Annual Report 2015

Thailand Institute of Scientific and Technological Research (TISTR)

Ministry of Science and Technology (MOST)

Message from the Governor

In fiscal year 2015, Thailand Institute of Scientific and Technological Research (TISTR) played an essential role in conducting new scientific and technological research, providing scientific services, and developing innovation as targeted. It is a great responsibility of TISTR to accomplish our missions which include: 1) Strengthening of organizational ability in conducting research and development, 2) Providing scientific and technological services, 3) Transferring, commercializing TISTR's technology and promoting the utilization of technology and innovation both for commercial and social purposes, 4) Creating innovation, and 5) Managing infrastructure and organization. The outstanding research in 2015 was, for instance, Research and Service on Bioplastics, by BioScience Department; the Biodegradable Bioplastic Testing Laboratory was established and well-equipped with advanced technology, appliances, and skilful staff. In this laboratory, analysis and testing of bioplastic products were performed in compliance with ISO 17088. Another research of the year 2015 was Research and Development on Biosplint made from degradable bioplastic made from agricultural material. Other research achievements include an invention of a dehumidifier for paddy at farm level, VITISTRA nutraceuticals and cosmetics from grape seed, establishment of a learning center for vapour heat treatment (VHT) of fresh fruits for export in the upper northern region at Tambon Maejua, Denchai district, Prae province that could increase best quality to Thai fruits exported to the countries where plant quarantine regulations are strictly enforced.

In aspects of scientific and technological services, TISTR's achievements were focused on, for instance, testing of plastic packaging, certification of biodegradable products in compliance with ISO/IEC 17065, and provision of mechanical test, vibration test, fatigue test and durability test, certification for quality and safety of parts, equipment, and products used in the rail system, and provision of engineering consultancy services. The collaborative project on Thailand-China Joint Research Center on Railway System was also initiated on analysis and testing that could strengthen the rail system of both in Thailand and the ASEAN region.

One more important project dedicated to Thai industrial sector was Science, Technology and Innovation Matching Program (STIM), which aimed to enhance competitiveness of Thai entrepreneurs using science, technoloy and innovation for the development of products, packaging, processes, and standards via coaching and consulting techniques integrated with marketing and financial system.

We were also proud of our success as evidenced by Awards of the year 2015 that TISTR had received, for instance: 2014 Silver Conch Award for Excellence in Public Relations Performers, from the Public Relations Association of Thailand. This indicated that the public relations scheme of TISTR not only made our research and service activities known to the public, but also increased social awareness in scientific knowledge, a foundation for creating the knowledge-based society. Another prize that TISTR proudly presented was Outstanding Workplace in Occupational Safety, Health, and Environment, from the Department of Labour Protection and Welfare.

For all 52 years since the establishment, TISTR has set its goal to discover effective strategies that could be a managerial innovation which can accelerate the success of our missions. We are speeding towards the national development of science and technology whereas making the most of science and technology for national benefits and strengthening all economic and social sectors that affect the betterment of Thai people's quality of life and the prosperity of the nation as a whole.

With the wisdom of Thai researchers, TISTR will be a driving force of the progress of the nation.

The Governor of Thailand Institute of Scientific and Technological Research

Dr. Luxsamee Plangsangmas

GOVERNOR

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Dr. Luxsamei Plangsangmas
Board Member
and Secretary

Content

History of TISTR

The Thailand Institute of Scientific and Technological Research (TISTR) is a state enterprise of the Thai Government having the mandates to conduct scientific research and provide technical services. It was firstly established on 25th May 1963 as the Applied Scientific Research Corporation of Thailand (ASRCT) under the Office of the Prime Minister and was changed into "Thailand Institute of Scientific and Technological Research (TISTR)" in 1979 under the supervision of Ministry of Science and Technology. TISTR is financially funded by the Thai government to undertake activities as defined in the Thailand Institute of Scientific and Technological Research Act B.E. 2522. The objectives since its establishments are as follows :

1. To conduct research and provide scientific and technological services to the public and business sectors for the national economic and social development ;
2. To conduct scientific and technological (S&T) research for the ultimate use of natural resources appropriate with economy, environment, healthcare, and people's welfare;
3. To improve national productivity according to the government's policy via the utilisation of scientific and technological research in the development of agricultural, industrial and commercial sectors;
4. To provide training to scientific researchers;
5. To provide testing, calibrating and other scientific - related services.

Vision

ASEAN's leading organisation in research, development and service in science, technology and innovation.

Missions

1. To develop research and development capabilities.
2. To develop science and technology service capabilities.
3. To develop technology transfer capabilities and to maximise the ultilisation of technology and Innovation both for commercialisation and social benefits.
4. To develop creativity and innovation capabilities.
5. To develop TISTR's capabilities in infrastructures and organisational management.

Key objectives

1. To strengthen the capabilities in research and development and the effectiveness in S&T service provision to the Green Growth development of the country
2. To play a key role in the ASEAN Economic Community (AEC) via the development of the networks related to R&D, innovation, and S&T services while harnessing TISTR's human resource for making the most of joining the AEC.
3. To enhance Thailand's competitiveness in scientific and technological infrastructure together with TISTR's competitive advantages in technology.
4. To develop the systems, equipment, marketing, rules and regulations, management systems, information, mechanisms, and the good governance supportive to the enhancement of science, technology, and innovation of TISTR and its capabilities in managing TISTR's S&T initiatives for the business sector and the public.

Strategies:

Strategy 1. IncreasingTISTR's effectiveness in science, technology, and innovation for a comprehensive support of the knowledge-based society, responding to current life styles of Thai people.

Strategy 2. Increasing TISTR's competitive advantages in enhancing national economic growth.

Strategy 3. Increasing TISTR's capabilities in science, technology, and innovation for promoting energy and environmental security of the country.

Strategy 4. Increasing effectiveness in organisational management.

Organisational culture and Shared values

Organisational culture: Managing organisational intelligence, creating innovation value

Shared values SMART TISTR

S : Satisfaction customer's satisfaction
M : Mindfulness customer awareness
A : Accountability serving professional service to customers
R : Recognition building organizational creditability among customers
T : Trustworthy working with reliability and honesty
T : Talent strategic human resource planning
I : Innovation boosting creativity and innovation processes
S : Self development improving awareness, talent, and competency
T : Teamwork inclusive work environment
R : Responsibility doing duties at one's best

Statement of Direction(SOD)

The direction for organisational development of TISTR that corresponds with the national and organisational development strategies is "to add value and increase research and services expertise, to transfer research and development to commercial and social target customers, and to build stronger relationships and collaboration of research network locally and internationally."

Short-term plan

1. To conduct research and development and create innovations for national benefits in economic, social and environmental development under the scope of market demands.
2. To develop the administration system in compliance with international standards.
3. To strengthen the research networks by joining hands with other organisations in the governments and private sectors in the country and overseas.
4. To promote S&T services and the utilisation of research for commercial and social purposes.

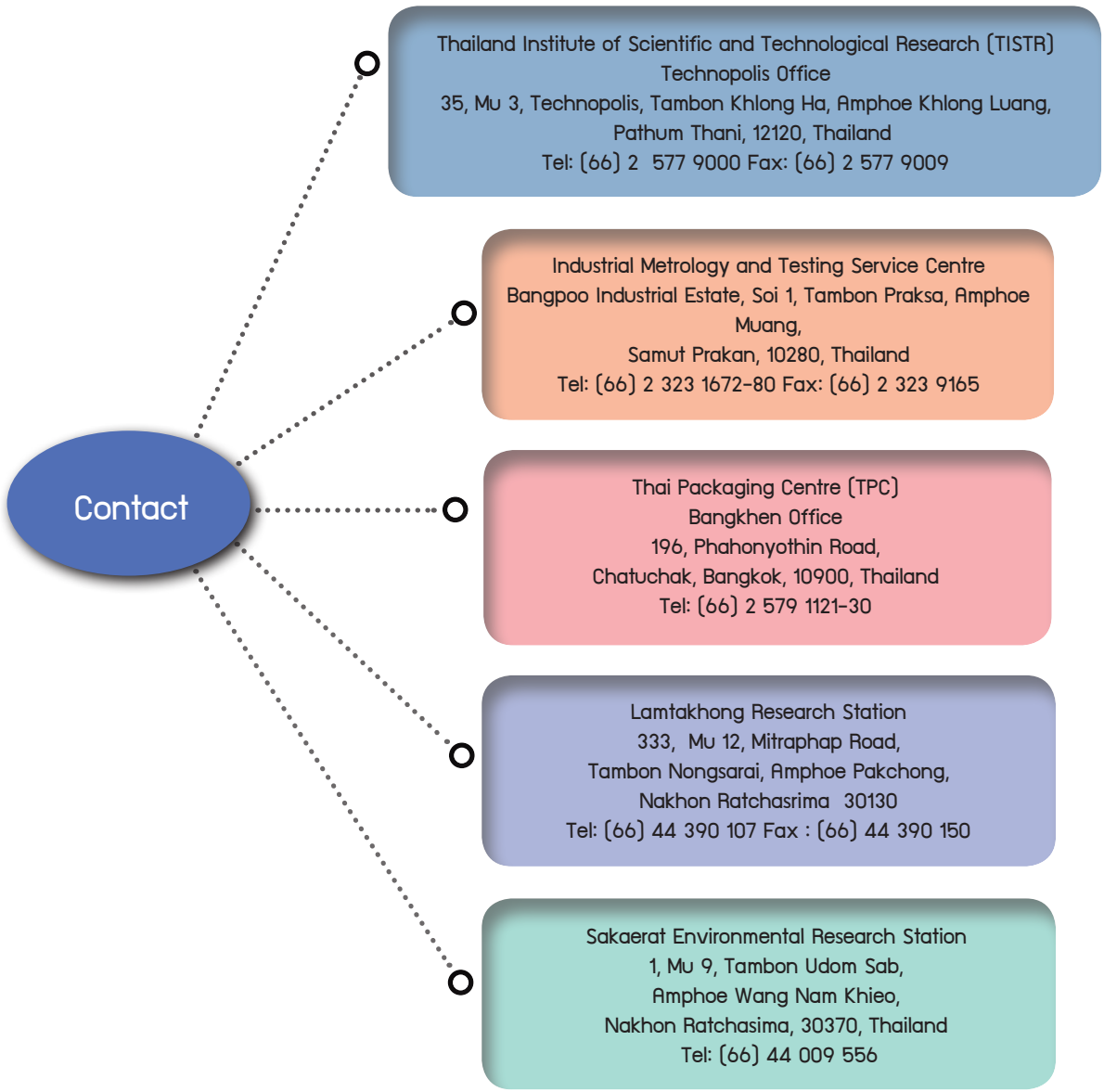
Long-term Plan

1. To build a sustainable network of S&T services locally and internationally.
2. To produce the value-added R&D products and innovation in order to increase social and economic values of the nation.

Type of Organisation

Type of OrganizationThe Thailand Institute of Scientific and Technological Research (TISTR) is a state-owned enterprise established to comply with government's special policy under the Ministry of Science and Technology (MOST). It was originally set up as the Applied Scientific Research Corporation of Thailand (ASRCT)" by the Applied Scientific Research Corporation of Thailand Act B.E. 2506 (1963). After the establishment of the Ministry of Science, Technology and Environment (MOSTE) on March 23, 1979, ASRCT Act was replaced by the Thailand Institute of Scientific and Technological Research Act B.E. 2522 (1979) up to present.

TISTR's core products and services include R&D products such as technology, knowledge, publication, patent, prototype machinery, product prototype, as well as scientific and technological services including analysis, testing, calibration, research service, consultation and training.TISTR delivers its products to customers in various forms including technical presentation, research report, analytical report, calibration report, technology transfer, and training.



Website: www.tistr.or.th Call Center : 02 577 9300

Industry and Future Outlook

The Office of the National Economic and Social Development Board, Thailand set the target of 3.5-4.5% of country's economic growth by 2015 according to various supportive factors i.e. the continuous growth of tourism, the government's policy to accelerate the budget spending since the early fiscal year 2015, the spending plan to boost economic system, the investment by the private sector to support the government investment projects, and the promotion for investment in the last half of 2013. The consumption of the private sector has shown increasing trend from the low rate of oil price and easing monetary from the reduction of the policy rates. This helped decrease the debt burden of household sector. However, with the slow recovery of world economy, coupled with the structural problems of export such as wage raised, limitation of production technology, and elimination of tax benefit (GSP) by the European Union, it resulted in the amount of export products and service that fell down below the forecast.

For science, technology and innovation (STI) development in 2014, International Institute for Management Development (IMD) ranged Thailand at the 44th from 61 countries by its competitive capability. During 2000-2013, the average amount of R&D investment was about 0.27% of GDP. In 2013, Thailand increased its R&D investment to 0.48% of GDP of which 53% were from the government and 47% were from the private sector. In the future during the 12th National Economic and Social Development Plan (2017-2021), the critical context for future change is the rapid change of technology and innovation, resulting in the change of production and commerce that use technology for more efficient production. By that reason, the manufacturing sector that cannot adapt to the change and lacks of research, development and innovation investment will lose their competitiveness. The aging society shall also affect the labor shortage in the country. The demand of products and services for aging people shall become increasing accordingly. The higher economic linkage in local and oversea level shall result to the domestic SMEs to improve the development of their productivity, business model including the development of industrial standard for the environmentally-friendly-products and responsibility to society and community. In addition, the climate change will lead to the decadence of natural resources and environment rapidly.

According to the 12th National Economic and Social Development Plan, the targets of government policy and development are to enhance the competitiveness and to come across the middle-income-trap to the higher-income society. STI development emphasizes technology and innovation to the change of production and living. It places important to disruptive technology to make products simple, cheaper and compact. The digital technology shall be applied to increase the efficiency and add value to the goods and services to support the quality of life and people's career. The future outlook shall come with the STI context development including R&D investment in researchers, infrastructure, and management, as well as commercialization of R&D for the public with the intellectual property protection.

Key Factors affected the Core Business

To drive TISTR to achieve its goal and road map, there were several key factors affected to its core business as the followings.

• THE DEVELOPMENT OF S&T PRODUCTS AND SERVICES

TISTR aims to be an organization with high performance in S&Ts, technology transfers, and S&T services to enhance the capability and performance of private sector and society. Therefore, the development of TISTR's products and services to meet the demand of customers and its stake holders is one of major factors to achieve the organization's goal.

• THE ENHANCEMENT OF TARGET SMES' COMPETITIVENESS

The enhancement of private sector's competitiveness by applying S&T is the main goal of TISTR Master Plan year 2012-2021. It focuses the increasing role of R&D and S&T services investment. Thus, TISTR designed the process of access on demand of the target SMEs. Also, the development of process to utilize scientific know how to enhance capability of SMEs, the development of supportive process to the implementation, the marketing development, the management of intellectual property, and the development of funding source were key processes to enhance those SMEs' capability and competitiveness respectively.

• THE DEVELOPMENT OF INFRASTRUCTURE AND MANAGEMENT TO SUPPORT ORGANIZATIONAL DEVELOPMENT

To support the organizational development, TISTR developed its infrastructure in various areas particularly equipment, tools, facilities, Excellent Centers, etc. In this situation, the improvement of efficiency related management and investment was important to the organisational development in long term.

• THE ENHANCEMENT OF CREATIVE INNOVATION

To utilize the transferred technologies of TISTR to SMEs for the real benefit of society, TISTR supported and promoted those SMEs to apply TISTR's R&D for the development of economic, social, and environment.

• THE ACCEPTANCE OF TISTR'S ACHIEVEMENTS FROM THE STAKEHOLDERS

To develop R&Ds and services, TISTR has emphasized essentially on its stakeholders. Many developments and improvements were done efficiently in many ways i.e. set up customers' feedbacks tools, develop the process of R&D involvement, develop mechanisms for technology transfers, and develop TISTR's working process.

• REVISE TISTR'S RULES AND REGULATIONS

in responding to current situation and in line with TISTR's development plan TISTR revises its rules and regulations to support and facilitate working process and implementations.

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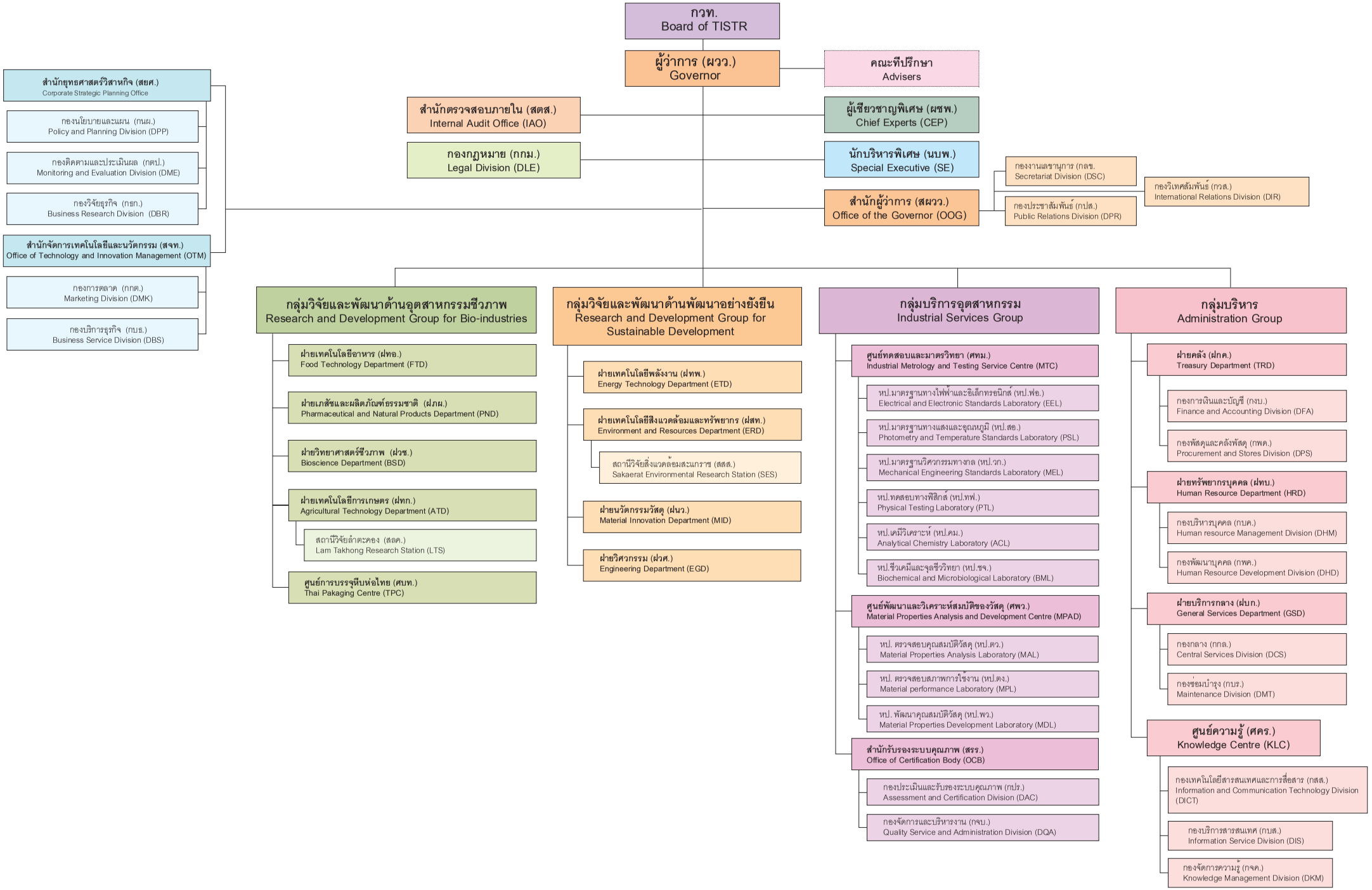
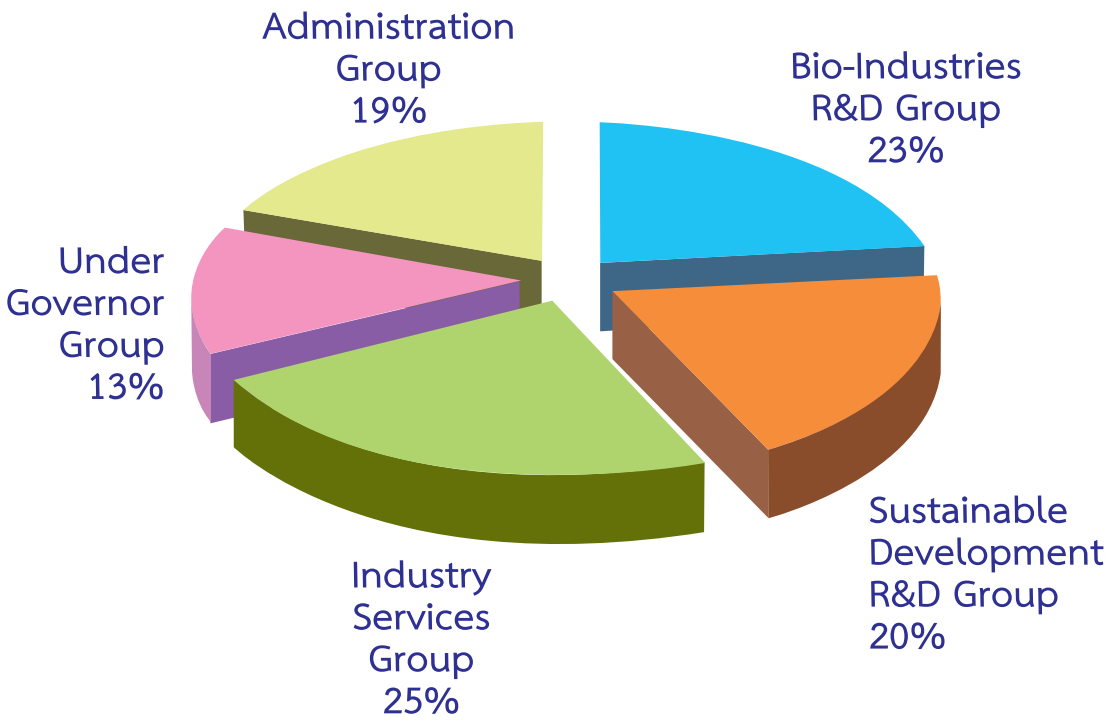
Organisation Chart of TISTR



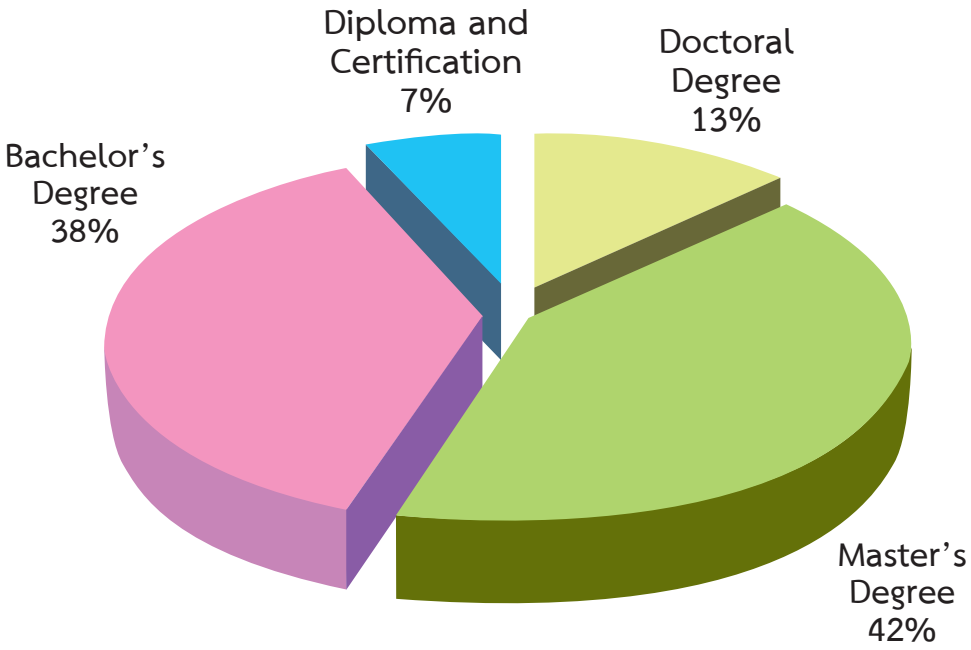
Human Resource

AS OF SEPTEMBER 2015, THERE WERE TOTALLY 886 STAFFS COMPRISING 613 PERMANENT STAFF AND 273 EMPLOYEES: MALES 274 (44.69%), FEMALES 339 (55.3%). THE TOTAL NUMBERS OF STAFF AND EMPLOYEES COULD BE CATEGORIZED ACCORDING TO FUNCTION GROUP, AND EDUCATIONAL DEGREES AS FOLLOWS:

Functional Group	Amount	Percentage
Bio-industries Research and Development	142	23%
Sustainable Development Research and Development	122	20%
Industrial Services	151	25%
Under Governor	80	13%
Administration	118	19%
Total	**613**	**100%**



PROPORTION OF TISTR'S STAFF BY EDUCATIONAL DEGREES

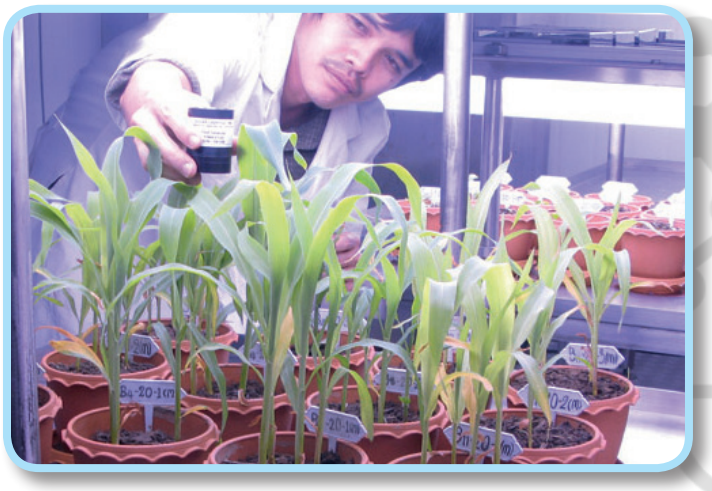


NUMBERS OF STAFF AND EMPLOYEES

TISTR's achievements in 2015

Research and Services on Bioplastics Biodegradable bioplastic testing laboratory

Department of Bioscience, TISTR has established a Biodegradable Bioplastic Testing Laboratory as the first laboratory in Thailand accredited by DIN CERTCO, Germany, in the scope of "Breaking down of plastic under the biofermentation process of a prototype testing in compliance with ISO 16929" The laboratory is ready with basic information, technology, equipment and appliances, and skillful personnel in the establishment of testing laboratory for bioplastic products according to ISO 17088, the latest standard having been recognized worldwide focusing on 4 areas: 1) Breaking down of plastic under the biofermentation process 2) Analysis of chemical components and heavy metals 3) Evaluation of biodegradation by inspecting microorganism activities 4) Quality assessment and toxicity against an ecosystem of compost manure. The Laboratory also has developed the preliminary biodegradation test method of biodegradable plastic for the first time in Thailand and has already applied



for a patent. The test method of biodegradable plastic is valuable to research and development in material and bioplastic packaging of both the government and private sectors as it can be performed in a shorter time with high precision and less cost when compared to other methods of the standards.

Research and Development on formulation of bioplastic product

Department of Material Innovation, TISTR has achieved in the conduct of research and development on "Degradable Biosplint from bioplastic" used for support of broken bones and joints. The splint was made of agricultural materials, generally used for controlling and shaping the damaged part of broken bone or joint dislocation into the right position. It could be used in patients having abnormal curvature of bone or club foot, preventing muscle shrinkage and other tissues such as those injured from burns caused by fire or hot water, protecting from broken bones for those having Osteopenia or patients after surgery who need to refrain from moving arms or legs during rehabilitation. The Biosplint has its advantage in removability/reshapability for many times, water rinsability, light weight, high durability and good ventilation, odorless and no skin irritation. The

Biosplint could be used as a substitute to those made of petrochemical plastic, adding value to agricultural material and being environmentally friendly.

Testing of plastic packaging

Thai Packaging Centre (TPC), TISTR, has provided testing services of plastic packaging, particularly in physical properties such as tensile strength, tear resistance, bursting strength, slow permeability, gas permeability, etc.

Certification of quality of biodegradable products

Office of Certification Body (OCB), TISTR has been well equipped and enlarged its roll to be the Product Certification Body in order to provide services to Thai industrial sector in terms of the quality system assurance of biodegradable products in compliance with ISO / IEC 17065. The scope of certification for biodegradable products consists of: 1) Basic materials, 2) Component, Constitute, 3) Finished Products having properties in compliance to the International

Standards such as ISO 17088, the Regional Standard such as EN 13432, and the National Standard such as ASTM D 6400 or other equivalent.

Paddy Dehumidifier at Farm Level

Food Technology, TISTR, successfully designed and developed a Paddy Dehumidifier at Farm Level for farmers to use it during the rainy season. The paddy dehumidifier was designed to be easy to use, could contain paddy of 500 kg/batch and was able to reduce humid in paddy from 20% to 14% within 3 hours. The dehumidifier had the highest capacity of 2 tons/day and used LPG as heat source. It could be used for drying other kinds of grains or herbs such as soybean, mung bean, red bean, kernel, coffee bean, ginger, galangal and turmeric, etc. The machine was energy safe and so far it has been used in many areas of Ayutthaya and Trad provinces.

VITISTRA Nutraceutical Cosmetics from Extracts of Thai Grape Seed

Department of Pharmaceutical and Natural Products, TISTR successfully developed nutraceutical cosmetics from extracts of Thai grape seed using Nano-emulsion technology – emulsion of small particles that could effectively contain extracts of grape seed having essential components and high pharmacological potency that could be used as an active ingredient in cosmetics. Accordingly, VITISTRA - the Nano anti-aging cream has been developed comprising 2 products

which are VITISTRA Day Cream and VITISTRA Night Cream. Safety and dermatological test of these 2 products were performed without using animals as regulated by the European Union (EU). To assure safety in human use, a testing on Normal Human Dermal Fibroblast (NFDH) was conducted and the result showed that these 2 products were safe to human skin.

VITISTRA Food Supplement from Extracts of Grape Seed

Department of Pharmaceutical and Natural Pro ducts, TISTR, successfully developed VITISTRA food supplement from extracts of grape seed obtained from byproducts of Thai grape seed in the industrial sector. The key process was focused on preparing of grape seed, performing biological extract (TISTR-GSE), analyzing chemical components of TISTR-GSE, and studying pharmacological properties such as anti-oxidants, anti- DNA damage, anti-mutation in DNA, and anti-inflammatory in large intestine. The safety of TISTR-GSE was also tested in terms of cytotoxicity both in normal cell lines and cancer cell lines and it was found that TISTR-GSE contained high OPCS which was pharmacologically effective.

VITISTRA Food Supplement Capsule

VITISTRA Food Supplement Capsule has effective properties in prophylactic treatment and skin nutrients. The product has its advantages in lower cost when compared to the imported ones and less intake of capsules but having more effectiveness of anti-oxidants. The safety of product was also performed in terms of Acute Oral Toxicity Test, OECD Test Guideline 423.

Learning Center for Vapour Heat Treatment (VHT) of Fresh Fruits for Export in the Upper Northern Region

TISTR joined hands with the Northern Science Park introduce the technology of Vapour Heat Treatment (VHT) of fresh fruits for export industry in the Upper Northern Region so as to develop the production process and standards of Thai fresh fruits. The pilot plant of VHT was established in the upper Northern Province, Tambon Mae Jua, Denchai district, Prae province. It has a capacity to treat 5 tons of mangos and could destroy fruit fly eggs while valuable nutrients and taste of fruit could be preserved as well as its storage life could be extended to 2-3 weeks. This could also help upgrade fruit up to international standards and could be exported to the countries where laws in plant quarantine were strict.

The pilot plant of VHT included 1) Cut stem of fruits before treatment 2) Clean fruits using 3-step rinsing system (1. Rinse with chlorine 2. Rinse with hot water of 50° C for 5 minutes and 3. Rinse with cool water of the room

temperature so that the fruits would not get damaged.) Then, leave the fruits to dry and treat them using vapour heat at 47 °C, relative humidity at 95% not less than 20 minutes. This process could also dry fruit fly eggs on fruits without using chemicals. Finally, the treated fruits were packed for distribution.

Capability of Thai Entrepreneurs' Competitiveness with STIM Program

Science Technology and Innovation Matching Program (STIM) is the system that will strengthen capability of Thai entrepreneurs' competitiveness by apply science, technology and innovation with the development of a product. Not only the product innovation will be obtained but also the perspectives of packaging, process and standard via the mentoring system and consulting in technology linked with marketing and finance in a systematic collaborative teamwork.

In fiscal year 2015, the STIM provided assistance to more 80 OTOP (one Tambon one product) and SME entrepreneurs in the development products, packaging, standard and design of machines and processes. The successful projects were, for example, body and facial scrub and lip gloss from organic jasmine rice (Organic Herbs@Chiang Rai Co., Chiang Rai province), frying machine for Northern style chili powder (Lab chili powder produced by Mae Chan Fon Lab Chili Powder, Payao province), icecream from flowers (Chiang Rai Homemade Icecream, Co., Ltd., Chiang Rai province), strawberry sparkling cider (Siam Northern Winery, Chiang Rai province), dried rambutan and dried longkong in syrup (Iyha Co., Ltd.), thick and thin cotton gloves coated with rubber (Community Enterprise of Rubber Farmers at Ban Nai Suan, Surat Thani province), turkey sausage (Community Enterprise for Turkey, Nakhon Phanom province), facial scrub from jasmine rice (Sustainable Agricultural Network, Tambon Nong Khaen, Pathumrat district, Roi Et province), crispy mushroom sheet (Lom & Fon Organic Farm, Udon Thani province). STIM Program is a collaborative mission among alliances of both the government and private sectors to provide a One-Stop service in order to promote OTOP and SME entrepreneurs in applying science, technology and innovation with the development of their products and services for the global competition.

Testing and Development of the Rail System

Material Properties Analysis and Development Centre (MPAD),TISTR recently extended it services in the area of the rail system. It is well prepared with an advanced testing laboratory and skilful staff. The services provided concerning the rail system include mechanical test, vibration test, fatigue test, durability test, quality and safety assurance of parts, equipment, and products of the rail system and engineering consultation to local manufacturers of the rail system and parts, importers, rail system subcontractors, managers of rail transport service, maintenance staff, etc. These services were in compliance with the standard of State Railway of Thailand, Thai Industrial Standards, and other international standards such as American Railway Engineering Association (AREA).

TISTR was also assigned by the Ministry of Science and Technology (MOST) to run the collaborative program on Thailand-China Joint Research Center on Railway System. The responsibility is to test the mechanical properties, strength, vibration, fatigue, and durability of parts, equipment, and products used in the rail system, for instance, sleeper, rail and joint, fastening, bogie, and train brake, etc. To promote and implement the government's policy on the rail system, TISTR has initiated the project on standard testing and development. A testing center was established in order to provide full services on testing as well as quality and safety assurance of parts, equipment, and products in the rail system both locally and other countries in ASEAN.

Awards of Achievement in 2015

Awards for organisation

"Sang Ngern": 2014 Silver Conch Award for Excellence in Public Relations Performers

TISTR was granted the 24th "Sang Ngern" 2014 Silver Conch Award for Excellence in Public Relations Performers, in organization category from the Public Relations Society of Thailand. On 27 February 2015, Mr.Visanu Krua-Ngam, Deputy Prime Minister presided over the ceremony and presented the Award to Mr.Yongvut Saovapruk, Governor of TISTR at Santi Maitree Building, Government House. TISTR emphasized the importance of public relations to publicize its R&D results to the target groups by various multimedia types. It was to encourage knowledge, awareness, and positive image of TISTR as an organization, dedicated to Thai entrepreneurs particularly SMEs and community enterprises without making any profits so that those businesses could compete in the global markets by utilization of science, technology and innovation.

Award of Outstanding Workplace in Safety, Occupational Health, and Good Environment

TISTR was awarded in Outstanding Workplace in Safety, Occupational Health, and Good Environment from the Department of Public Welfare, Ministry of Labour to promote organization as a role model that could manage its organisation for safety, health, and good environment consistent with the law of work safety and standard system. The Award was announced the honorable to the public and Mr.Arin Lekhakul, Acting Director of Central Services Division was a representative of TISTR to receive the Award on 24 August 2015 at Hilton Hua Hin Resort & Spa.

Awards for Outstanding Personnel

Person-of-the-Year Award

Mr.Yongvut Saovapruk, Governor of TISTR received the Person-of-the-Year Award 2014 in organizational management and development from the Project 1 Million Saplings of Goodness for the King, Honorable Prize for the Path of Life, Thai Prize for Thai Society. Mr.Amphol Sena-narong, the Privy Councilor, for H. E. King of Thailand presided the award presentation ceremony on 6 February 2015 at the Convention Hall, Convention Center of Chulaborn Research Institute, Bangkok. The Award was given to persons who were successful in their work and family, or dedicated to social and country benefits.

Award of Excellence in Poster Presentation

Dr.Anchana Pattanasupong, Senior Researcher, Bioscience Department including her research team, Mr. Chanchai Kahapana, Ms.Nidtayaporn Sompakdee, Ms.Noppawan Srasangta, Ms. Sirorat Tungsatitporn, Ms. Kanrawee Bosuwan received the Award of Excellence in Poster Presentation on Quality of Compost Tested from the Broken of Polylactic Acid Plastic at Prototype Level According to the ISO 16929 : 2013 at the 9th National Soil and Fertilizer Conference, during 2-4 July 2015, Hansa JB Hotel, Hat Yai, Song Khla.

TISTR's Flagship Program Building Centers of Excellence in R&D

Technology Center for Development of Quality Seedling for Economic Community Forest Extension

The infrastructure of Technology Center has been started including 3 plant nurseries for quality seedling cultivation as a supply for area extension of economic community forest, 1 hydroponic plant nursery. In 2015, there were totally 100,000 seedlings were produced and stored in these 4 plant nurseries and also training of local vegetable and mushroom as cash crop for the quality of life of the community.

Technopolis, SMEs and the Community (Northeast)

The project has the objectives to develop the incubation center for agricultural technology in the northeast that can support the learning environment of agricultural entrepreneurs/SMEs, enhancing their competitiveness in production, cost reduction, quality and standard, and adding value to agricultural produces. This center will serve as a learning center for sustainable agriculture in the northeast in order to implement the sufficiency economy philosophy as suggested by HM the King.

S&T for storage life expansion to tackle the oversupply of longan

A Learning Center of Storage Life Extension for Export Longan is located in the Lao Yao Tambon Administrative Organization, Ban Hong district, Lamphun province. It has been operated as a prototype of fumigation plant of sulphur dioxide in order to reduce sulphur residue in longan flesh and also an emission of sulphur dioxide in the air

Facilitate Access to Food Processing Technology for SMEs in the Remote Area

TISTR provided the infrastructure in science, technology and innovation to SMEs in the area under the Provincial Administrative Organisation of Phrae, Denchai district, Phrae province. It aimed to develop the processing food and solve the problem of difficult access to advanced technology of food processing so that SMEs could apply science, technology and innovation with their production process more effectively.

Enhancement of OTOP Entrepreneurs' Competitiveness with Science, Technology and Innovation in Each Region of Thailand

This project promoted cooperation between OTOP entrepreneurs and scientists or researchers in the government sector in using science, technology and innovation to solve the problems occurring in the administration and organizational process, and to utilize infrastructure more effectively. OTOP entrepreneurs, thus, could expand markets or find new markets for their products which had been developed based on technology transferred by TISTR's researchers and its network to create product innovation.

Testing Center for Biodegradation

TISTR viewed that the testing for biodegradation was essential infrastructure that should be promoted in order to strengthen bioplastic industry in Thailand. Therefore, the Biodegradability Testing Laboratory was established to provide testing service in compliance with ISO 17088 or TIS 17088-2555, and also registered with DIN Certo, Germany.

Center of Excellence for Algae

The Center of Excellence for Algae was initially established in 2015 with a total budget of 38.0650 million baht for the construction and public utilities and specific equipment. The Center will operate focusing on cultivation of algae in extended open marine environment using advanced solar energy technology in order to save energy and conduct research in algae. The Center has collected many strains of both marine and fresh algae together with information related, making it ready for the services. Moreover, high potential strains of algae for utilizing in various purposes have been selected together with technologies that are ready to be transferred.

Research and Development

Research and Development Achieved in 2015

1. R&D in Food Products

1. Commercial product of dong quai (*Angelica Sinensis*)

The R&D project was conducted on food products from dong quai (*Angelica Sinensis*) for boosting health. The product obtained, dong quai herbal drink, was also tested for its quality and consumers' acceptance.

2. Value-added health and cosmetic products from agricultural waste of agro-processing industry

The R&D project was conducted to add value to agricultural waste such as fruit seed from agro - processing industry by using technologies and extraction process so that the extract obtained could be used as raw material in production processes of health products and cosmetics.

3. Development of edible wild fruits for health food and drink products

TISTR selected the variety of Mamao (*Antidesma thwaitesianum* Müll. Arg.), Ceylon Oak (*Schleichera oleosa* (Lour.) Oken) and Korlan (Nephelium melliferum Gagnep.) which are locally wild fruits to be cultivated as economic plants. The chemical components were also investigated in order to be used as raw material for production of health food and drink. Cultivation techniques were transferred to local farmers for suggesting alternative plants to be cultivated as economic plants and could help save the environment. Currently, TISTR collected more than 20 varieties of Mamao, Ceylon Oak, and Korlan in nursery beds which were ready for any study visit of locally wild fruits at Lamtakhong Research Station.

4. Herbal products for smoking reduction

TISTR collected the varieties of herbs that were effective on smoking reduction. Demonstration nursery beds were made for collection, propagation, and study of cultivation techniques. Moreover, the pre-harvesting and post-harvesting practices as well as and storage life extension of fresh and dry herbs were investigated for commercial purposes. The extraction of key components for reducing smoking as crude substances was conducted to be used as a prototype product having an appearance, flavor and packaging that met the needs of smokers who wanted to reduce smoking. The storage life of this herbal product was also studied. The pharmacological and toxicological testings were applied with this herbal product to analyze its safety when using with smokers.

5. New varieties of chrysanthemums to increase utilization potential and upgrade product quality

TISTR developed the new 22 varieties of chrysanthemum which had better properties and were massively required in the market. These varieties had been already registered for TISTR's copyrights with the Department of Agriculture. The new varieties of chrysanthemum would

help farmers and sellers to do their flower business with Thai flower varieties, not violating the copyright law of using foreign varieties. In producing the new varieties, the biotechnology was used to obtain chrysanthemum free from plant diseases, thus reducing production and power costs in the beds. Not only cultivation techniques for better quality of chrysanthemum with lower cost, TISTR also promoted farmers in using this flower as raw material for producing health products, such as food supplement for migraine relieving, bad breath product, and anti-stress product.

6. Mushroom varieties and a temperate mushroom production system in low land for commercial purposes

In order to promote cultivation of economic mushroom for commercial purposes, TISTR developed varieties of yanagi matsutake mushroom and shiitake mushroom suited for the lowland. Besides, Lentinus mushroom strains were improved using Gamma ray and the results showed that when it was readily mature for harvesting, the hybrid strain was obtained and gave increasing yields. A prototype of automatic filling machine for substrate was also designed and developed in order to save energy and increase efficiency. Thus, it was useful to both producers of spawns and substrates, and farmers who could make benefits from this full process.

7. Dehumidification technology of paddy rice in small farming scale

TISTR developed a paddy rice dehumidifier for rice seed production using basic technology but it was energy saving and efficient for filling paddy rice in a container with high speed of 500 kg/batch with production capability 2 tons/day. This dehumidifier could reduce initial moisture content from 20% to 14% which was beneficial to farmers to use it in the rainy season or when they want to dry paddy rice for consumption. In 2015, TISTR demonstrated the working process of this humidifier to farmers in Ayutthaya, Songkhla, Phatthalung, Lampang, and Ubon Ratchathani

8. Organic postharvet technology

An organic postharvest practice was experimentally used by TISTR in order to control quality of vegetable and fruit supplied into the markets. The method used was to investigate the plant extract at suitable concentration to be used as a growth inhibitor for potato and onion. The extract obtained was semi-purified having Allelopathy substance that could inhibit the growth while extending storage life of potato and onion. This method could help reduce postharvest loss. Moreover, for some exported fruits that need glossy skin such as Nam DoK Mai mango, orange, and golden banana, TISTR developed the wax coating from vegetable of which quality was comparable to the market product. Another postharvest technology developed was a prototype of controlled atmosphere system for extending storage life of vegetable and fruit for future utilization.

9. Healthy food and cosmeceutical from Thailand native legumes

TISTR conducted research and development on cultivation of Thailand native legumes from upstream starting from a cropping system of legume to selection of high potential legumes for product development. This could promote farmers to cultivate legumes as an alternative plant in the drought season for earning extra income from legume processing. Moreover, any interested entrepreneur could ask for technology transfer from TISTR for commercial purposes.

10. Using microencapsulation technique in product development for obese and diabetic population

TISTR developed a dryer prototype combining spray drying with fluidized bed system in order to work more effectively in encapsulating quercetin and catechin. The production capacity of this dryer was 4 liter/hr. It is useful for manufacturers both in the industrial sector and small enterprises, especially those in medicine and modified medical food powder industries. The dryer could help reduce production cost and control food quality that might be lost during production process and storage.

11. Nutraceuticals products from herbs and natural products: Part 3

TISTR developed Nutraceuticals products from passion fruit for relieving symptoms of Parkinson's disease caused by disorder of nerve cells in the brain of the elderly, together with anti-nausea drugs from herbs for patients of cancer chemotherapy. The research was aimed to develop herbal products from quality materials as alternative to chemical drugs, reduce import values of foreign drugs, and promote the use of herbs as raw material in national drug industry

2. R&D in health products

1. Production Technology of standardized extract from natural products at semi-industry: Part 1

TISTR studied bioactive compounds and selected herbal extracts having anti-bacterial effect at laboratory scale in order to develop into the process of extract production at semi-industrial scale, both analysis techniques and quality control as well as stability of active compounds in the extract. The extracts of which quality had been controlled and standardized had advantages in less time consuming at preparation stage of herbal material for drug industry, herbal industry and others.

2. Material and medical appliances for health promotion of the elderly

TISTR conducted research in dental material by developing the formula for production of long-lasting resin composite material for dental restoration or filling that could reduce recurrent tooth decay and expenses paid for several times of restoration. This resin composite material could also make the teeth more aesthetic, bonding effectively to the tooth structure and having the good quality comparable to the commercial one. TISTR also developed dental filling material and scaffold suitable for biological use, of which biological properties and safety were tested. For pain-relieving kits, a gel composite pad was developed to prevent pressure and tissue trauma using gel synthesis and gel pad forming processes for patients and the elderly

3. Appliances, machines and equipment used in factories and educational institutes

TISTR developed appliances, machines and equipment used in factories and educational institutes of which 2 projects were achieved in fiscal year 2015. The first project was a development of a prototype of elemental analysis appliance using fluorescence spectroscopy, used as a learning material in an educational institute. The second project was a development of a prototype of a land slide and flash flood early warning system which had been already installed at Ban Pha Mub, Tambon Mae Poon, Lablae district, Uttaradit province. This early warning system could help villagers to monitor and be ready in evacuation to the safe areas.

4. Ultrasonic drug delivery

TISTR developed the cultural practices for herbs used as effective local anesthetics. The experiment was conducted on cultivation of herbs both in greenhouse and at farm level by investigating the proper amount of fertilizer used that had an effect on increasing yield and chemical components. The drug delivery appliance through skin using ultrasound wave comprised a transducer of low and high frequency for delivering local anesthetics. Another one was an ultrasound controller of anesthetics delivered through skin that could work effectively and more rapidly. The target customers of this appliance were a working-age group and the elderly used this appliance for physical therapy.

3. R&D on renewable energy

1. Development of high efficiency reactor for producing synthetic fuel from biomass

TISTR developed a high efficiency reactor for producing synthetic fuel from biomass in order to produce different types of fuel. In this project, the knowledge and expertise of TISTR's researchers were used in the development process of which the performance was improved while productivity was also extended from laboratory to a semi-pilot scale or larger in order to serve other target groups such as research and development organizations both of the public and private sectors and entrepreneurs for commercial applications

2. Efficiency increase of synthesis gas from biomass for firing high-temperature ceramic

TISTR developed prototypes of hydrosteam gasification and a pelleting machine in order to synthesize fuel gas which had higher calorific value and develop a prototype of production technology of synthesis gas using a partially steam hydrogasification process for firing high-temperature ceramic. A test run of the hydrosteam gasification system in the synthetic process was performed until the system and the synthesis gas having higher calorific value were obtained. The technologies on synthesis gas production from biomass and biomass briquetting production technique were ready to be transferred to the target groups in ceramic industries and drying process related industries.

3. The development of the complete production process of synthetic fuel from biomass, waste, and plastic waste

The research was focused on the development of the complete production process of synthetic fuel by pyrolysis technique. The design, development, improvement, and experiment lead to a creation of a prototype for the production of synthetic fuel from biomass, waste, and plastic waste. The synthetic fuel was tested as well as knowledge concerned was collected, leading to the reduction of fuel consumption in the heating and the use of waste, especially the garbage problem causing deterioration to the environment. Currently, TISTR has a complete developed prototype together with knowledge and technology of the production of synthetic fuel from fat residue/food debris, from waste materials in the palm oil industry using sub-critical hydrothermal liquefaction.

4. Green innovation from the development of biofuel production technology from Ligno cellulose

TISTR studied and developed steps to adjust the fiber material condition and cellulose digestion in order to obtain sugar for using in ethanol production including design and manufacturing of a reactor for the above purpose. This technology is useful for the development and improvement of ethanol production from Ligno cellulose fiber material, increasing production, and reducing costs in production process of cellulosic ethanol for the industries of ethanol production.

Patents and Petty Patents, as registered with Department of Intellectual Property in Fiscal Year 2015

In fiscal year 2015, TISTR filed 40 R&D products for patents and 6 for petty, of which 4 were granted.

Patents

1. Production process of migraine headache relief herbal product from the extracts of chrysanthemums.
2. Elimination process of alkaline and alkaline earth in the production of biodiesel.
3. Production process of a catalyst Type ZSM-5 from bagasse ash
4. Production process of zeolite filter media Type 5A from bagasse ash.
5. Corn liquor of plum flavor.
6. Production process of high value carotenoids pigment from commercial Elakatothrix algae in one step.
7. Production process of high value carotenoids pigment from commercial Chlorococcum algae in one step.
8. Production process of gel beads from tamarind seed extract.
9. Process and formula for making slow-release chemical organic fertilizer for rice farming fertilized only once.
10. Wet Algae cell braking by Rotary ball mill.
11. Production process and formula of tooth paste from the extracts of Stephania venosa (Bl.) Spreng.
12. Process and formula of feed for tissue culture of Beach morning glory (Ipomoea pes-caprae).
13. Plant growing apparatus in a water-saving system container.
14. The develop process of microalgae by encoding acyl-CoA reductase gene for enhancing biofuel production.
15. The develop process of microalgae by using caleosin protein for enhancing biofuel production.
16. The develop process of microalgae by encoding acyl-carrier protein synthetase gene for enhancing biofuel production.
17. Method of calcium phosphate scaffold preparation using bio-additive.
18. Packaging for ceramic products.
19. Dehumidifier of seeds and grains.
20. Dehumidifier of seeds and grains by adjusting hot air flow.
21. Formula and production process of mouthwash product

from the extracts of chrysanthemums.

22. Recipe and production process of curry powder fried rice with steamed fish topping.

23. Recipe and production process of vegetarian ball from mushroom.

24. Formula and production process of Mamao juice mixed with concentrated mixed fruit juice.

25. Production process of concentrated Mamao juice and formula of ready to drink fruit juice
mixed with Mamao juice.

26. High speed pressing machine for TISTR's interlocking blocks.

27. Formula and production process of tooth paste from the extracts of chrysanthemums.

28. Production process of pineapple cider beverage.

29. Formula and production process of Gag fruit juice mixed with sacha inchi peanut oil.

30. Moving rotary valve.

31. Alternate open/close sliding valve.

32. The equipment of separator of fine sand particles in hot syngas.

33. Catalytic inverter from combustion of biomass, garbage, coal, and other fuels.

34. Biological treatment system for water sources
contaminated with pesticides.

35. Formula and production process of lip gloss from rice bran oil

36. One-way and folded channel of mixer impellers

37. Production process and formula of anti-vomitting herb for cancer patients treated with chemotherapy.

38. Lignin precipitation from black liquor using enzyme.

39. Position of Amino acid LYGPDTPI and IISPPDSSY on CEA tumor marker protein for design and production of antibody

40. Array Ultrasound head with suction cup

Petty Patents

1. Formulation and production process of Phyllanthus emblica and Zanthoxylum limonella roll on deodorant.

2. Formulation and production process of Phyllanthus emblica and Zanthoxylum limonella moisturizing cream.

3. Formulation and production process of Phyllanthus emblica and Zanthoxylum limonella moisturizing gel.

4. Formulation and production process of Phyllanthus emblica and Zanthoxylum limonella facial lotion.

5. Formulation of ready-to-eat gluten free noodle.

6. Formulation and production process of facial and body scrub from jasmine rice.

Petty patents granted in 2015

1. Formula and production process of mushroom beverage.

2. Process for waste water treatment of swine farming using microalgae Oscillatoria okeni TISTR 8549.

3. Treatment system for eliminating of SO2 using ozone.

4. Recipe and production process of mushroom soup.

International Publications and Proceedings

1. Aiemsard, R. et al. 2015. Effect of drying on total phenolic compounds, antioxidant activities and physical properties of palm sugar. *Journal of Food Science and Agricultural Technology*, 1(1), pp. 126-130.

2. Anuwattana, R. et al. 2015. Synthesis of NA-A zeolite from rice stubble ash and aluminium hydroxide sludge. In: *Proceeding of the Burapa University International conference 2015*. Chonburi: Burapa University, pp. 853-858.Boonruang, A. et al. 2015. Preparation and properties of PSZTM ceramics with different methods. *Key engineering Materials*, 659, pp. 132-137.

3. Boonruang, A. et al. 2015. Preparation and properties of PSZTM ceramics with different methods. *Key engineering Materials*, 659, pp. 132-137.

4. Chanonmunag, P. et al. 2015. Depositions of acid aerosols and black carbon from biomass burning over the Sakaerat Biosphere Reserve Forest, Thailand. *The European Conference on Sustainability, Energy & the Environment.* United Kingdom: The International Academic Forum, pp. 1-14.

5. Chanonmuang, P., Khummongkol, P. and Kazuhide, M. 2015. Dry deposition of SO2 over dry dipterocarp forest, Thailand. *Sains Malaysia* 44(3), pp. 317-323.

6. Charuchinda, P. et al. 2015. Caleosin from Chlorella vulgaris TISTR 8580 is salt-induced and hemi-containing protein. *Bioscience, Biotechnology and Biochemistry*, 79(7), 1119-1124.

7. Chen, S. et al. 2015. A cost-effective acid degumming process produces high-quality Jatropha oil in tropical monsoon climates. European *Journal of Lipid Science and Technology*, 117(7), pp. 1079–1087.

8. Dillenschneider, J. M. et al. 2015. Novel ¶2s+¶2a *electrocyclization* of triethylenic-malonic acids exemplified for a one-pot synthesis of new γ-dilactones cis-fused with a cyclopentene. *Journal of Heterocyclic Chemistry*. [on-line]. Available at: http://onlinelibrary.wiley.com/wol1/doi/10.1002/jhet.2419/full [accessed 27 May 2015].

9. Eiamwat, J. et al., 2015. Seed flour prepared by fat extraction of rambutan seeds with SC-CO2. Isan *Journal of Pharmaceutical Sciences*. 10 (suppl.), pp. 138-146.

10. Galaup, P. et al. 2015. First isolation of Brevibacterium sp. pigments in the rind of an industrial red-smear ripened soft cheese. International *Journal of Dairy Technology*, 68(1), pp. 144-147.

11. Giwanon, R. et al. 2015. Antibacterial activities of essential oil from Zingiber Cassumnar Roxb. against Serratia marcescens associated with bacterial keratitis. Isan Journal of Pharmaceutical Sciences. 10 (suppl.), pp. 173-178.

12. lan Vu, H. T. et al. 2015. Tantichroenia aidae sp. nov., for acetic acid bacteria isolated in Vietnam. *Annals of Microbiology* (Springer Berlin Heidelberg), pp.1-7.

13. Jaengklang, C. et al. 2015. Determination on antioxidant capacity and TLC analysis of Ten Thai Russula Mushroom extracts. *Isan Journal of Pharmaceutical Sciences*. 10 (suppl.), pp. 241-250.

14. Jariyaphinyo, S., Larpkiattaworn, S. and Chienthavorn, O. 2015. Comparison of pyrolysis of Jatropha cake with different catalysts using PY-GC/MS. *Key Engineering Materials*, 659, pp. 201-205.

15. Jiang Ngiam, R. and Artchawakom, T. 2015. Odonata of Sakaerat Environmental Research Station, Nakhon Ratchasima, Thailand. *Agrion*, 20(2), pp. 56-59.

16. Jitrwung, R. and Yargeau, V. 2015. Biohydrogen and bioethanal production from biodiesel-based glycerol by enterobacter aerogenes in a continuous stir tank reactor. International *Journal of Molecular Sciences*, 16, pp. 10650-10664.

17. Kageyama, H. et al. 2015. Improved alkane production in nitrogen-fixing and Halotorant Cyanobacteria via abiotic stresses and genetic manipulation of synthetic genus. Current Microbiology, 7(1), pp. 115-120.

18.Keawprak, N., Boonrueng, A., and Siridamrong, P. 2015. The effect of silane coupling agent on mechanical properties of dental resin composite. *The 2nd annual meeting of Thai Society of Dental Biomaterials*. Bangkok: Chulalongkorn University, pp. 14-20.

19.Klungsupya, P. et al. 2015. Anti-anxiety activity, acute toxicity and cytotoxic property of extract of Clausena harmandiana (Pierre) leaves. *Isan Journal of Pharmaceutical* Sciences. 10 (suppl.), pp. 199-206.

20. Klugsupya, P. et al. 2015. Determination of free

radical scavenging, antioxidative DNA damage activities and phytochemical components of active fractions from Lansium domesticum Corr. fruit. Nutrients, 7, pp. 6852-6873.

21. Lao-ubol, S. et al. 2015. Textural and structural properties of SBA-15 supported Zn catalyst for transesterification reaction: effect of Zinc loading method. *Pure and Applied chemistry international Conference 2015*. Bangkok: The Chemical Society of Thailand/King Mongkut's University of Technology Thonburi, pp. 728-731.

22. Larpkiattaworn, S. et al. 2015. Dispersion stability of drinking water treatment sludge. Key engineering Materials, 659, pp. 69-73.

23. Maneesin, P., Wangchanachai, G. and Seebuppha, C. 2015. Effect of garlic and modified atmosphere packaging (MAP) on quality of chilled splendid squids. In: *Proceedings Food Innovation Asia conference (FIAC2015) Innovative ASEAN Food Research* towards the World. Bangkok: Chulalongkorn University. pp. 249-256.

24. Meesat, R. et al. 2015. Development of powder and ready to health drinks using aloe vera. *Journal of Food Science and Agricultural Technology*, 1, pp. 111-115.

25. Muangman, T. et al. 2015. Superoxide anion scavenging activity and mitochondrial toxicity of various tamarind (Tamarindus indica L.) seed coat extracts. *Isan Journal of Pharmaceutical Sciences*. 10 (suppl.), pp. 189-198.

26. Nakhan, P., Utistham, T. and Wetwatana, U. 2014. Study of volatile organic compounds (VOCs) and heavy metals contained in aluminium coating package waste from pyrolysis process. *The 3rd Annual PSU Phuket International Conference 2014*. Phuket: Prince of Songkla University, pp. 59-65.

27. Natpinit, P. et al. 2015. Reduction of greenhouse gas emissions from RD 41 rice cultivation by single fertilization with zeolite 4 A. In: *Proceeding of the Burapa University International conference 2015*. Chonburi: Burapa University, pp. 699-706.

28. Ngernchuklin, P., Eamchotchawalit, C. and Safari, A. 2015. Comparison of actuator performance in lead-based and lead-free piezoelectic symbols. *IEEE International symposium. Singapore*: The Institute of Electrical and Electronic Engineers, pp. 261-264.

29. Ngernchuklin, P. et al. 2015. Electromechanical displacement of soft/hard PZT bi-layer composite actuator. *Key Engineering Materials*, 659, pp. 96-101

30.Noophan, P. et al. 2015. Mixing intensity effects of attached growth on enriched Anammox cultures. *Environment Asia*, 8(1), pp. 34-40.

31. Panpraneescharoen, S., Punsuvon, V. and Puemchalad, C. 2015. Comparison of homogeneous and heterogeneous catalysts in biodiesel production from *Pongamai pinnata oil. Asian journal of chemistry*, 27(3), pp. 1023-1027.

32. Pengkumsri, N. et al. 2015. Physicochemical and antioxidative properties of black, brown and red rice varieties of northern Thailand. *Food Science and Technology (Campinas)*, 35(2), pp. 331-338

33. Pinkhien, T., Wongtrakul, P. and Klungsupya, P. 2014. Nanoemulsions containing grape seed extract from Vitis vinifera cv. Ribier (Pok dum) and their bioefficacy study. In: Proceedings International *Graduate research conference 2014*. Chiang Mai: Chiang Mai University, HS 55-60.

34. Praditniyakul, B. et al. 2015. Effect of cooling methods on quality and consumer perceptions of angelica (Angelica sinensis Oliv.) in different retail packages during storage. In: Proceedings *Food Innovation Asia conference (FIAC2015) Innovative* ASEAN Food Research towards the World. Bangkok: Chulalongkorn University. pp. 244-248.

35. Punphan, V. et al. 2015. Effect of Different Chemical Pretreatment Methods and Enzymatic Saccharification on Chemical Composition of Sugarcane Shoots and Leaves. The *26th Annual Meeting of the Thai Society for Biotechnology and International Conference (TSB2014)–3Bs*: Biodiversity, Biotechnology and Bioeconomy. Chiang Rai: Mae Fah Luang University, pp.72-77.

36. Rafael, W. et al. 2015. Amycolatopsis rhabdoformis sp. nov., an actinomycete isolated from a tropical forest soil. International *Journal of Systematic and Evolutionary Microbiology*, 65, pp.1786-1793.

37. Rerk-am, U. et al. 2015. Phytochemicals and anti-oxidative DNA Damage activity against H_2O_2 of *Nymphaea lotus* Linn. flowers ethanolic extracts. *Isan Journal of Pharmaceutical Sciences.* 10 (suppl.), pp. 234-240.

38. Saman, P. et al. 2015. Probiotic isomalto-oligosaccharide production from Thai rice. *Journal of life Science,* 8, pp. 822-827.

39. Sirisattha, S. et al. 2015. Protomics potential and its contribution toward sustainable agriculture. *Agroecology, Ecosystems and Sustainability*. CRC Press Taylor & Francis Group, pp. 152-179.

40. Soradech, S. et al., 2015. Encapsulation of Anthocyanin from Mamao (Antidesma thwaitesianum Mull.Arg.) by using freeze dry technology. *Isan Journal of Pharmaceutical Sciences.* 10 (suppl.), pp. 104-111.

41. Srinorakutara, T. et al. 2015. Effect of commercial cellulase enzymes on ethanol production from pretreated rice straw at high solid loading. *Journal of Food Science and Engineering*, 5, pp. 67-75.

42. Srinorakutara, T. et al. 2015. Simultaneous saccharification and fermentation of alkali-acid pretreated sugarcane trash to ethanol. *The 26th Annual Meeting of the Thai Society for Biotechnology and International Conference (TSB2014)*–3Bs: Biodiversity, Biotechnology and Bioeconomy. Chiang Rai: Mae Fah Luang University, pp. 6-12.

43. Srinorakutara, T. et al. 2015. The effect of rice straw size on batch enzymatic hydrolysis at high solid loading for cellulosic ethanol production. *The 26th Annual Meeting of the Thai Society for Biotechnology and International Conference (TSB2014)*–3Bs: Biodiversity, Biotechnology and Bioeconomy. Chiang Rai: Mae Fah Luang University, pp. 85-97.

44. Tan, M. K., Dawnrueng, P. and Artchawakom, T. 2015. Taxonomic review of *Kuzicus Gorochov*, 1993 (*Tettigoniidae* : *Meconemationae*), with two new species from Thailand and key to species. Zootaxa, 3999(2), pp. 279-290.

45.Tan, M. K., Liu, C. and Artchawakom, T. 2015. Taxonomic review of *Tapiena* (*Orthoptera:Phaneropteridae: Phaneropterinae*), with key to species and new species from Thailand. Zootaxa, 3920(1), pp. 040-050.

46. Thasanaphan, P. et al. 2015. Remain Creep life assessment of service superheat tube boiler. *Key Engineering Materials*, 659, pp. 686-690.

47.Thepkhun, P. and Masayuki, S. 2014. Environmental impact assessment on high quality biodiesel from jatropha oil. *The Management and Innovation Technology International Conference*. Chonburi: Ramkhamhaeng University, pp. 16-20.

48. Thiensong, B., Eiamwat, J. and Natpinit, P. 2015. Composition and physicochemical charac-teristics of rambutan seed oil extracted by supercritical carbon dioxide. In: *Proceedings Food Innovation Asia conference (FIAC2015)* Innovative ASEAN Food Research towards the World. Bangkok: Chulalongkorn University, pp. 348-353.

49. Thisayakorn, K. et al., 2015. Effect of *Passiflora foetida* on abnormal locomotion in MPTP induced Parkinson-like behavior in mice. *Isan Journal of Pharmaceutical Sciences.* 10 (suppl.), pp. 167-172.

50. Timyamprasert, A. et al. 2015. Esterification of waste palm oil in wastewater pond for community biodiesel production. *Applied mechanics and materials*, 692, pp. 133-138.

51. Timyamprasert, A. et al. 2015. Optimization for community biodiesel production from waste palm oil via two-step catalyzed process. *Materials science and Engineering* A, 5(6), pp. 238-244.

52.Trujillo, M. E. et al. 2015. *Modestobacter lapidis* sp. nov. and Modestobacter muralis. sp. nov., isolated from a deteriorated sandstone historic building in salamanca, Spain. Antonie van Leeuwenhoek, 108, pp. 311-320.

53. Woraharn, S. et al. 2015. Development of fermented Hericiumerinaceus juice with high content of L-glutamine and L-glutamic acid. *International journal of Food Science and Technology*, 50(9), pp. 2104-2112.

54. Woraharn, S. et al. 2015. Evaluation of factors that influence the L-glutamic and γ-*aminobutyric* acid production during Hericium erinaceus fermentation by lactic acid bacteria. CyTA - *Journal of Food*, 14(1), pp. 47-54.

55. Yasunaga, T., Yamada, K. and Artchawakom, T. 2015. First Indochinese records of the plant bug genus Hypseloecus Reute (*Hemiptera : Heteroptera : Miridae : Phylinae : Pilophorini*), with descriptions of eight new species from Thailand. Zootaxa, 3925(1), pp. 075-093.

56. Yousif, G. et al. 2015. *Streptomyces mangrovi sp. nov*., isolated from mangrove forest sediment. *Antonie van Leeuwenhoek*, 108(3), pp. 783-791.

Technology transfer: the technology for social and commercial utilizations

In 2015, TISTR used R&D outputs, technology and innovation in supporting and strengthening the industrial sectors, SMEs entrepreneurs as well as the society, community and people. This aimed to increase competitiveness of these target groups by using knowledge of science and technology as a major driver to the country development according to the government policy through all technology transfer activities, training, research and consultancy services. The outcomes are as follows:

-Social purposes. TISTR managed for activities by selecting the relevant research projects that were completed in 2015 and the knowledge in the areas of TISTR's expertise transferred to various groups in the society, for instance, the community near Technopolis, local and regional research stations in collaboration with networks. Collaborative activities and knowledge sharing to the community are as follows:

Interlocking block technology, manufacturing of interlocking blocks and construction of building using interlocking blocks. Seven trainings were organized for provincial entrepreneurs in Buriram, Sisaket and Nakon Pathom, as well as at the headquarter in Technopolis, Pathum Thani, comprising a total of 320 attendants. The success of the project was performed by conducting a follow-up evaluation in the farmers' group growing organic vegetables as a community enterprise at Baan Nong Krat, Buriram, of which members formerly earned income from selling organic fertilizers and vegetables. The result showed that these farmers could use the transferred technology in producing interlocking blocks, thus earning extra income of 21,000 baht per month.

High quality TISTR organic fertilizer and management of fertilizer plant. To promote and support farmers be able to produce high quality fertilizer in accordance with Thai Agricultural Standard and reduce production costs, TISTR transferred fertilizer technology for 19 sessions in 9 provinces with a total of 1,538 attendants. The samplings of fertilizer from 12 groups were conducted for testing. A follow-up after training showed that 10 farmer groups were capable of producing fertilizer of the TISTR formula which was compiled with the standard. TISTR also offered technical assistance over the management of the fertilizer plant formerly built in One Tambon One Fertilizer Plant Project but had become inefficient in management. Finally the 3 plants could be reopened for more effective production.

Upgrading OTOP products, ceramics and packaging development. TISTR provided on-site training for improving manufacturing processes such as molding, coating techniques, developing violet coating, types of ceramic products and furnace usage. Improving thermal efficiency in furnace was performed for the Sankampaeng glazed pottery village group in Chiang Mai, the Bangklam pottery village group in Songkla and the Thonhong ceramic village group in Nakhon Si Thammarat. A follow-up on the implementation showed the reduction of fuel costs in furnaces and also increased earnings for those three groups.

Mushroom cultivation in cold climate and promoting farmer careers in the area of the Royal Project Foundation

TISTR provided 6 training courses at the Highland Research and Development Institute (Public Organization) and the Royal Angkhang Research Station as follows: commercial production of quality Ling Zhi mushroom, production of Shiitake mushroom from bedlogs, production of Portobello mushroom, training on compost making for Portobello mushroom, training on Straw mushroom cultivation in greenhouse and training staffs on mushroom cultivation with good agricultural practice: GAP for food crops, were given to 164 participants including farmers, hill tribes, and staffs worked for the Royal Project.

Production of chrysanthemums for reducing production cost and upgrading product quality, and production of disease-free chrysanthemum plants.

TISTR transferred technology for producing disease-free planting materials, effective production of chrysanthemums for high quality yield in order to reduce the production cost of farmers via training courses which were held for Thai Samakkhi farmers and the community in Nakhon Ratchasima. Also, 10 quality varieties of 15,000 chrysanthemum plants were distributed to farmer groups from October 2013 to February 2014 for plantation.

Development of coating solution from plant mucilage for prolonging storage life of fruits for export.

Training on plantation management and development of coating solution was organized for the groups of export fruit growers at Noppharat subdistrict Administrative Organization, Pathum Thani. Many entrepreneurs were interested in the coating solution developed by TISTR for trial use.

Using science and technology for prolonging exported longan to solve the oversupply problem.

Ten training courses were given to farmers, entrepreneurs, government agencies, Subdistrict Administrative Organizations and interested people in Lamphun, Tak, Nan, Payao and Chiang Rai, with totaling 998 participants. The training courses provided in these following topics: the use of QR code for exported longan and other agricultural produces, management of sulfur dioxide fumigation plant for community benefits, production of tailor-made fertilizer for longan and prevention of diseases and insect pests in longan by biological method.

-Commercial production.

A number of TISTR R&D products that Thai entrepreneurs were interested in and further developed for commercial production were as follows:

Technology transfer of cosmeceutical products from herbs to Shinete' Babyface Network Co., Ltd. Three cosmeceutical products, namely, NYMPH DE MALA cream for sun protection, NYMPH DE MALA cream for anti-melasma and wrinkle reduction and Lico-scar cream for protection of Keloid and hypertrophic scars were transferred for commercial production. The Lico-scare cream contains Licorice extract while both NYMPH DE MALA products were made from water lily, Nymphaea as a novel herbal ingredient found having anti-tyrosinase and antioxidant activities as well as anti-inflammation against UV.

Technology transfer of fat-free yogurt ice-cream production to Chiang Rai Homemade Ice-cream Co., Ltd. The ice-cream recipe contained ingredients having antioxidant activity which were suitable for consumers concerned of health and weight control.

Technology transfer for organic chemical fertilizer production to Ruk Baan Rao Co. Ltd. for promoting the uses of organic fertilizer and organic chemical fertilizer produced from municipal waste as substitution to chemical fertilizer, and transferring knowledge of organic fertilizer and organic chemical fertilizer for commercial production.

Technology for instant Kaeng Phak Wan Pa production to Lerttham Development Co., Ltd. This low-fat healthy product contains high calcium from fish meat, dietary fiber, iron and vitamins. Its recipe has no chemical preservatives and is safe for consumption.

• **Licensing.** TISTR granted a license to Pathommak Co., Ltd. in utilizing TISTR algae strains as follows:

- Cyanobacteria strains Nostoc muscorum TISTR 8871 and Nostoc TISTR 8873 for use as an ingredient in producing a soil amendment product and sustainable commercial production of crops.
- Cyanobacteria strain Hapalosiphon welwitschii TISTR 8237 for use as ingredient in commercial production of bio-fertilizer
- Bacteria strain Bacillus megaterium var.phosphaticum TISTR 1313 for use as ingredient in commercial production of phosphate-solubilizing bio-fertilizer

- Research and consultancy services. TISTR provided services to entrepreneurs and government agencies in research and development within areas of expertise as well as consultation in process improvements as follows:

- Agricultural technology. The research and development service were conducted in increasing productivity of organic longan, training and technology transfer of nano organic slow-released fertilizer to farmers, and production of organic chemical fertilizer/soil amendment from waste of sugar processing plant.

- Food products, machinery and processing equipment. The R&D products were, for example, coconut butter products, product development from coconut oil, instant rice mixed grains beverage, process development of ready-to-drink orange juice, herbal drink products for health and beauty, Ao Manao fish cracker, equipment development for cold-pressed coconut oil processing, vacuum fryer for processing fruits, papaya washing machine, development of coconut shell drilling apparatus for ready-to-eat roasted coconut drink, tamarind scrub cream filling machine as well as development of distilling machine and auxiliary apparatus.

- Health products and medical equipment. The R&D products were focused on, such as development of organic beauty care recipe for kids, cleansing product from coconut oil, development of UPP 5610 powder heat pack from natural material, production process of rubber coated knit gloves and development of molding machine for individual insoles (foot supports).

- Energy and environment. The energy and environment outputs were, for example, optimization of laboratory wastewater treatment for innovation agency, preparation and development of tourism standards (Thailand Clean Tourist City Standard), preliminary evaluation of biogas production from cassava pulp with ethanol distillation column tower, utilization of wastewater from upflow anaerobic sludge blanket (USAB) treatment for cassava growers, consultancy service and improvement of air pollution control system as well as research and development on biomass conditioning technology.

Scientific and Technological Services

Thailand Institute of Scientific and Technological Research (TISTR) is one of Thai state enterprises providing integrated services of science and technology (S&T) that can be certified according to the international standards, namely, ISO/IEC 17020, ISO/IEC 17021 and ISO/IEC 17025. The types of services are as follows:

1. Analysis and testing of materials and products to follow standards, laws and regulations of Thailand and internationally.
2. Calibration in all fields of industrial metrology of which services can be provided both in-house and on-site.
3. Inspection of the operating conditions and failure analysis of materials, equipment and machines in the industry.
4. Quality system assessment and accreditation according to International Standards such as ISO 9001, ISO 14001, TIS/OHSAS 18001, ISO 22000, GMP, HACCP, and Thailand Tourism Standard.
5. Certification of products such as products made from biodegradable materials.
6. Inspection body service for boilers, liquefied petroleum gas tank and pressure gauge.
7. Training/Consultation of laboratory quality management system according to ISO/IEC 17025 and related disciplines such as quality management system, analysis technique, testing, failure analysis, calibration, failure analysis and risk assessment.

In fiscal year 2015, TISTR provided S&T services to customers as follows:

- 127,315 requests from customers in measuring, testing, analysis, and calibration;
- 54 training courses with 2,148 attendants, 296 of which were customers of Office of Certification Body requiring to be certified of quality management system. Most of customers were in the groups of food, chemicals, and automotive parts. TISTR also helped build up capacity of personnel in the industrial sector via training courses of 2,511 attendants.

Examples of customers

- Dumex Ltd.
- TOA Paint (Thailand) Co., Ltd.
- Sammitr Motors Manufacturing Public Co., Ltd.
- Cho Heng Rice Vermicelli Factory Co., Ltd.
- Thai Edible Oil Co., Ltd.
- Amata B.Grimm Power Co., Ltd.
- President Bakery Public Co., Ltd.
- IRPC Public Co., Ltd.
- The Dairy Farming Promotion Organization of Thailand
- Expressway Authority of Thailand

Certification on food safety for TESCO Lotus Stores countrywide

Food safety is a key component that has been expected to be seriously aware of from all sectors such as manufacturers, government and consumers. The objective of food safety measures is to prevent any hazardous risks in food poisoning. The main concept of food safety covers 3 areas:

1. Minimize the basic hazard that could occur by carefully select materials, good quality ingredients, clean containers, appropriate cleaning, hygienic production environment and good equipment free from contamination.

2. Minimize/inhibit and kill the germs using heat treatment at appropriate time.

3. Prevent re-contamination by preparing or cooking food in a hygienic environment such as separating between the raw and cooked material.

There are other important principles be considered, for instance, infrastructure, operation system, and personnel. Therefore, safety in food manufacturing must concern the good principles of production process, appropriate use of food additive as controlled by laws, and the good manufacturing practice (GMP).

Office of Certification Body (OCB), TISTR, was selected to evaluate the quality system of TESCO Lotus via assessing Ekachai Distribution System Co., Ltd. which had 107 retail shops under and its certification was expired in December 2015. The renewal of certification must be submitted to Food and Drug Administration of Thailand which required a certificate to assure that the manufacturer has been assessed by the organizations registered and shown on "List of Assessors for Food Manufacturing Plants in compliance with Thai Laws", according to List No. 6 attached to the Announcement of the Food and Drug Administration. OCB has been registered as an assessor No. 006/2557 since 17 September 2014 to 2017. It is also announced in the Announcement of Ministry of Public Health No. 193 (B.E. 2543) on "Production processes, equipment for production and food storage, and the Announcement No. 342 (B.E. 2555) on "Production processes, equipment for production and food storage of processed food in ready-to-sell containers".

Issues for assessment cover 6 areas as follows:

1. Location and buildings
2. Tools, manufacturing machines and equipment in production process
3. Process control
4. Sanitary system
5. Maintenance and cleaning
6. Personnel and hygiene

The result of the assessment of Ekachai Distribution System Co., Ltd. has divided the retail shops intp 4 categories: Tesco Lotus Talad, Tesco Lotus Express, Tesco Lotus Value, and Tesco Lotus Hyper, with a total 107 branches scattering in the north, northeast, central region, and the south.

References/Sources

Announcement of Ministry of Public Health No. 193 (B.E. 2543) on "Production processes, tools and equipment for production and food storage.

Announcement No. 342 (B.E. 2555) on "Production processes, equipment for production and food storage of processed food in ready-to-sell containers".

Beyond the Boundaries of International Cooperation on STI in AEC

International cooperation in Science, Technology and Innovation (STI) is an important factor driving the development and prosperity of the nation and region. TISTR has undertaken international relations and cooperation in STI with many foreign countries, especially among the ASEAN member countries. TISTR has maintained its role in the global stage to develop and enhance STI personnel capability in order to support the Thai Government's goal and policy in establishing international cooperation in STI to enhance the national competitiveness. TISTR is guided by the overarching goal of using STI to connect between countries and to promote scientific cooperation as an essential element of foreign policy through the three mechanisms: Diplomacy for Science (Diplomacy can facilitate international scientific cooperation), Science for Diplomacy (STI cooperation can improve international relations), Science in Diplomacy (STI can generate cooperation and informally support a foreign policy between countries). In this regard, it is necessary to use STI for boosting international cooperation so that Thailand will become an innovative society and play a proactive role on the global stage. Moreover, it helps encourage every sector in Thailand to participate in strengthening the national competitiveness on STI, develop the innovative society with creativity and responsibility to the global community, and enable Thailand to play a role of a global innovation partner.

Based on the Government's visions as mentioned above, TISTR set goals and core strategies to work in the areas of international relations and cooperation, as follows :

1.) To enhance STI capability in the needed scientific fields for an improvement of R&D activities of TISTR. International cooperation will be established and expanded with target foreign countries in many scientific fields and projects, such as, establishing new international cooperation related to the novel technologies, or expanding cooperative networking for enhancing STI knowledge.

2) To create atmosphere conducive to boosting international cooperation, expanding markets for Thai products, and improving organizational image and the nation through various programs of international relation activities, for instance, supporting target foreign countries with their needed technologies on the basis of mutual benefits, or exchanging experts/researchers to give advice and knowledge.

3) To gain regional recognition as an STI research institute playing a constructive role on the global stage. Not only TISTR could gain benefits from this cooperation and involvement, but national competitiveness could be enhanced by disseminating TISTR's R&D works and advancement to the global community, especially to the ASEAN community, such as, participating in international scientific forum to exchange STI knowledge.

4) To gain recognition from stakeholders concerned who consider international cooperative activities in STI is an important part of national development, and they will take part in promoting TISTR's R&D works and advancement abroad.

TISTR has categorised 2 groups of countries based and issues based to establish bilateral collaboration with ASEAN countries.

Group 1: Countries with close relation with Thailand, and Thailand has scientific expertise that another party needs.

1.1 Lao PDR – Botany, agricultural technology, and technology for communities.

1.2 Vietnam – Biotechnology, testing and analysis.

1.3 Myanmar – Agricultural technology, food technology, testing and analysis.

Group 2: Countries with close relation with Thailand, and Thailand and another party have scientific expertise and scientific need in equal.

2.1 Malaysia – Biotechnology, testing and analysis, and material innovation.

2.2 Indonesia – Testing and analysis, agricultural technology, and biotechnology.

2.3 Philippine – Agricultural technology.

TISTR also worked on the international cooperation under the ASEAN framework which is the project of 'the Establishment of Biomass Open Research Centre (BORC)'. TISTR worked as a focal agency to submit a project proposal of 'ASEAN Network of Biomass Open Research (ANBOR)', which was endorsed by Sub-committee on Sustainable Energy Research (SCSER) and counted as ASEAN Biofuel Flagship, during the 69th ASEAN Committee on Science and Technology Meeting (ASEAN COST 69), held on 25 – 26 May 2015, in Phuket, Thailand. The ANBOR project was designed to be operated as a platform for establishing collaborative linkage among related persons and sectors inside Thailand and the ASEAN countries working together through the research network in the fields of biomass utilization throughout its entire value chain, and it will have been developed as the Biomass Open Research Centre (BORC) in the future.

Entering the ASEAN Economic Community (AEC) not only leads us to establish and strengthen partnership with ASEAN member countries, but also with ASEAN dialogue partners including ASEAN+3 (China, Korea, and Japan) and ASEAN+6 (Australia, India, and New Zealand). All of them have close relation with Thailand and ASEAN member countries and they have scientific expertise that Thailand and ASEAN member countries need. For example, China and Japan hold S&T expertise in the fields of railway system technology, renewable energy and environmental technology, bio-science and agricultural technology, materials technology, and nanotechnology; Korea has expertise in the fields of bio-science and materials technology; Australia has expertise in the field of functional food; India has expertise in the fields of herb and natural products, processing agricultural products, and New Zealand has expertise in the fields of dairy farm and its products.

Although each of the ASEAN member countries hold different potential levels of S&T expertise and capability, and have different scientific need, every country is aware of importance of S&T international cooperation in dealing with many present global issues, especially, to defend and alleviate problems of natural disaster and food security, digital technology, green technology, energy technology, water management, biodiversity for human's prosperous health and living. For the bright future of ASEAN region, Thailand and ASEAN member countries should take advantage of their strengths as a driving force to build the national and regional development and prosperity with science and technology. ASEAN member countries also need to do more international cooperation in S&T among the members for the great potential of ASEAN member countries.

International Collaboration

During fiscal year 2015, TISTR conducted 33 projects of international collaboration as follows:

- Bilateral collaboration : In these 33 projects , there were 26 projects which had been collaborated with ASEAN+6 countries (China, Japan, Korea, India, Australia, New Zealand) and the others with the countries in other regions like France, United Kingdom, Fiji, Canada. There were 28 on-going projects and 5 new projects in fiscal year 2015.

- Multilateral collaboration : 1 project under the framework of collaboration among the members of The Asia-Pacific Metrology Programme (APMP)

Highlights of international activity

ASEAN members

Pha Tad Ke Botanical Garden, Lao PDR

- TISTR researchers visited Lao PDR during 9-13 December 2014 to survey vegetation in at Kham Muan district and collected the samples to be used as references at the plants museum of TISTR. The samples of seed were also collected and stored in the Bank of Plant Germplasm of TISTR.

- Four researchers of Pha Tad Ke Botanical Garden, Lao PDR had a site-visit at Lam Takhong Research Station, and Sakaerat Environmental Research Station, Thailand during 3-12 April 2015

The Agency for the Assessment and Application of Technology (BPPT), Indonesia

- TISTR researcher visited BPPT for training of Identification of Enumeration of Lactic Acid Bacteria in Functional Foods during 4 March – 28 April 2015.

SIRIM Berhad, Malaysia

- Ms.Sarifah Binti Rejab, Head of Cosmetic Program, SIRIM Berhad, visited TISTR, Technopolis, Pathum Thani on 8 May 2015 and gave a presentation on “The Potential of Halal Cosmetic”.

Dialogue Partners in ASEAN +6 Contries

Council of Scientific and Industrial Research (CSIR), India TISTR delegation visited CSIR, India during 23-26 February 2015 to sign the Working Program VII for S&T Collaboration in the areas of pharmaceutical and natural products, herbal plants, and food technology. The delegation also had a site visit to the R&D institutes under CSIR in Lucknow, i.e. Central Institute of Medicinal & Aromatic Plants (CIMAP) and Central Drug Research Institute (CDRI)

National Institute of Advanced Industrial Science and Technology (AIST), Japan

- TISTR executives and researchers participated in the the 9th AIST-TISTR-NSTDA Conference during 26-29 April 2015, held at AIST Tokyo Waterfront, Tokyo, Japan. TISTR delegates gave presentations in various parallel sessions, i.e. renewable energy, biotechnology, metrology, environment, and technology transfer.

- TISTR researcher collaborated in the joint project on water purification by synthesizing a photocatalyst and brought it for testing at AIST laboratory during 1-30 March 2015.

CSR Co.,Ltd. China

- TISTR researchers attended the training on vibration at CSR, China during 25 May – 6 June 2015.

Yunnan Academy of Science and Technology Development (YASTD), China

- In cooperation with Yunnan Academy of Science and Technology Development (YASTD), the experts from Yunnan Fomdas Flower Co.,Ltd., one of the biggest companies in Yunnan for chrysanthemum visited TISTR to provide training on improvement of chrysanthemum strain during 21-23 July 2015.

National Metrology Institute of Japan (NMIJ), AIST, Japan

TISTR in cooperation with NMIJ and National Institute of Metrology, Thailand hosted the international conference on the 2nd Proficiency Testing Seminar in Thailand: Trace Elemental Analysis in Polished Rice Flour on 28-29 September 2015, at Maruay Garden Hotel, Bangkok.

International Conference

In fiscal year 2015, TISTR hosted many international conferences and invited several experts and scientists from the alliance institutes to join in both as trainees and speakers in order to provide learning and exchange of experience on R&D, S&T services, and organizational management.

1.The International Advisory Committee Meeting 2014

TISTR invited experts from world leading organizations to be the International Advisory Committee (IAC) of TISTR. The 1st meeting was held on 28 November 2014 at TISTR, Technopolis, Pathum Thai. There were IAC members attending the meeting as follows:

(1) Dr. Kjell-Hakan Narfelt, Chief Strategy Officer, VINNOVA, Sweden.

(2) Dr. Ryoji Chubachi, President of National Institute of Advanced Industrial Science and Technology (AIST), Japan.

(3) Dr. Richard B. Dasher Director of US-Asia Technology Management Center (US-ATMC), Executive Director of Center for Integrated System, Consulting Professor, Stanford University, USA.

(4) Prof. Richard Archer Logan Campbell, Professor of Food Technology, Institute of Food Nutrition and Human Health (IFNHH), College of Health, Massey University, New Zealand.

(5) Ms. Sabine Krieg, MBA Research Strategy and International Business Development, Fraunhofer Institute for Interfacial Engineering and Biotechnology, IGB, Germany (on behalf of Prof. Dr.Thomas Hirth, Director, Fraunhofer Institute for Interfacial Engineering and Biotechnology, IGB).

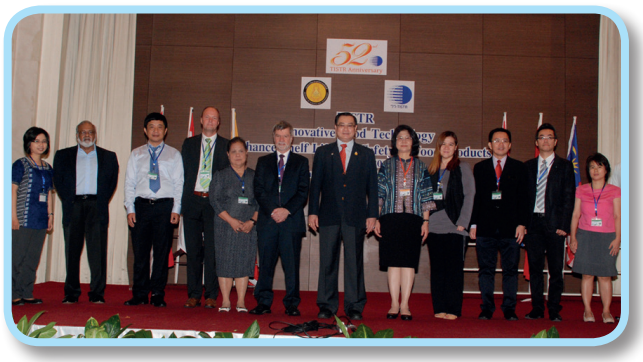
The meeting was aimed to open a forum for suggestions and comments from the IAC members related to the implementation on R&D and service of TISTR, including the strategic plan for technology roadmap to support TISTR's outstanding performance and as the leading R&D institute in the country and overseas.

2. The ASEAN+3 Organic Agriculture Forum TISTR organized the ASEAN+3 Organic Agriculture Forum during 24-25 June 2015 at Rama Gardens Hotel. Many experts and researchers from the R&D institutes on organic agriculture were invited as guest speakers. It was a platform of learning and experience exchanging as well as sharing the trend, challenges, and utilization of organic agriculture among ASEAN+3 member countries

3. The Asia Pacific Regional Workshop on Biomass Energy Resource Assessment and Biomass Open Research Forum: "Biomass Resource Assessment for ASEAN+6 Countries"During 6-8 July 2015, TISTR in cooperation with the Asian and Pacific Centre for Transfer of Technology (APCTT) and International Renewable Energy Agency (IRENA) hosted the Asia Pacific Regional Workshop on Biomass Energy Resource Assessment at Rama Gardens Hotel, Bangkok. The Workshop gathered participants from Thailand and Asia&Pacific totally of 25 persons to discuss on biomass renewable energy resource assessment. In 9-10 July 2015, TISTR including APCTT, and NSTDA hosted the Biomass Open Research Forum: "Biomass Resource Assessment for ASEAN+6 Countries" at Rama Gardens Hotel, Bangkok to exchange views and ideas on biomass status and technology development for bio-energy. The participants brainstormed on the establishment of ASEAN Network on Biomass Open Research (ANBOR), a mechanism to enhance collaboration among ASEAN+6 countries in RDI on biomass.

4. Innovative Food Technology to Enhance Shelf Life and Safety of Food Products

TISTR organized the International Conference on Innovative Food Technology to Enhance Shelf Life and Safety of Food Products during 16-17 July 2015 at Rama Gardens Hotel, Bangkok. The speakers were experts from various countries, i.e. USA, New Zealand, Netherland and ASEAN members. The conference was aimed to share the technical information from the participants, and exchange views and experiences on food technology, food preservation and safety. It was also a platform to create the future collaboration in R&Ds onward.



Gallery of Highlight Activities

TISTR organized a press conference on the opening of 'TISTR's Bio-plastic Comprehensive Testing Service for ASEAN Community and Environmental Sustainability', and held a seminar on 'Armed Thailand Bio-plastic Business', on December 3, 2014, at Ballroom C, Centara Grand at Central Plaza Ladprao, Bangkok.

TISTR organized an opening ceremony of 'Learning Center for Vapor Heat Treatment (VHT) Technique for Export Products of fruits for export in the upper northern region of Thailand', on January 23, 2015, at Tambon Mae Jua, Denchai district, Phrae province. The technology of VHT technique aims to increase value-added Thai fruit products and raise local fruit processing to meet the international standard.

TISTR organized a press conference on new product of instant foods for the elderly to tackle five diseases most commonly found, and held a seminar on 'Smart Eating, Smart Living', on March 5, 2015, at Miracle Grand Convention Hotel, Bangkok.

TISTR joined in an exhibition of S&T successful showcases of agricultural R&D for communities, herbal medicine, promotion of exports of small and medium enterprises, water resource development, security on energy/environment, tourism in Thai tradition, rail system technology, at the event of 'Innovation and Technology for Thai SMEs and Farmers', held on March 27 – 28, 2015, at Suan Son Pradipat, Hun Hin district, Prachuap Khiri Khan province.

TISTR joined an exhibition by demonstrating 'hydroponics techniques' in order to promote healthy vegetable and chemical-free vegetable consumption, suggest the way to earn extra income from full or part-time job, and to improve sustainable quality of life, in the event of 'Science Caravan', held on June 1 – 3, 2015, at National University of Laos (NUOL), Vientiane, Lao PDR.

TISTR organized press conference on new products of food supplement and nano-cosmeceuticals extracted from grape seeds, technology of high content in-cell analysis, and a dehumidifier for reducing moist of paddy at farming scale, on June 12, 2015, at Conference Hall, TISTR, Technopolis, Phathum Thani province.

TISTR conducted international conferences in the occasion of TISTR's 52nd anniversary celebration of establishment, namely:

- International conference on 'ASEAN+3 Organic Agriculture Forum' to promote organic agricultural systems and techniques, in June 24–25, 2015, at Rama Gardens Hotel Bangkok.
- International conference on 'Innovation Food Technology to Enhance Shelf Life and Safety of Food Products', in July 16 – 17, 2015, at Rama Gardens Hotel Bangkok.
- International conference on 'Biomass Open Research Forum on Biomass Research Assessment for ASEAN+6', in July 9 – 10, 2015, at Rama Garden Hotel Bangkok.
- International conference on 'the 2nd Asian Fermented Food on Probiotic: the Potential Ingredients of Health Products', in August 27 -28, 2015, at Hotel Centara Grand at Central Plaza Ladprao Bangkok.

TISTR organized an event of 'TISTR & Friends 2015', in the occasion of TISTR's 52nd anniversary celebration of establishment, to promote successful showcases of SME and OTOP entrepreneurs, and community enterprises. Under this project, TISTR worked with 14 agencies to create networking among governmental agencies, educational and financial institutes in order to strengthen entrepreneurs' domestic and international competitiveness. The event was held in July 13 – 15, 2015, at Central Plaza Ladprao, Bangkok.

TISTR signed a Memorandum of Understanding (MOU) with vocational colleges of Chiang Mai Colleges of Agriculture and Technology and Lamphun College of Agriculture and Technology, for technology transfer in the project of extending shelf life of Longan for export. The signing ceremony was held in July 17, 2015, at Le Meridien Chiang Mai Hotel, Chiang Mai province.

TISTR organized an event of 'Lamtakong Fair 2015', for Lamtakong Research Station's open house consisting of various activities, such as successful showcases of agricultural technology and its advancement, science camp/classroom activities, free-of-charge vocational training, during August 13 – 16, 2015, at Lamtakong Research Station, Nakhon Ratchasima province.

TISTR organized an opening ceremony of mushroom cultivation plant under controlled environmental system design in September 26, 2015, at the Royal Project Foundation Pa Miang, Chiang Mai province. The event was honored by the presence of H.S.H. Prince Peesadej Ratchanee, as a Chairman of the ceremony.

TISTR in cooperation with the Office of Vocational Education Commission (VEC) held a foundation stone laying ceremony of 'Learning Center for Technology Transfer and Business Management of Ethanol Production from Cassava for Communities' in September 21, 2015, at Kamphaeng Phet College of Agriculture and Technology, Kamphaeng Phet province. In this occasion, Mr. Thani Thanyaphot, a Provincial Governor of Kamphaeng Phet, presided over the ceremony.

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