Permanent Secretary of MHESI, MHESI executives and staff, and Dr. Chutima Eamchotchawalit, Governor of TISTR.

TISTR contributed to the relief efforts by providing:

1. Instant food and vitamin-enriched drinking water.
2. Lemongrass balm for treating athlete's foot and skin diseases caused by fungi.
3. Electrolyte water for disinfection, used to eliminate viruses, bacteria, and fungi by spraying, wiping, and cleaning affected houses.

This initiative highlights TISTR's commitment to supporting communities in times of need through practical applications of their research and innovations.

Research and Development Projects Completed in Fiscal Year 2024

TISTR conducts integrated R&D with missions aligned with the new economy model "Bio-Circular-Green: BCG," following the sufficiency economy philosophy to ensure sustainable development for the country. The BCG model includes:

- **Bio Economy:** Focusing on the efficient use of resources.
- **Circular Economy:** Maximizing the reuse of materials.
- **Green Economy:** Addressing pollution problems.

In fiscal year 2024, 39 R&D projects were completed under various innovative expert centers, as well as the biodiversity research center, Lamtakhong research station, Sakaerat environmental research station, industrial metrology and testing service center, material properties analysis and development center, Thai packaging center, and railway transportation system testing center. Here are the highlights:

Expert Centre of Innovative Agriculture (InnoAg)

InnoAg aims for excellence in community agriculture technology, integrating R&D, technology, and innovation to address national issues for both social and commercial use. It also focuses on technology transfer and infrastructural development to provide services to economic and social sectors. InnoAgr has expertise in organic agriculture, R&D and cultivation promotion of herbs, indigenous plants, and new economical plants, strain improvement of mushrooms, factors in 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 fiscal year 2024, one project was completed:

1. Research and development of Edelweiss production system for utilization in agriculture, food industry, and cosmeceuticals.

Expert Centre of Innovative Health Food (InnoFood)

InnoFood focuses on research and development to add value to domestic raw materials, functional food, and dietary supplements. InnoFood aims to create innovation in health food and health food products, including infrastructural services to support Thai entrepreneurs in using research results for commercialization, to be competitive in the global market. InnoFood has expertise in functional food and beverage products, dietary supplements, natural substances in food, and instrument and machinery design for food production.

In fiscal year 2024, four projects were completed:

1. Research on innovative protein from Thai bio-based plants to promote health and develop into commercialization for future food security.

2. Research and innovation development promoting the insect industry to uplift competitiveness in the creative economy.

3. Research on innovative functional food products and functional active compounds to promote health in joints and bones for pre-aging and aging society.

4. Research and development on production factors affecting nutrition enhancement of Asparagus officinalis L. for use in health supplement food production.

Expert Centre of Innovative Herbal Products (InnoHerb)

InnoHerb specializes in cosmeceutical and pharmaceutical products derived from herbs. It serves as an integration center for research, development, service, and the creation of innovative health products from herbs, ensuring international compliance. The goal is to use research to add value to products for commercialization. InnoHerb has expertise in the extraction technology of active natural substances from herbs and conducts research in pharmacology and toxicology.

In fiscal year 2024, seven projects were completed:

1. Research and development on health products from high-quality functional active volatile compounds.

2. Research and development on functional active compounds from economic mushrooms for use in the functional food industry.

3. Research on identity herbs of the Southern region: Garcinia cambogia to develop health-promoting products.

4. Development of herbal products to enhance competitiveness and uplift the herbal industry to 4.0.

5. Innovation and technology development to create value-added products from Bengal currant (Carissa carandas L.) and promote it as a potential plant of the country.

6. Development of service infrastructure potential in quality testing, efficacy, and cosmetic production to meet international standards.

7. Development of potential and standards in production, testing, and analysis of cosmetic products at the industrial level to enhance the competitiveness of small and medium enterprises (SMEs).

Expert Centre of Innovative Clean Energy and Environment (InnoEn)

InnoEn aims for excellence in renewable energy and environmental management, promoting sustainable integration into the country's economy and green society. It focuses on infrastructure development for the transfer of knowledge, technology, and innovation. InnoEn has expertise in clean energy from biomass, environmental management, energy-related resources, climate change, biodiversity, and regulations/mechanisms in carbon footprint and water footprint.

In fiscal year 2024, nine projects were completed:

1. Application of biotechnology processing to biomass waste materials from sugarcane farming to produce alternative energy according to the BCG model approach.
2. Research and development on efficiency, waste reduction, and utilization of secondary products from the three-step gasification process.
3. Efficiency enhancement for alternative energy production from biomass by Torrefaction and gasification processes.
4. Research and development on innovation to enhance energy technology competitiveness from biogas under the Bio-Circular-Green Economy (BCG) concept.
5. Development of municipal waste management technology to produce energy and create value-added products.
6. Innovative separation and value-added product creation from colored polyethylene terephthalate (PET) plastic waste.
7. Innovative management and processing of municipal waste and single-use plastic packaging to create value-added products and utilization according to the circular economy principle.
8. Carbon cycle evaluation and bio-methanol product development for various industries.
9. Testing of decentralized electrical generation from solar energy combined with biogas from continuous bio-material sources and net zero carbon dioxide management.

Expert Centre of Innovative Materials (InnoMat)

InnoMat focuses on conducting R&D on innovative materials, transferring technology and innovation to promote and support industrial development, creating jobs, and generating sustainable incomes for local communities. InnoMat has expertise in R&D on health materials, energy and environment materials, and natural materials, adding value and standards to products.

In fiscal year 2024, four projects were completed:

1. Development of tooth structure reinforced materials to meet quality standards for dental use.
2. Innovative utilization of by-products and residues from pineapples for alternative energy production and high-value products based on the Bio-Circular-Green (BCG) economy model.

3. Recycling utilization of biomass power plant ash into products to promote the growth of field crops.

4. Innovative materials from bioresources and recycled materials for healthcare.

Expert Centre of Innovative Industrial Robotics and Automation (InnoRobot)

InnoRobot provides a comprehensive range of technology services in robotics and automation. These services include consultancy, design, and manufacturing of automation and automatic control systems according to customer requirements, as well as training programs and technology transfer of automation production technology to entrepreneurs.

In fiscal year 2024, one project was completed:

1. Value-added creation of waste materials from coffee bean processing for Northern region entrepreneurs.

Biodiversity Research Centre (BRC)

BRC is the national centre for the collection, conservation, and R&D on the sustainable utilization of bio-resources, aiming to enhance national competitiveness in bio-industry and bio-economy at both regional and global levels. BRC has expertise in the collection, preservation, and management of biodiversity information databases, including microorganisms, plants, and animals, as well as R&D in science, technology, and innovative bio-substances and bio-products.

In fiscal year 2024, four projects were completed:

1. Development of probiotic microorganism technology for sustainable utilization.

2. Development of probiotic microorganism technology for sustainable utilization.

3. Development of commercial algae production for comprehensive value-added creation in the BCG economic system.

4. Development of a database system of microorganism information and a digital service system to support the bio-based economy development of the country.

Lamtakhong Research Station (LTRS)

LTRS is a focal area for conducting agricultural research and disseminating agricultural technology to communities and society. Its mission includes conducting research, development, and translating agricultural technology, along with fostering awareness of natural resource conservation. LTRS has evolved into a learning site for scientific research, contributing to sustainable development. It serves as a learning site for botany, plant genetic conservation, agriculture studies, and eco-tourism. LTRS also provides

a service center for conference venues and accommodation, offering close consultation and knowledge from researchers.

In fiscal year 2024, three projects were completed:

1. High precision agriculture production potential development for economic plants using digital technology and unmanned aerial vehicles.
2. Research and development on alternative protein from high-protein pigeon pea variety for utilization in the food industry.
3. Research and development on yield and quality enhancement processes of soybean under drought stress.

Sakaerat Environmental Research Station (SERS)

SERS is an UNESCO Biosphere Reserve that plays a role in conservation development and supports scientific research linked to international networks globally. SERS conducts environmental and forest ecological research (dry evergreen forest and dipterocarp forest) to create academic wisdom and provide support for the economic and social development of Thai people. SERS also serves as a learning site for students, an eco-tourism destination for relaxation, and a research and educational site for various plants and animals. SERS provides a service center for conferences and seminars, with facilities and accommodation.

In fiscal year 2024, one project was completed:

1. Conservation prototype and habitat restoration to maintain biological diversity and sustainable utilization in the Sakaerat biosphere reserve area.

Industrial Metrology and Testing Service Centre (MTC)

MTC aims to enhance the capacity of the industrial sector, promoting the strength of government and educational agencies. It provides analysis, testing, and calibration results that are accepted at the international level and competitive in the global market according to government policies.

In fiscal year 2024, one project was completed:

1. Uplifting quality infrastructure potential in the smart electronics industry.

Material Properties Analysis and Development Centre (MPAD)

MPAD provides services and consultancy in testing, analysis, and inspection of raw materials, components, and products according to international standards and regulations. MPAD also offers technical consultancy for improvement and development in materials and a complete range of

production processes from upstream to downstream, including biodegradable testing of materials both domestically and internationally.

In fiscal year 2024, two projects were completed:

1. Product quality testing for environmental compliance according to international standards.
2. Development of a material testing laboratory for aircraft components and repair parts production industry.

Thai Packaging Centre (TPC)

TPC is the national agency for comprehensive packaging technology in compliance with international standards. It aims to maintain product quality, reduce losses caused by non-standard packaging, and develop packaging to add value to products and increase export efficiency. TPC has expertise in packaging development and testing.

In fiscal year 2024, one project was completed:

1. Smart packaging for preserving the freshness of fruits and vegetables during transportation and online distribution.

Railway Transportation System Testing Centre (RTTC)

RTTC is the national central agency for testing, quality certification, and development of standards, products, technologies, and entrepreneurs in the transportation system, including railway systems and connecting components to land transportation. RTTC provides services following regulations by transportation agencies in accordance with international standards to ensure the quality and safety of railway system products, reduce risks and losses from non-standard products, promote the development of domestic entrepreneurs in railway system production, and disseminate railway transportation technology and knowledge.

In fiscal year 2024, one project was completed:

1. Uplifting quality infrastructure potential in the smart electronics industry.

Patents and Petty Patents

Total 53 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 – 2 ITEMS

No.	Title
1.	"Box" design: thin wall, vertical box
2.	Box design (cool box, 2 Maha-Prom flowers motif)

2. PETTY PATENTS – 51 ITEMS

No.	Title
1.	Recipe and extraction process for active substance from goat skin and its skincare products from such process
2.	Recipe and extraction process for active substance from longan and sleep-assisted product from such process
3.	Set of apparatus for microalgae cultivation (Plastic Tubular Photobioreactor, PTPBR) using carbon dioxide as auxiliary raw material
4.	Formula and extraction process for active substance from the mycelium of Reishi mushroom and its skincare products from such process
5.	Formula and extraction process for active substance from Indian oyster mycelium and its skincare products from such process
6.	Recipe for marinating starter in vinegar fermentation and fermentation process for coffee husk vinegar
7.	Formula and production process for composite material to enhance water conveyance efficiency
8.	Vegetable washer with airlift water circulation system
9.	Formula and production process for sunscreen product with extract from Reishi mushroom GC species

No.	Title
10.	Formula and production process for skincare product (serum) with extract from Reishi mushroom GC species
11.	Cleaning process for flue gas contaminated with carbon dioxide using multi-stage pressure swing adsorption (PSA)
12.	Recipe and production process for protein nugget from concentrated red bean protein
13.	Recipe and production process for coffee husk cider drink
14.	Production of plant seedling with mycorrhizal fungi (*Amanita princeps*) for plantation in the agroforestry area
15.	Recipe and production process for Karanda extract transethosome
16.	Recipe and production process for Garcinia gel (round fruit variety) drink
17.	Apparatus for steam generation from biomass burner
18.	Formula and production process for cosmetic containing polysaccharide extracted from microalgae, herbal extract and probiotic by-product
19.	Incubator for efficient degradation of rice stubble by microbe
20.	Growth medium and protocol for growing *Rhodobacter sphaeroides* TISTR 1529, *Rhodobacter capsulatus* TISTR 1567, *Rhodopseudomonas palustris* TISTR 10077 and *Rhodospirillum rubrum* TISTR 10080
21.	Production process for folk pickles using pure inoculum in fermented juice from rice washing water
22.	Formula and production process for anti-fungal hair tonic from Garcinia extract
23.	Recipe and production process for sore throat soothing lozenge with Karanda
24.	Recipe and production process for ready-to-eat jelly containing Aloe vera extract
25.	Microalgal cultivation for food, applying submersible lighting with LED, capacity 2500 litre
26.	Molten salt electrolysis converting carbon dioxide into carbon nano material
27.	Formula and production process for herbal shampoo anti-dermatophyte for pets
28.	Recipe and production process for Karanda extract food supplement in jelly form
29.	Recipe and production process for food supplement products from Russula extract

No.	Title
30.	Recipe and fermentation process of cricket meal for broiler chicken health enhancement
31.	Production process for protein hydrolysate from Pigeon pea
32.	Formula and extraction process for active substance from Zingiberaceae and anti-inflammatory products from such process
33.	Formula and production process for Chrysanthemum oil microemulsion gel product to sooth burning sensation
34.	Formula and extraction process for secondary active substance from the mycelium of Reishi mushroom and food supplement products from such process
35.	Testing system for carbon dioxide absorption from industrial sources using microalgae (field test)
36.	Formula and extraction process for active substance from Indian oyster and food supplement products from such process
37.	Horizontal polishing shaft coffee mucilage removing machine
38.	Recipe and production process for powdered probiotic related to human pancreas
39.	Formula and production process for Nanostructure lipid carrier containing Jute flower extract to use in beauty products
40.	Preparation procedure for heat storage material in hot pack
41.	Recipe and production process for protein drink containing Mung beans hydrolysate
42.	Leachate treatment using steam reforming and coagulation processes
43.	Distilled liquor from mango
44.	Production process for flocculant from seashell
45.	Coffee husk charcoal kiln
46.	Fermented cashew apple juice
47.	Formula and material preparation for sugarcane seedling pots forming from bagasse and sugarcane leaves
48.	Zeolite production from biomass ashes, process to eliminate volatile organic compounds (VOCs)
49.	Disposal plastic bags washer and shredder using continuous spinning system

No.	Title
50.	Cement composite material containing palm oil fiber
51.	Compost and soil conditioner produced from industrial waste from cassava starch industry processing into High Fructose Syrup

National and International Publications Fiscal year 2024 National and International Publications

Total 68 Articles

1. NATIONAL PUBLICATIONS 24 ARTICLES

No.	Name of the article	Name of the Journal
1.	The study on host plants and the quantity of ectomycorrhiza *(Amanita princeps)* mushroom suitable for growth in *Dipterocarpaceae* seedlings under greenhouse	Khon Kaen Agriculture Journal, 51(6), November-December 2023, p.1049-1059
2.	Effects of Colchicine on growth and morphological characteristics of genus Ficus.	Thai Journal of Science and Technology, 11(4), October–December 2023, p.14-24
3.	*In vitro* Shoot induction and growth of Black Galangal *(Alpinia nigra* (Gaertn.) Burtt) in sterile condition	Thai Science and Technology Journal, 32(1), January-February 2024, p.25-32
4.	Effects of temperature and packaging on quality of Pigeon Pea Seeds *(Cajanus cajan* L.) during storage	Thai Journal of Science and Technology, 12(1), January – March 2024, p.9-18
5.	Induction of morphological characteristic differentiation of Thai Native Asiatic Pennywort *(Centella asiatica* L.) by acute gamma irradiation	Agricultural Science and Innovations Journal, 55(1), January-April 2024, p.32-50
6.	The needs of hotel business entrepreneurs on the production of Patumma *(Curcuma alismatifolia* Gagnep) in the Southern part of Thailand	Journal of Humanities and Social Sciences Thonburi University), 18(2), May - August 2024, p.95-105

No.	Name of the article	Name of the Journal
7.	Effect of packaging on the storage quality of Soybean seeds	Thai Journal of Science and Technology, 12(2), April-June 2024, p.1-11
8.	Effect of plant growth regulators on yield and chemical composition of *Cananga fruticosa* x odorata flowers	Thai Journal of Science and Technology, 12(2), April - June, p.1-10
9.	Large scale growth and phycocyanin production of *Spirulina platensis* TISTR 8666	Srinakharinwirot University Journal of Sciences and Technology, 16(31), January-June (2024), p.1-13
10.	*In vitro* shoot growth of Prorphu Angkhang *(Caulokaemprefia appendiculata* k. Larsen&Triboun) endemic species in Thailand	Udon Thani Rajabhat University Journal of Science and Technology, 11(3), September–December 2023, p.61-73
11.	Farm management with organic materials on quality and chemical composition of soybean seeds cv. Chiang Mai 60	Prawarun Agricultural Journal, 21(1), January–June 2024, p.210-216
12.	The ability of seedling growth and development of Pigeon Pea selected variety	Thai Science and Technology Journal, 32(3), May-June 2024, p.77-95
13.	A study on SiC susceptor configuration for microwave hybrid heating	Suranaree Journal of Science and Technology, 30(5), October-December 2023, p.1-5
14.	Production of healthy wines rich in antioxidants from coffee cherry peels Arabica cultivars	Rattanakosin Journal of Science and Technology, 6(2), May-August 2024, pp. 29-39
15.	2-Keto-gluconate production and purification by thermotolerant acetic acid bacterium *Nguyenibacter vanlangensis* KKS-R1	Journal of Applied Research on Science and Technology, 22(3), September - December 2023, pp. 1-9
16.	Biohydrogen production from sewage sludge and biomass substrate model	Proceedings of The 6th Suan Dusit National Academic Conference 2024 (SDNC2024) “BCG Innovation for Education”, page 516-530 14 June 2024, at Suan Dusit University
17.	Automatic water level control system	The 16th Electrical engineer network conference (EENET2024), 29-31 May 2024 at Atsawan Nongkhai Hotel, Nongkhai, p.297-300

No.	Name of the article	Name of the Journal
18.	Temperature and humidity control systems for mushroom house	The 16th Electrical engineer network conference (EENET2024), 29-31 May 2024 at Atsawan Nongkhai Hotel, Nongkhai, p.293-296
19.	Improvement the bandwidth and gain of a Bow-Tie antenna using T-Shape notch in additional with electromagnetic band gap for radar	The 16th Electrical engineer network conference (EENET2024), 29-31 May 2024 at Atsawan Nongkhai Hotel, Nongkhai, p.137-140
20.	Development of horizontal polishing shaft coffee mucilage removing machine	The 7th National conference in Science, Technology and Innovation "Science to drive Technology and Green Innovation" (On-site and Online), 22 August 2024, Faculty of Science and Technology, Rajamankala Phra Nakhon University, p.1-6
21.	Improvement of a Bow-Tie antenna using electromagnetic band gap with the Open Loop Notch for radar application	The 15th Conference in Engineering, Science, Technology, and Architecture (ESTACON 2024), 23 August 2024, Rajamankala Isan, Khon Khan Campus, p.364-369
22.	The design of a Planar Dipole indoors antenna using technique SSFG for DTV systems	The 15th Conference in Engineering, Science, Technology, and Architecture (ESTACON 2024), 23 August 2024, Rajamankala Isan, Khon Khan Campus, p.370-375
23.	Quality control of a model sorting system via application	The 15th Conference in Engineering, Science, Technology, and Architecture (ESTACON 2024), 23 August 2024, Rajamankala Isan, Khon Khan Campus, p.202-207
24.	The development of sweetness testing technology for sugarcane juice and sugar solution using Near Infrared program	The 7th National conference on Science and Technology, Chandrakasem Rajabhat University, 7 June 2024 (Online presentation), Faculty of Science, Chandrakasem Rajabhat University, p.9-17

2. INTERNATIONAL PUBLICATIONS - 44 ARTICLES

No.	Name of the article	Name of the Journal
1.	Bayesian insights into Green Pit Viper Trimeresurus (Cryptelytrops) macrops sexual dimorphism with respect to influence of gravidity and habitat disturbance	Herpetological Journal Vol. 33, NO. 4, (October 2023), pp. 88-96
2.	Hydrothermal carbonization of oil palm trunk: Hydrochar properties and combustion behaviors	Energy Reports Vol. 9, Sup. 11 (October 2023), pp. 380-386
3.	CO_2-Rich Gas Conversion to Carbon Nanotube via Molten Salt Electrolysis	Journal of Physics: Conference Series Vol. 2602 (2023), pp. 1-6
4.	Vertical profile and flux measurements of ammonia in a deciduous forest in Japan towards improvement of bi-directional exchange model	Atmospheric Environment Vol. 315, 15 (December 2023), 120144, pp. 1-12
5.	Production of F1 *Papilionanthe hookeriana* (Rchb.f.) Schltr. homozygous and heterozygous: Amplified fragment length polymorphism (AFLP) analysis of flower colors and self and cross-pollination ability between different flower colors	International Journal of Agricultural Technology Vol. 19, NO. 6 (November 2023), pp. 2707-2726
6.	Non-destructive measurement of Tetrahydrocannabinol (THC) and Cannabidiol (CBD) using near-infrared spectroscopy	International Journal of Agricultural Technology Vol. 19, NO. 6 (November 2023), pp. 2413-2426
7.	Functional genome analysis and anti-Helicobacter pylori activity of a novel *bacteriocinogenic Lactococcus* sp. NH2-7C from Thai fermented pork (Nham)	scientific reports 13, Article number: 20362 (2023), pp. 1-17
8.	Methylation and bio-accessibility assessment of arsenate in crickets (*Gryllus bimaculatus*)	Chemosphere Vol. 350 (February 2024) 141032, pp. 1-9

No.	Name of the article	Name of the Journal
9.	First confirmed parasitism of pleasing fungus beetles *(Coleoptera, Erotylidae)* by a tropical rhyssine ichneumonid, and first record for Cyrtorhyssa moellerii Bingham (Hymenoptera, Ichneumonidae) from Thailand (*Hymenoptera, Ichneumonidae*) from Thailand	Journal of Hymenoptera Research Vol. 96 (2023), pp. 783–804
10.	Influence of protectant for encapsulation by freeze-drying and spray-drying techniques, and packaging environments on the stability of the probiotic *Bifidobacterium animalis* subsp. lactis strain KMP-H9-01 during storage	Drying Technology Vol. 42 NO. 4 (2024), pp. 762-774
11.	Alleviative and Anti-Inflammatory effects of tuna blood hydrolysates on MPP+ and TNF-α – induced Parkinson-Like disease model through the regulation of Keap1-Nrf2 antioxidant pathway and apoptosis	Journal of Functional Foods Vol. 116 (May 2024), 106134, pp. 1-16
12.	The thermal behavior during the co-combustion of bituminous coal and oil palm trunk hydrochars	Energy Sources, Part A: Recovery, Utilization, and Environmental Effects Vol. 46 NO. 1 (2024), pp. 706-718
13.	Hydrogen production by steam reforming of fusel oil over nickel deposited on pyrolyzed rice husk supports	Energy Reports Vol. 9, Sup. 11 (October 2023), pp. 462-469
14.	Comparative genomics reveals insight into the phylogeny and habitat adaptation of novel *Amycolatopsis* species, an endophytic actinomycete associated with scab lesions on potato tubers	Frontiers in Plant Science Vol. 15 (2024), pp. 1-22 https://doi.org/10.3389/fpls.2024.1346574
15.	Development of β-glucan production from microorganisms as active ingredients in cosmeceutical products for skin youthfulness	Science Asia Vol. 50 NO. 2 (April 2024), pp. 1-8

No.	Name of the article	Name of the Journal
16.	Suppression of Inflammation in Adipocyte-Macrophage Coculture by Passion Fruit Seed Extract: Insights into the p38 and NF-ϰB Pathway	Advances in Pharmacological and Pharmaceutical Sciences Vol. 2024, Article ID 7990333, pp. 1-11
17.	Physicochemical properties and *in vitro* prebiotic activity of *Ulva rigida* polysaccharides	Biocatalysis and Agricultural Biotechnology Vol. 59 (July 2024) 103252, pp. 1-8
18.	Valorization of Oil Palm Trunk Waste: A Path to Green Catalyst for Bioethylene Synthesis via Diluted Ethanol Dehydration	Waste and Biomass Valorization Vol. 15 (2024), pp. 3031–3044
19.	Comparison and environmental controls of soil respiration in primary and secondary dry dipterocarp forests in Thailand	Frontiers in Forests and Global Change Sec. Forests and the Atmosphere Vol. 7 (July 2024), pp. 1-14 https://doi.org/10.3389/ffgc.2024.1294942
20.	Genomic Assessment of Potential Probiotic *Lactiplantibacillus plantarum* CRM56-2 Isolated from Fermented Tea Leaves	Tropical Life Sciences Research Early Views (July 2024), pp. 1-20
21.	Passiflora edulis extract ameliorates HFD-induced hepatic steatosis mediated through Nrf2 and IRS-1 activation, NFϰB suppression, and hepatic lipid metabolism and bile acid modulation in obese rats	Journal of Functional Foods Vol. 120 (September 2024), pp. 1-12
22.	Evaluation of Encapsulated Astaxanthin from White Shrimp Shells *(Litopenaeus vannamei)* on Hepatotoxicity (Penilaian Astaxantin Berkapsul daripada Kulit Udang Putih (Litopenaeus vannamei) terhadap Kehepatoksikan)	Sains Malaysiana Vol. 53, NO. 2 (February 2024), pp. 239-248

No.	Name of the article	Name of the Journal
23.	Impact of *Lactocaseibacillus* (Lactobacillus) *paracasei* sup. *paracasei* TISTR 2593 probiotic supplementation on the gut microbiome of hypercholesterolemia Patients: A Randomized Controlled Trial	Nutrients Vol. 16, NO. 17 (September 2024), 2916, pp. 1-11
24.	Courtship and mating behaviour of the intermediate bow-fingered gecko *Cyrtodactylus intermedius* in the wild	Herpetological Bulletin Issue Number 169 - Autumn (2024), pp. 25-26
25.	The Innovative Production of Sugarcane Juice Clarification Materials from Sugar Industry By-Products	International Journal of Applied Engineering and Technology (London) Vol. 5 No. 4 (December 2023), pp. 2919 – 2926
26.	The Study of Nanoparticle Composition in Sub-urban area	Proceedings of The 8th International Conference on Nanotechnology –NanoThailand 2023, pp. 31-37 29 November – 1 December 2023 Dusit Thani Pattaya, Chonburi, Thailand
27.	Purification of biomethanol synthesized from biogas by three stages distillation	Proceedings of Pure and Applied Chemistry International Conference 2024 (PACCON 2024)
28.	Improved hydrogen electrolysis in sodium hydroxide solution by stainless steel electrodes optimization	Proceedings of Pure and Applied Chemistry International Conference 2024 (PACCON 2024), pp. 427-431 26-27 January 2024 at Bangkok International Trade & Exhibition Centre (BITEC)
29.	Synthesis of zeolite from industrial-waste coal fly ash for amine solution regeneration in CO_2 capture	Proceedings of Pure and Applied Chemistry International Conference 2024 (PACCON 2024) 26-27 January 2024 at Bangkok International Trade & Exhibition Centre (BITEC), pp. 339-343
30.	A demonstration process of high quality biomass pellet produced from sugarcane wastes	Proceedings of Pure and Applied Chemistry International Conference 2024 (PACCON 2024), pp. 372-376 26-27 January 2024 at Bangkok International Trade & Exhibition Centre (BITEC)
31.	Investigation of mechanical properties on TPS/PLA bio-plastic composite with oil palm fiber	Proceedings of Pure and Applied Chemistry International Conference 2024 (PACCON 2024), pp. 1026-1030 26-27 January 2024 at Bangkok International Trade & Exhibition Centre (BITEC)

No.	Name of the article	Name of the Journal
32.	Synthesis of biphasic calcium phosphate porous ceramic from fish scales	Proceedings of Pure and Applied Chemistry International Conference 2024 (PACCON 2024), pp. 599-602 26-27 January 2024 at Bangkok International Trade & Exhibition Centre (BITEC)
33.	Preparation and characterization of oil palm fibers from oil palm trunks for industrial applications	Proceedings of Pure and Applied Chemistry International Conference 2024 (PACCON 2024), pp. 603-607 26-27 January 2024 at Bangkok International Trade & Exhibition Centre (BITEC)
34.	Enhancing the mechanical properties of pineapple leaf fiber paper sheets with a dispersing agent	Proceedings of Pure and Applied Chemistry International Conference 2024 (PACCON 2024), pp. 1031-1034 26-27 January 2024 at Bangkok International Trade & Exhibition Centre (BITEC)
35.	Mechanical properties of hybrid fibers paper sheet from pineapple leaf fiber and banana fiber for packaging	Proceedings of Pure and Applied Chemistry International Conference 2024 (PACCON 2024), pp. 1009-1013 26-27 January 2024 at Bangkok International Trade & Exhibition Centre (BITEC)
36.	Developing hydrophobic cellulose fibers for oil absorption from pineapple leaves	Proceedings of Pure and Applied Chemistry International Conference 2024 (PACCON 2024), pp. 1035-1041 26-27 January 2024 at Bangkok International Trade & Exhibition Centre (BITEC)
37.	Improved Gas Production from Biomass in the 3-Stage Gasifier	Proceedings of ASEAN Bioenergy and Bioeconomy Conference 2024, pp. 95-100 July 4th, 2024 (Room MR109GH, QSNCC, Bangkok)
38.	Influence of Raw and Torrefied Biomass in 3-Stage Gasification Technology	Proceedings of ASEAN Bioenergy and Bioeconomy Conference 2024, pp. 101-107 July 4th, 2024 (Room MR109GH, QSNCC, Bangkok)
39.	Synergistic Effects of Plastic Wastes and Sludge for Producing Fuel via Co-pyrolysis in a Batch Reactor	Proceedings of The 33rd Thai Institute of Chemical Engineering and Applied Chemistry International Conference (TIChE2024), pp. 410-417 March 7-8, 2024, Krungsri River Hotel, Phra Nakhon Si Ayutthaya, Thailand
40.	Enhancement of Porous Carbon from Oil Palm Empty Fruit Bunch and CO_2 Capture Application	Proceedings of The 33rd Thai Institute of Chemical Engineering and Applied Chemistry International Conference (TIChE2024), pp. 418-424 March 7-8, 2024, Krungsri River Hotel, Phra Nakhon Si Ayutthaya, Thailand

No.	Name of the article	Name of the Journal
41.	Chemical Recycling of Waste PET into Terephthalic Acid by Alkaline Hydrolysis	Proceedings of The 33rd Thai Institute of Chemical Engineering and Applied Chemistry International Conference (TIChE2024), pp. 425-431 March 7-8, 2024, Krungsri River Hotel, Phra Nakhon Si Ayutthaya, Thailand
42.	Synthesis of Alkyl Branched-Chain Sulfonate Surfactant from Methyl Ester	Proceedings of ASEAN Bioenergy and Bioeconomy Conference 2024 (ABB 2024) No.1 Vol.7, (July 4th, 2024), pp. 115-121 Queen Sirikit National Convention Centre (QSNCC) Bangkok, THAILAND
43.	The effect of calcination temperatures on NIR reflection of lateritic soil pigments	Proceedings of Pure and Applied Chemistry International Conference 2024 (PACCON 2024), pp. 738-742 26-27 January 2024 at Bangkok International Trade & Exhibition Centre (BITEC)
44.	Synthesis and characterization of cellulose aerogel composite from pineapple leaves and polyvinyl alcohol	Proceedings of Pure and Applied Chemistry International Conference 2024 (PACCON 2024), pp. 711-715 26-27 January 2024 at Bangkok International Trade & Exhibition Centre (BITEC)

Performance in Science and Technology in 2024

TISTR, through its Industrial Services Group (IDS), focuses on providing science and technology services to elevate the quality of domestic industries to international standards. In addition to offering services with modern, internationally-standardized equipment, IDS designs equipment for testing and develops test methods tailored to customers' desired products and materials. IDS also supports and strengthens the National Quality Infrastructure (NQI) to enhance the global competitiveness of Thai entrepreneurs.

Moreover, TISTR aids both government and private sectors, domestically and internationally, by organizing seminars to transfer various technologies. These seminars cover specific topics for SMEs and start-ups, helping to develop human capital in areas such as new skills, re-skilling, and up-skilling. Examples of the curriculum include upskilling in quality systems, packaging, food, metal, and inspection. These programs include non-degree courses and "Train-the-Trainer" courses to create new skills for lecturers, students, and university personnel in practical, academic, and advanced knowledge, both online and on-site. This initiative builds human capital in science, technology, and innovation (STI), aligning with MHESI's strategy to produce a higher quality workforce to support the competitiveness of Thai industries.

Additionally, TISTR has been recognized as a network institution by the Council of Engineers, enabling it to organize engineering courses and evaluate professional development units for engineers (CPD). In 2024, TISTR was appointed by the Department of Industrial Works (DIW), Ministry of Industry, as an examining institution for boiler life assessments according to DIW's announcement. This made TISTR the first institution in the country to provide such services for testing and evaluating boilers in the petrochemical industry and power plants across Thailand. TISTR is also registered as an examiner for boiler controllers according to the Ministry of Industry's announcement. Those who pass the exam receive a certificate for boiler control according to DIW criteria. TISTR also acts as an approved Proficiency Testing Provider (ISO/IEC 17043) in the areas of temperature, electricity, and chemistry.

In summary, IDS's performance in 2024 included testing and analyzing raw materials, products, packaging, and quality accreditation for 2,314 businesses, covering 216,274 MSTQ items and generating revenue of 148.34 million baht. Additionally, 2,887 personnel from industrial and government sectors were trained in STI skills through 84 courses. Consultation in engineering, academic, and laboratory quality accreditation (ISO/IEC 17025) was provided to six government and private sector entities, with training courses publicized via the BDS system to increase customer recognition.

In the 2024 fiscal year, the IDS achieved accreditation in 20 additional areas under ISO/IEC 17025. These include:

- 4 areas via the Industrial Metrology and Testing Service Centre
- 14 areas via the Railway Transportation System Testing Centre
- 1 area via the Thai Packaging Centre
- 1 area via the Office of Certification Body

The detailed accreditations are as follows:

- Organizational carbon footprint verification according to guidelines from The Thailand Greenhouse Gas Management Organization (TGO) (ISO 14064-1:2018)
- Tensile testing (Iron) according to TIS 20-2559, TIS 24-2559, TIS 528-2560, TIS 1228-2561, TIS 1390-2560, TIS 1479-2558, TIS 1884-2564, TIS 1999-2560, TIS 2012-2558, TIS 2060-2560, TIS 2140-2560
- Tension testing for fiber-reinforced polymer according to TIS 2973-2562
- Rockwell hardness test - HRBW, HEC BS EN ISO 6508-1:2016
- Flexural test TIS 528-2560
- Testing for alcohol hydrometer
- Test method for scrub resistance (Commodity): Emulsion paint TIS 272-2564, TIS 285 book 20-2564, TIS 2321-2564
- Stacking test and drop test for metal drum (General goods)

Additionally, the Office of Certification Body provided evaluation services according to international standards such as ISO 17021/17065, including:

1. Specifications for compostable plastics according to ISO 17088 standard
2. Organizational Carbon Footprint Verification in the following areas:
    - o Power generation and electric power transaction
    - o General manufacturing industries
    - o Metals production
    - o Mining and mineral production
    - o Pulp, paper, and print industries
    - o Chemical production industries
    - o Transportation
    - o General services activities

Key Achievements in 2024

1. Performance and Safety Inspection Laboratory

Part of the Material Properties Analysis and Development Center (MPAD), this laboratory was

designated by the Department of Industrial Works, Ministry of Industry, as an evaluation unit for the Remaining Life Assessment of Boilers since 2023. It stands as the first laboratory in Thailand to cater specifically to the petrochemical industry and power plants, with clients including PTT Global Chemical PLC and BLCP Power Limited.

In addition to its core services, the lab has ventured into biomechanics, focusing on material properties and the efficiency of medical devices. It offers a comprehensive, one-stop service for mechanical, chemical, and material structure analysis, handling products like cardiac catheters, mechanical thrombectomy devices, dental implants, and metallic medical bone screws in compliance with ASTM -543 Annex 3 standards. Recently, it achieved ISO 17025 accreditation from the Thai Industrial Standards Institute (TISI).

2. Material Biodegradation Testing Laboratory

Also under MPAD, this laboratory specializes in testing the biodegradation of materials. With skilled personnel, state-of-the-art equipment, and a robust quality management system, it has earned ISO/IEC 17025 accreditation from TISI and international product certifications for biodegradable plastics under ISO 17088 from:

- o DIN CERTCO, Germany
- o Biodegradable Products Institute (BPI), USA
- o Green Label Project, Thailand Environment Institute (TEI)

Test results from this lab enable manufacturers and distributors to acquire biodegradable product logos, aiding in exports. The laboratory has expanded its capabilities to include testing the biodegradability of plastics in marine environments (ASTM D6691) and chemical products like personal care items, surface cleaners, and lubricants in freshwater and seawater environments (OECD 301 and OECD 306).

In fiscal year 2024, the lab's tests under ASTM D6691 and OECD 301 (Topics A and F) were accredited under the ISO/IEC 17025 standard by TISI. It also earned the Green Label logo from TEI, an internationally recognized certification in over 50 countries.

3. Material Properties and Failure Analysis Laboratory

Under MPAD, this laboratory provides testing for materials and aircraft parts in compliance with the AS9100D standard. Approved for seven testing areas covering 13 standards, it supports industries like aerospace, defense, and transportation. Key services include durability tests for fighter training wings, landing gear components, missile tail assemblies, and main deck container parts for air transport.

The lab also plays a pivotal role in Thailand's aircraft repair and refurbishment industry, serving clients such as AviusULD Company Limited, Revima Asia Pacific Company Limited, and Senior Aerospace (Thailand) Company Limited.

In addition to its aerospace focus, the lab is developing expertise in testing composite materials and related products, making it one of the first labs in Thailand to meet international standards. Testing includes evaluating the physical properties and usage conditions of composite materials, such as stiffness testing of underground fiberglass tubes for electric wires and structural H-beam tests for chemical storage bins. These advancements address the needs of local entrepreneurs by emphasizing safety and ensuring competitiveness in both price and quality.

4. Electric Train Tunnel Wall Testing

Conducted by the Railway Transportation System Testing Centre (RTTC), this service supports prominent clients such as Unique Engineering and Construction PLC, Italian-Thai Development PLC, the Mass Rapid Transit Authority of Thailand (MRTA), and the Project Management and Construction Supervision Consultant 2 (PMCSC2). Currently, RTTC provides testing for the electric train tunnel walls of the MRT Purple Line (South), spanning Tao Poon to Rat Burana (Bangkok Outer Ring Road).

Additionally, RTTC has expanded its expertise to include testing bridge expansion joints for road network construction projects under the Department of Highways (DoH) and the Department of Rural Roads (DRR). This initiative accelerates project timelines by reducing testing durations and eliminating the need for overseas sample testing. Current clients include DoH, DRR, CivilStates Co., Ltd., Wattanasuk International Co., Ltd., and NRSC Engineering Co., Ltd.

5. Onboard Charger (OBC) Testing and Safety Evaluation

In collaboration with local electric vehicle manufacturers (EVMs), RTTC has developed testing and safety evaluation services for onboard chargers using existing equipment. This initiative, involving leading manufacturers like Delta Electronics (Thailand) Public Company, has created tailored test protocols for local EVMs. These protocols enable controlled manufacturing processes that meet EV standards without requiring significant investment in new testing equipment. This approach helps local manufacturers remain competitive with international companies.

6. Standard Testing of rPET Plastic for Food Packaging

Managed by the Thai Packaging Centre (TPC), this project, funded by the Program Management Unit for Competitiveness (PMUC) from 2022 to 2024, upgraded testing and analysis capabilities to meet EU10/2011 standards for rPET plastic used in food contact materials. The project aligns with the Ministry of Public Health's Announcement No. 435-2565, which supports the circular economy and ensures the safe reuse of PET in the food industry.

7. Enhancing Comprehensive Packaging Services

Led by TPC, this five-year initiative (2021–2025) aims to strengthen the capabilities of small and medium enterprises (SMEs) in packaging science, technology, and innovation to boost product value.

The program focuses on fostering self-reliance and global competitiveness among SMEs, with notable achievements in fiscal year 2024, including:

- o Training 472 entrepreneurs in packaging development and value addition.
- o Developing 20 innovative packaging solutions for SMEs.
- o Preparing Work Instructions (WI) and ensuring process accuracy for food packaging testing under ISO/IEC 17025, focusing on lead and cadmium in plastic (TIS 656).
- o Testing 600 packaging and food packaging materials.
- o Validating four test methods:
  1. Nine-element testing in melamine utensils (TIS 2921).
  2. Formaldehyde content testing in melamine utensils (TIS 2921).
  3. Melamine content testing in melamine utensils (TIS 2921).
  4. Testing for colorants in plastic food-contact materials (Resolution AP(89)1).
- o Introducing six new tests for food packaging:
  1. Durability of printing color (TIS 655 1-2553).
  2. Temperature resistance (TIS 655 1-2553).
  3. Odor testing (TIS 1136-2559).
  4. Flavor testing (TIS 1136-2559).
  5. Antimony content (TIS 2493 2-2556).
  6. Germanium content (TIS 2493 2-2556).
- o Conducting shelf-life studies for three food products:
  - ▸ “Oon-ai” rice.
  - ▸ Unstoppable rice crust.
  - ▸ “Sai-jung” Chinese pastry.

8. Smart Packaging for Fresh Fruit and Vegetable Preservation During Transportation and Online Marketing

A project series by the Thai Packaging Centre (TPC) includes four subprojects aimed at enhancing freshness, safety, and sustainability in fruit and vegetable packaging:

1. Smart Label for Sulfur Dioxide Measurement

Developed as a safety indicator for fresh longan, this smart label measures sulfur dioxide levels to ensure safe consumption. The indicator changes color based on the gas concentration:

- o Red-orange when the longan is freshly fumigated with sulfur dioxide.
- o Green after seven days, indicating the gas has evaporated.

2. Research and Development of Edible Coating for Shelf-Life Extension

This project focused on prolonging the shelf life of ready-to-eat fresh fruits, achieving notable results:

o An edible coating that extends the shelf life of mangoes to 14 days.

o Recognition with the Best Paper Award 2024 for oral presentation at the 5th International Conference on Informatics, Agriculture, Management, Business Administration, Engineering, Science, and Technology, held May 29-31, 2024.

3. Packaging Development for Fresh Fruit Protection During Transportation

Designed to protect fresh fruits during transit, this subproject developed innovative solutions, including:

o A pulp-molded box for individual fruits, with mango as the case study.

o A stackable gift set packaging option.

4. Research and Development of Coldbox

This subproject focused on creating environmentally friendly alternatives to traditional foam boxes for transportation. Highlights include:

o Development of cold insulators and thermal insulation boxes using natural materials.

o Testing of the thermal properties of three newly designed cold insulator formulas.

These advancements aim to improve safety, shelf life, and environmental sustainability in packaging solutions for the fruit and vegetable supply chain.

Publications and Awards

The Industrial Services Group (IDS), through its various centers, has achieved significant milestones in 2024, including academic contributions and prestigious recognitions:

Publications

1. "Life Assessment of a Superheater Tube in a Coal-Fired Power Plant"

o Published in the proceedings of ME-NETT 2024 (38th), held from July 16-19, 2024.

2. "Feasibility Biomechanical Study of Injectable Biphasic Calcium Phosphate Bone Cement Augmentation of the Proximal Femoral Nail Anti-Rotation (PFNA) for the Treatment of Two Intertrochanteric Fractures Using Cadaveric Femur"

o Published in Biomedical Physics and Engineering Express, Volume 10, June 2024.

Awards

1. Sampao Nawa Thong Award

o Received by the Office of Certification Body (OCB) for integrating a digital system into its work processes, enhancing client services and operational efficiency.

o Recognized by the Thai Chamber of Commerce/Board of Trade of Thailand as a digital-transformed organization.

o Achievements include:

- Adoption of the TISTR JUMP system for auditing and certifying services.
- Implementation of e-payment systems and streamlined government convenience services.
- Establishment of a comprehensive customer database for faster and more efficient client response.

2. Best Paper Award 2024

o Awarded to the Thai Packaging Centre (TPC) for an oral presentation at the 5th International Conference on Informatics, Agriculture, Management, Business Administration, Engineering, Science, and Technology (May 29-31, 2024).

o Topic: "Effects of Edible Coating on the Quality and Shelf-Life of Fresh-Cut Kimju Guava *(Psidium guajava)*."

These achievements highlight IDS's commitment to innovation, academic excellence, and customer-focused digital transformation.

Commercial Technology Transfer

TISTR has carried out 140 projects focusing on technology transfer, commercialization, research, and consultancy services. These projects were conducted across various research and development groups, including the Bio-Industries and Sustainability Development groups, the Industrial Services Group (providing industrial analysis and testing), and the Strategies and Innovation Management Group (focused on the readiness and application of R&D results). Below are examples of successful outcomes from these four workgroups:

1. Research and Development Group for Bio-Industries

The Research and Development Group for Bio-Industries focuses on conducting R&D, providing analysis and testing services, and offering consultancy to meet the needs of both the industrial sector and community enterprises. This is achieved through the application of bio-industrial technologies. The group also aims to translate research findings into commercial applications and foster the creation of new businesses through technology transfer and incubation.

One outstanding project for 2024 is the development of peptide extract production from rice at a semi-pilot scale, in collaboration with **Lion (Thailand) Co., Ltd.** This project is conducted by the **Innovative Cosmetic Services Center (ICOS)** and the **Expert Center of Innovative Herbal Products (InnoHerb).**

Project Overview:

In 2024, Lion (Thailand) launched a project to utilize defatted rice bran, which contains 10-15% protein and is low in fat. This high-protein rice bran has the potential to be used as a raw material for producing protein or peptide extracts for use in cosmetics, functional foods, and medicinal food. The company recognized the nutritional value of defatted rice bran for cosmetic products and identified a demand for these extracts within international markets.

To support this, Lion (Thailand) approached TISTR to conduct R&D and develop technology for peptide extract production from rice at a semi-pilot scale. The project included:

1. Developing a chemical quality control process for the rice-derived peptide extract.
2. Conducting biological activity testing and safety assessments to create a Certificate of Analysis (COA) for the peptide extract.

By integrating the scientific and technological expertise from **InnoHerb**, the project has contributed to the industrial-scale development of peptide extract production, aimed at incorporating the extract into the company's cosmetic products. The central focus of the project is to create value from waste materials. Biological activity tests have shown that the protein derived from the rice extract has skin regeneration properties.

2. Research and Development Group for Sustainable Development

The Research and Development Group for Sustainable Development focuses on R&D for comprehensive value creation, emphasizing technology and green innovation to enhance sustainable competitiveness. The group also drives engineering innovation to meet the needs of target groups and improve the competitiveness of the industrial sector while promoting community well-being.

Study on Carbon Dioxide Absorber Performance from Cement Plant Exhaust Gases Using Pressure Swing Adsorption Technique

This project, conducted in collaboration with **SCG Cement Co., Ltd.**, was carried out by the **Expert Centre of Innovative Clean Energy and Environment (InnoEn).**

Carbon dioxide (CO_2) emissions from the industrial sector are a major contributor to greenhouse gases, significantly impacting climate change and affecting both human and ecological health. To address this, TISTR developed a gas separation prototype using a multi-stage Pressure Swing Adsorption (PSA) technique. This 3-stage PSA method efficiently separates CO_2 from exhaust gases emitted from industrial plant chimneys, increasing CO_2 concentration from an initial 12% to over 90%.

In addition, the knowledge from this project has been registered for two patents:

1. Purification Process of Methane and Carbon Dioxide Gases from Biogas Resources by Multi-Stage Pressure Swing Adsorption System (Patent Application No. 2201000043).

2. Cleaning Process of Carbon Dioxide Contaminated Exhaust Gas by Multi-Stage Pressure Swing Adsorption Process (Patent Application No. 2403001410).

This research initiative has led to a collaboration between TISTR and SCG to study the performance of various CO_2 adsorbents for use in cement plant exhaust gases, utilizing TISTR's CO_2 separation prototype. The study included testing a one-stage PSA adsorption process and evaluating adsorbent performance developed by SCG.

The completion of this research brings direct and indirect benefits to SCG, such as waste value creation and a reduction in pollutants and greenhouse gases. Furthermore, it paves the way for the development of this technology at a pilot scale. This research applies CO_2 capture technology (Carbon Capture Utilization and Storage: CCUS), contributing to Thailand's future goal of achieving carbon neutrality.

3. Industrial Services Group

The Industrial Services Group provides comprehensive science and technology services for the industrial sector and community enterprises, with a focus on product quality development and industrial production processes. The group also offers analysis, testing, and calibration services, with laboratory management systems certified according to the international standard **ISO/IEC 17025.**

Additionally, it provides inspection services through an inspection unit certified according to **ISO/IEC 17020.**

In fiscal year 2024, the Industrial Services Group had an outstanding project supporting technology disruption:

3D Scan and Performance Testing on Commercial Truck Structure for System Integration Study of Electric Vehicles

This project, conducted in collaboration with **PTT Public Company Limited's New Energy Technology Research Department**, was carried out by the **Railway Transportation System Testing Centre (RTTC).**

Electric vehicles (EVs) are gaining popularity in Thailand due to their fuel savings and low maintenance costs. As a result, businesses are increasingly opting for EVs. The Railway Transportation System Testing Centre, a unit of the Industrial Services Group, is equipped with state-of-the-art analysis and testing devices, as well as skilled researchers, to provide testing services for quality evaluation and the lifespan of automotive and railway system components.

TISTR's involvement in this project focused on evaluating the performance of conventional commercial truck structures in preparation for integrating electric vehicle drive systems. The steps included:

1. 3D Scanning of the main components of a conventional commercial truck—cab, suspension, and chassis—to collect dimensional data for creating a model-based simulation using finite element analysis.

2. Weight Measurement of the cab and chassis, assembled with the suspension, and instant calculation of the center of gravity for the module set to assist in the electric vehicle design.

3. Static Load Testing of the chassis structure assembled with the suspension, providing preliminary data for verifying the simulation model of the traditional commercial truck structure's performance.

These data are critical for designing electric vehicles based on commercial truck structures, directly impacting customers' businesses and ensuring efficiency, integrity, and safety. The analysis, testing, and calibration services are essential for building confidence in both the export products and investments of Thailand's industrial sector.

4. Strategies and Innovation Management Group

The Strategies and Innovation Management Group is responsible for setting organizational directions and strategies in alignment with the corporate plan. It develops action plans and drives strategies at various levels to support the use of science, technology, and innovation, ultimately fostering the development of small and medium-sized enterprises (SMEs). In fiscal year 2024, the group also focused on developing social innovation entrepreneurs and area-based community

enterprises (OTOP), providing support based on science and technology needs identified from on-site problems and provincial strategic plans across all regions.

Uplifting and Applying Wisdom Identity for Value Creation of Local Community Products into International Competition (TOP Premium Product)

This project, part of the **Enhancement of Industrial Business and Community Enterprises**, was conducted in collaboration with the **Department of Industrial Promotion** and executed by the **Innovative Business Service Division** within the **Technology and Innovation Management Office.**

The **Division of Community Industry Development**, a governmental organization focused on the development and promotion of grassroots entrepreneurs, partnered with the Strategies and Innovation Management Group to organize an activity aimed at uplifting and applying the wisdom identity for value creation in local community products to meet international competition standards (TOP Premium Product). The goal was to enhance local community product development by blending traditional wisdom with technology and innovation to create top-tier products with unique identities that meet current market trends, consumer needs, and ensure sustainable growth.

The target groups were community enterprises or OTOP entrepreneurs at the 3-5 star level, operating in **Bangkok** and **Nonthaburi** provinces. The development process involved a complete range of activities, including:

- **Product Development and Marketing:** Collaborating with experts, researchers, and craftsmen.
- **Potential Evaluation and Target Group Selection:** Identifying 29 businesses to participate in the project.
- **Training Workshops:** Knowledge transfer, new product development using tools like Chat GPT BMC SCAMPER, and on-site coaching at production sites.
- **Product and Packaging Development:** Ensuring products met consumer standards and packaging requirements.
- **Publicity and Marketing:** Utilizing social media and organizing market testing at **Central Eastville Department Store** to introduce new products and create opportunities for international competition.

These efforts were aimed at developing new entrepreneurs who could leverage the benefits of science, technology, and innovation to enhance their businesses.

Additionally, TISTR maintains a network and collaborative relationships with government sectors, state enterprises, private sectors, and community enterprises to support the use of R&D results. This includes transferring technology to SMEs that lack R&D capabilities, enabling them to either start or

expand businesses without conducting their own R&D. This approach accelerates competitiveness, helping SMEs respond to changes in the global market.

In fiscal year 2024, TISTR brought STI (Science, Technology, and Innovation) results into commercialization through 20 projects, including those in the bio-industries sector, to promote sustainability in business, as following:

List	Project	Technology transfer benefiters
1	Technology transfer on production of brightening and anti-aging cosmeceutical product containing inky cap mushroom extract	Smile corner company limited
2	Permission to use of bacteria strains for production of organic matter treatment and degradation product	Leader Micro Biology company limited
3	Technology transfer on production of cosmetic product from goat	Odee Style company limited
4	Technology transfer on production process of food supplement product for sleep aid and snoring relief from longan active compounds	Super Good 89 company limited
5	Permission to use of fungus strains for production of bio-control product on collar and root rot disease in tomato	Natural Farm company limited
6	Technology transfer on production of brightening and anti-aging cosmeceutical product containing Hom Thong banana extract for commercialization	Mrs. Sineenart Vejphad
7	Technology transfer on product recipe of cashew milk mixed with tiger peanuts and production of cashew milk product by pasteurization commercially	Kao Nar Kao Kao company limited
8	Preparation method of seleniumenriched organic fertilizer for Thai Hom Mali rice	Pui Num Kaset Rungrueang company limited

9	Permission to use research patent on preparation method of mixed vegetable chicken soup in industrial scale and products from the mentioned method	Malila products 2014 (Thailand) company limited
10	Permission to use research patent on recipe and preparation method of ginger drink mixed L-theanine	Flourish company limited
11	Permission to use research patent on recipe and preparation method of sugar free coconut milk drink	Khlang Ma Prao, Koh Change community enterprise
12	Licensing on hot pack production for physical therapy	Unity Meditec company limited
13	Permission to use research patent on preparation method of banana drink mixed turmeric and products from the mentioned method	Thai House International company limited
14	Technology transfer licensing on production process of nano-hair tonic cosmeceutical product from safflower extract into commercialization	Herbornic company limited
15	Technology transfer on production method of facial cream product from algae and probiotic from Lactobacillus bacteria	Allabout Alca company limited
16	Permission to use algae strain Chaetophora sp. TISTR 9454 as ingredient in facial serum product development	
17	Permission to use algae strain Chaetophora sp. TISTR 9454 as ingredient in facial cream product from algae and probiotic from Lactobacillus bacteria	
18	Permission to use algae strain Phaffia rhodozyma TISTR 5953 as ingredient in production of animal food products.	Bio Wealth company limited

19	Permission to use petty patent preparation method of wine from cherry coffee husk, petty patent fermented juice as raw material in vinegar fermentation and preparation method of vinegar from cherry coffee husk for application in alcohol production and vinegar from grass jelly syrup	Sritawan Foods company limited
20	Technology transfer on production method of skin nourishing products from oyster mushroom	Supersayo company limited

Social Technology Transfer

In fiscal years 2023-2024, TISTR conducted a project to evaluate and develop potential outputs through appropriate technology and innovation in pilot areas of economically disadvantaged provinces. The project was funded in fiscal year 2022 under the research fund for poverty alleviation and inequity reduction of the Program Management Unit on Area-Based Development (PMU A). The project was carried out as part of PMU A's poverty alleviation mechanisms, which were assigned to regional universities as principal investigators tasked with addressing poverty issues.

TISTR supported regional universities by transferring ready-to-use technology knowledge and appropriate technology, tailored to the context of poor households, local environments, and regional agencies. The aim was to transform problems into opportunities, helping targeted poor communities enhance their self-development and build careers. Operations were carried out in 14 strategic provinces under PMU A: Mae Hong Son, Lampang, Phitsanulok, Kalasin, Sakon Nakhon, Nakhon Ratchasima, Roi Et, Mukdahan, Amnat Charoen, Yasothon, Sisaket, Yala, Pattani, and Narathiwat. The focus was on applying scientific, technological, and innovative processes, including the development of herbal products, health foods, raw materials for food production and agriculture, as well as production factors to improve standards. This included enhancing agricultural practices in line with Good Agricultural Practices (GAP), boosting food production and cosmetics, and conducting analysis and testing on active compounds and identity studies. A total of 43 technologies were employed, benefiting 848 individuals who used the knowledge to enhance their careers or solve occupational challenges.

The project has successfully helped alleviate poverty by generating income for farmers through the cultivation and sale of high-quality, safe raw materials. Additionally, it provided knowledge and skills development to increase product value and meet industry standards. This initiative has empowered poor households with the ability to apply government-developed technologies in their daily activities. Furthermore, the project facilitated collaboration with local agencies, promoting information sharing and resource utilization to maximize benefits and outputs. This approach not only addresses poverty but also develops the local economy by optimizing the use of local resources. Beneficiaries are now better equipped with education and knowledge for sustainable livelihoods, with opportunities for upskilling and reskilling.

The project aligns with government policies on poverty alleviation and inequality reduction, contributing to the long-term resolution of poverty, the creation of knowledge-based careers, and the promotion of sustainability in social, environmental, and economic dimensions. It also fulfills the goals outlined in Sustainable Development Goal (SDG) 1: No Poverty.

International Collaboration 2024

TISTR has actively engaged in research and academic collaborations with international network organizations, producing tangible outcomes aligned with the Bio-Circular-Green (BCG) Economy Model and the Sustainable Development Goals (SDGs). These international partnerships facilitate knowledge exchange, enhance skill development, and strengthen TISTR's capacity in research and development, reinforcing its role as a comprehensive solution provider in science, technology, and innovation (STI).

1. Collaboration in Eco-Friendly Packaging

The Thai Packaging Centre of TISTR, in collaboration with the Philippines Trade Training Center - Global MSME Academy (PTTC-GMEA) under the Department of Trade and Industry (DTI), Republic of the Philippines, organized a training program titled "Packaging for Micro and Small Enterprises." This program covered the following topics:

1. Affordable Product Packaging Solutions for Micro and Small Enterprises – Effective product packaging solutions and recent developments in international product packaging.
2. Sustainable Packaging – An updated overview of packaging waste and regulations.
3. Sustainable Packaging Solutions for MSMEs – Solutions to address packaging waste.
4. Packaging Technology and Innovation – Fundamentals of packaging.
5. Current Packaging Technology and Innovation – An introduction to the latest packaging technologies and innovations.

The training took place online from 13-14 December 2023 for PTTC officials and Filipino entrepreneurs.

Additionally, the Thai Packaging Centre organized an academic seminar titled "Packaging for Micro and Small Enterprises: Affordable Product Packaging Solutions for Micro and Small Enterprises" at ProPak Philippines 2024 on 31 January 2024 at the World Trade Center Metro Manila, Pasay City, Philippines.

Both the training program and the seminar provided valuable insights into agricultural product preservation, shelf-life extension through packaging technologies, reusable packaging, and environmentally friendly packaging solutions. These activities not only enhanced the capabilities of entrepreneurs but also established a strong international R&D collaboration between Thailand and the Philippines.

2. Collaboration in Plastic Waste Management

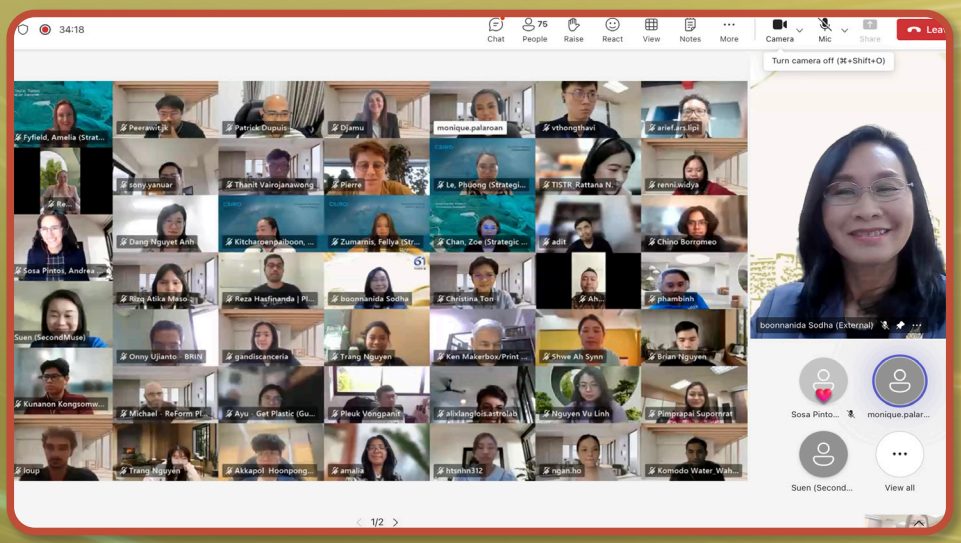
Dr. Chutima Eamchotchawalit, Governor of TISTR, has been appointed as an Advisor to the Advisory Plastics Innovation Hub Thailand (PIHT), part of the Indo-Pacific Plastics Innovation Network (IPPIN), managed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia.

In 2024, TISTR's Waste2Cash research team, led by Mr. Thanit Vairojanawong, Senior Research Officer from the Expert Centre of Innovative Industrial Robotics and Automation (InnoRobot), participated in the IPPIN Incubator Program 2024 and the IPPIN Accelerator+ Program 2024. The team presented the Waste2Cash project, which features an innovative plastic bottle and can sorting machine designed for use in local communities, schools, and the industrial sector. The project aims to provide innovative solutions to tackle plastic pollution, explore business matchmaking opportunities, and expand industrial applications.

Additionally, Governor Chutima and Dr. Rewadee Anuwattana, Research Expert from the R&D Group for Sustainable Development, attended the Ending Plastic Waste Symposium 2024 and the IPPIN Advisory Groups Forum 2024. They showcased TISTR's expertise in plastic waste management

through a technical poster titled "Technology and Innovation for Municipal Solid Waste Management and Value-added Creation According to the Circular Economy Concept." The poster highlighted the “Tan Diao Model” project, which focuses on comprehensive recycling and waste management, waste-to-energy conversion, income generation for sustainable communities, and linking these efforts to the Circular Economy.

The poster won first place in the CRC Award, recognized as the most impactful representation of circular economy principles in plastic waste management. The award was presented by executives from the Solving Plastic Waste Cooperative Research Centre (CRC), Australia.



TISTR participated in both the IPPIN Incubator Program 2024 and the IPPIN Accelerator+ Program 2024.

TISTR joined the Ending Plastic Waste Symposium 2024 and the IPPIN Advisory Groups Forum 2024 in Melbourne, Australia.

3. Collaboration in Food Technology

On 4 September 2024, TISTR signed a Memorandum of Understanding (MoU) with the National Research and Innovation Agency (BRIN) in Indonesia. BRIN is a key science and technology organization that plays a vital role in advancing science, technology, and innovation in Indonesia. Both BRIN and TISTR are members of the World Association of Industrial and Technological Research Organizations (WAITRO) in the Asia-Pacific region.

The objectives of this collaboration are to drive and integrate science, technology, and innovation, with a specific focus on technologies for herbal and indigenous plant products, as well as plant-based food products. This joint initiative builds on the previous cooperation that earned the WAITRO Innovation Award 2021 between TISTR and BRIN researchers.

Under this MoU, the Expert Centre of Innovative Health Food of TISTR and the Research Center for Appropriate Technology (RCAT), BRIN will jointly conduct research on the technological development of novel plant-based food. This project seeks to advance plant-based food production technologies that offer high nutritional value as alternatives to animal-based products and foster sustainability in the food industry.

4. Collaboration on Railway Inspection and Monitoring Technology

The Railway Transportation System Testing Centre (RTTC) of TISTR has implemented the "Technical Cooperation for Research and Implementation of Railway Inspection and Monitoring Technology Project." This project is funded 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). The project aims to enhance railway safety standards across ASEAN by leveraging research and technology for inspecting and monitoring railway infrastructure.

In 2024, TISTR organized a seminar titled "Technical Cooperation for Research and Development and Implementation of Railway Inspection and Monitoring Technology" on 10-11 June 2024 at TISTR headquarters. Following the seminar, the technical team visited Malaysia and Indonesia to demonstrate the installation and use of the train weight device (TWD) to railway technology organizations.

The train weight device (TWD) has been developed by TISTR as a dynamic railcar weighing system that accurately measures the weight of trains and freight cars while they are in motion. This technology enhances the safety and efficiency of rail and road freight transport, as well as supports the production of local railway content by Thai enterprises. The project targets the deployment of TWD systems in three countries: Thailand, Malaysia, and Indonesia. The collaborating organizations include the University of Sumatera Utara and PT Kereta Api Indonesia (KAI), Indonesia; and the Construction Research Institute of Malaysia (CREAM) and Universiti Teknologi MARA (UiTM), Malaysia.

A Seminar on “Technical Cooperation for Research and Development and Implementation of Railway Inspection and Monitoring Technology"

Installation and Demonstration of the train weight device (TWD)
in Malaysia and Indonesia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