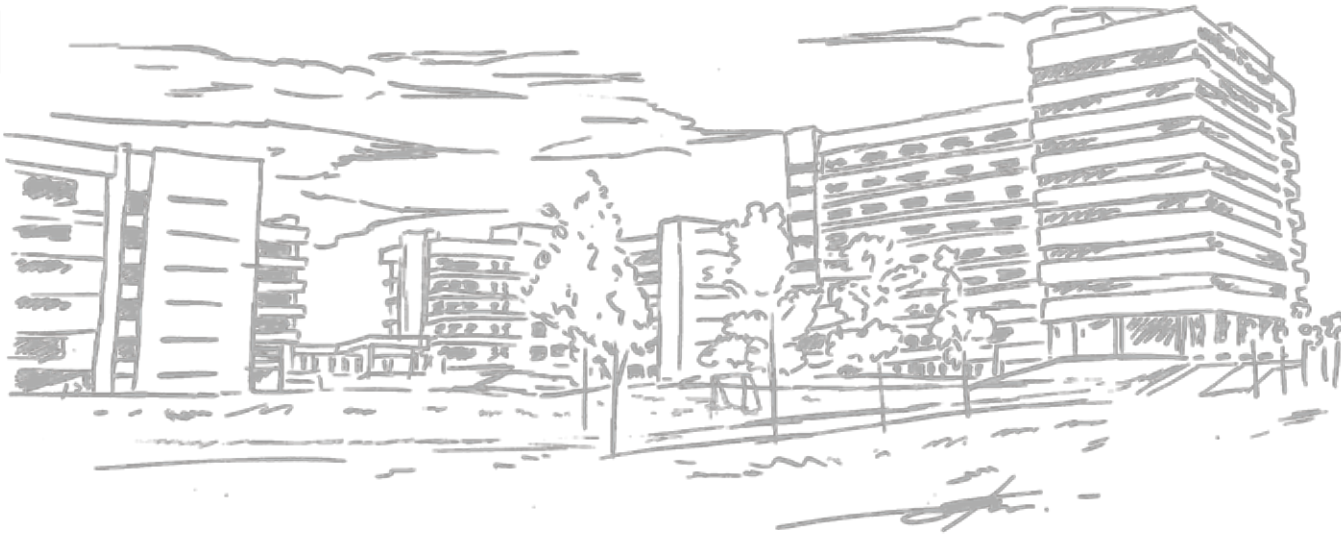
ANNUAL REPORT 2014

รายงานประจำปี 2557



สถาบันวิจัยวิทยาศาสตร์และเทคโนโลยีแห่งประเทศไทย (วว.)
Thailand Institute of Scientific and Technological Research (TISTR)

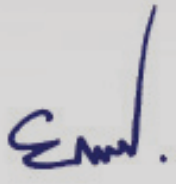
Message from the Governor

In fiscal year 2014, the Thailand Institute of Scientific and Technological Research (TISTR) has been striving towards excellence amidst the dynamic society and global changes. We have aimed to be excellent in commercialising scientific research and development (R&D) and providing standard scientific and technological (S&T) services. During 2014, the spotlighted R&D projects included the "Elongational Stress Tester for Ultra High Molecular Weight Polyethylene (UHMWPE)" firstly invented in Thailand which could provide elongational stress test in compliance to ISO 11542-2 and ASTM D4020-05; ready-to-eat mushroom products having high nutrition for a modern city lifestyle; ready-to-eat food to improve the quality of life of the elderly group; and the newly discovered 6 plant species in the Gesneriaceae family. Concerning the S&T services for industry, the performance was leveraged in engineering testing and consultancy services on assessments of the railway systems and railway parts up to the State Railway of Thailand Standards, Thai Industrial Standards, and Standards of American Railway Engineering Association. Our team also focused on performance and life cycle assessments of bridge expansion joints in case of earthquake; thus, increasing the quality of railway parts up to international standards and saving the shipping costs as these parts could be tested in Thailand.

The year 2014 also marked TISTR's success through award winning and prizes presented to us. It was our honoured to receive the Award of Excellence in Standard Services, "Provision of Scientific and Technological Services up to International Standards to Enhance Competitiveness of Entrepreneur (Good Performance 2013)" from the Office of the Public Sector Development Commission (OPDC), Thailand; the Award of Excellence in Certification Body (CB) 2014, from the National Bureau of Agricultural Commodity and Food Standards (ACFS), Thailand; and the Award of Excellence in Science 2013, Government category, from the Committee on Science, Technology, Communications and Telecommunications of Senate. Moreover, TISTR was recognized as "excellent" for its transparency and disclosure of the governmental procurement procedure ranked by the Thailand Development Research Institute (TDRI).

Another project TISTR initiated in the previous year was so-called "TISTR and Friends" with an aim to facilitate the utilization of TISTR's R&D and innovations among entrepreneurs of the community enterprises and small and medium enterprises (SMEs). Not only the R&D and innovative results from TISTR, we also called for collaboration among the parties concerned, such as Office of Small and Medium Enterprises Promotion (OSMEP) to support for information in network development among entrepreneurs, state enterprise banking systems from the Government Saving Bank and Krung Thai Bank, Thai Credit Guarantee Corporation, Department of International Trade Promotion (DITP), Ministry of Commerce to facilitate the export process, and Thailand Post under the Ministry Of Information and Communications Technology (MICT) to support for logistics and product distribution channels via e-Commerce. This synergistic support could promote a sustainable Thai innovation community, accelerating R&D and innovation to be transferred to entrepreneurs, and strengthening Thai industry that leads to national economic growth in the long run.

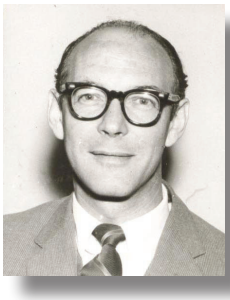
Fifty-one years of TISTR has been the 51 years of knowledge, skills and crystallised intelligence in science and technology through our strong commitment. We still have to work in concerted efforts with our alliances for the concrete outcome in transferring R&D results and innovations to entrepreneurs, leading to an improvement of the quality of life of Thai people and our nation's prosperity over all.



Mr.Yongvut Saovapruk

Governor

Former Governor



Mr.Frank G Nicholls

1963-1971

Lt.Gen Phraya Salwidharnnidhes

16 Oct 1964-15 Oct 1969

Professor Insee Chandrasatitya

16 Oct 1969 -7 Oct 1971

Professor Dr. Tab Nilanidhi

7 Oct 1971 - 3 Oct 1975

Dr.Wadanyu Nathalang

7 Oct 1975 - 2 Jun 1979

Professor Dr.Smith Kampempool

24 Mar 1980 - 23 Mar 1990

Dr.Santhad Rojanasoonthon

24 Mar 1990 - 30 Sep 1993

Mr.Chalermchai Honark

20 May 1994 - 31 Mar 1997

Dr.Kesha Lawanyawatna

1 Jul 1997 - 1 Apr 2000

Dr.Birasak Varasundharosoth

8 Sep 2000 - 14 Jul 2004

Dr.Nongluck Pankurddee

1 Oct 2004 - 30 Sep 2008

Mrs.Kasemsri Homchean

15 Feb 2010 - 23 Dec 2011

Board of TISTR

29 January 2013 – 28 January 2015

Lt.Gen.Tagernkarn Sri-am-pai
Board Chairman
(15 Aug 2014 - Present)

Mr.Voravidh Champeeratana
Board Chairman
(17 Apr 2014 - 24 Jul 2014)

Mr. Arkhom Termpittiayapaisith
Board Member

Prof.Dr.Soottiporn Chittmittrapap
Board Member

Mr.Udom Wongviwatchai
Board Member

Mr.Sivasak Naewchan
Board Member

Mrs.Wanee Thasanamontein
Board Member
(17 Apr 2014 -30 Oct 2014)

Mrs.Jitraporn Techacharn
Board Member
(29 Jan 2013 - 23 Jul 2014)

Mr.Kasemsun Chinnavaso
Board Member
(29 Jan 2013 - 23 Jul 2014)

Mrs.Pannee Sangsan
Board Member
(29 Jan 2013 - 23 Jul 2014)

Mr.Apichart Sudswang
Board Member

Mr.Yongvut Saovapruk
Board Member and Secretary

TISTR Executives

Mr.Yongvut Saovapruk

Governor

Dr.Anucha Leksakundilok

Deputy Governor Administrator

Dr.Suriya Sassanarakkit

Deputy Governor Research & Development for Sustainable Development

Excecutive Administrators

Dr.Suparb Artchariyasripong

Deputy Governor Research &

Development for Bio-Industries

Dr.Luxsamee Plangsangmas

Deputy Governor Industrial Services

Dr.Piya Chalermglin

Chief Expert

Mr.Anun Rungporntavewat

Special Excecutive

Administrators of Research and Development group for Bio-industries

1. Flt.Lt. Srisak Trangwacharakul	Director of Food Technology Department
2. Dr. Chuleratana Banchonglikitkul	Director of Pharmaceutical and Natural Products Department
3. Mrs. Chantara Phoonsiri	Director of Bio-science Department
4. Mr. Sayan Tanpanich	Director of Agricultural Technology Department
5. Mr. Sakkhee Sansupa	Director of Thai Packaging Centre

Administrators of Research and Development group for Sustainable Development

1. Dr. Thanes Utistham	Director of Energy Technology Department
2. Mr. Cherdchai Nakthipphawan	Director of Environment and Resources Technology Department
3. Dr. Chutima Eiamchotchawali	Director of Material Innovation Department
4. Mr. Yutthana Tantiwiwat	Director of Engineering Department

Administrators of Industrial Services Gruop

1. Mr. Cheumsakra Sinchaisri	Director of Industrial Metrology and Testing Services Centre
2. Mr. Wirach Chantra	Director of Material Properties Analysis and Development Centre
3. Dr. Jittra Wannawichitra	Director of Office of Certification Body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Administors of Administration Group

1. Mrs. Veeravan Rocejanasaroj — Director of Treasury Department
2. Mrs. Saisurang Chotipanich — Director of Human Resource Department
3. Mr. Narong Aungmaitreepirom — Director of General Services Department
4. Dr. Narumol Ruenwai — Director of Knowledge Centre


1


2


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Administrators under the Governor

1. Mrs. Vilawan Sailamai — Director of Office of the Governor
2. Mr. Nuttapon Nimmanphatcharin — Director of Corporate Strategic Planning Office
3. Miss Chaveevan Termvidchakorn — Director of Internal Audit Office

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TISTR

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.

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.

Organisational culture and shared values

Organisational culture: Managing organisational intelligence, creating innovation value

Shared values

SMART

S : Satisfaction - customer's satisfaction
M : Mindfulness - customer awareness
A : Accountability - serving professional service to customers
R : Recognition – building organisational creditability among customers
T: Trustworthy – working with reliability and honesty

TISTR

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.

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.

Strategies:

Strategy 1. Increasing TISTR'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.

Contact

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Thai Packaging Centre (TPC)
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Chatuchak, Bangkok, 10900,
Thailand
Tel: (66) 2 579 1121-30

Lam Takhong Research Station
333, Mu 12, Mitraphap Road,
Tambon Nongsarai, Amphoe Pakchong,
Nakhon Ratchasima 30130
Tel: (66) 44 390 107
Fax : (66) 44 390 150

Sakaerat Environmental Research Station
1, Mu 9, Tambon Udom Sab,
Amphoe Wang Nam Khieo,
Nakhon Ratchasima, 30370,
Thailand
Tel: (66) 44 009 556

Website: www.tistr.or.th
Call Center : (66) 2 577 9300

Type of Organization

The 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.

Industrial Status and Future Trends

Thailand's economy has progressed continuously for the past ten years with the Gross Domestic Product (GDP) worth around 9 trillion baht and the GDP Annual Growth Rate averages 7-8 percent. Categorized as a middle income country, Thailand has its weaknesses in structure on higher ratio of import dependence e.g. material, component parts, energy, capital, technology and innovation, but low productivity. Production sector relies more on local resources rather than knowledge. Accordingly, high consumption of resources has caused environmental and social problems. At present, Thailand is facing competition from the new groups of economic integration and the emergence of cheap labor countries such as China, India and Vietnam. In the mean time, it is forced to compete with many developed countries including Korea, Japan, United States, and those in the European Union. Moreover, it is found that Thailand has a sensitive economic structure since Small and Medium Enterprises (SMEs) still lack the use of science, technology and innovation in driving for productivity, efficiency, quality, value-added products, and newly developed products to cope with present and future trade barriers.

Major factors influencing science and technology development has gradually changed, for example, the rapid pace of technology development and the economic integration that accelerate resources mobilisation, trade and investment competition,

improvement of efficiency and competitiveness to battle trade barriers. Other factors concerned are medical and public health development that make people live longer, and the global warming. The afore-mentioned factors have a great impact on science and technology development towards innovation for the betterment of people's quality of life, promotion of trade and investment, and awareness of climate change that could be found in various disciplines, namely, biotechnology, nanotechnology, information technology, communication technology, renewable energy technology, materials science technology and intelligent network technology.

Science, Technology and Innovation (STI) Development has created the new wave of development trend such as knowledge-based economy, molecular economy, and experience economy, which integrate science-based knowledge in various fields. Currently, the concept of boutique economy is proposed, combining many branches of scientific knowledge related to mentality and focusing on people's happiness on a basis of living in clean and safe environments. STI will play an important role in building the said economy in terms of research and development, innovation, technology transfer, utilisation, S&T human resource development, infrastructure development, and supportive factors for STI development. However, Thailand needs to prepare itself to accommodate future changes and competition in terms of knowledge, awareness, information, R&D personnel, infrastructure and competitive advantages that could drive the country to be successful in the areas of innovative products and services, especially bio-material, biomass, life sciences, and food, which are environmentally friendly and under the concept of cultural creativity design.

Major Factors Affecting Business Operation

Major factors which have driven TISTR to achieve its direction and goals are as follows:

• Products development and scientific and technological services

TISTR is determined to be an organisation with high performance capability in conducting S&T research, transferring technology and providing S&T services to all sectors of the Thai society in order to strengthen both the private sector and the society. Thus, products development and S&T services that can serve customers' and stakeholders' needs are crucial factors for achieving TISTR's goals.

• Increasing competitiveness of the target entrepreneurs

Using science and technology to enhance competitiveness of the private sector is an important goal stated in TISTR's Strategic Plan 2012-2021 which focuses on increasing the investment ratio of the private sector on S&T research and services. TISTR has created the mechanisms for learning the needs of target customers so that the process of knowledge transfer could be customised to strengthen competitiveness of Thai entrepreneurs via the operational support system, marketing development, Intellectual property management, and funding source.

• **Infrastructure development and organisational management**

To support organisational development, it is necessary to develop infrastructure, especially instruments, equipment, buildings, and excellent centers, etc. Thus, enhancing efficiency of organisational management and capital investment administration are of important factors for organisational long-term development.

• **Innovation capability development**

In order to promote the use of TISTR R&D products and technologies in the Thai society, it is necessary to encourage and support those entrepreneurs for making uses of products or technologies transferred to them in all entities of economic, social and environmental developments.

• **Factors on stakeholders' recognition to TISTR's products and services.**

To make TISTR's R&D products and services to be well-recognised, it is necessary to pay most attention to the stakeholders concerned via providing channels for customer feedback, creating customers' involvement process, and developing mechanisms for leveraging working processes in transferring knowledge and technologies.

• **Factors on amendment of laws, rules and regulations development to be applicable with organisational direction**

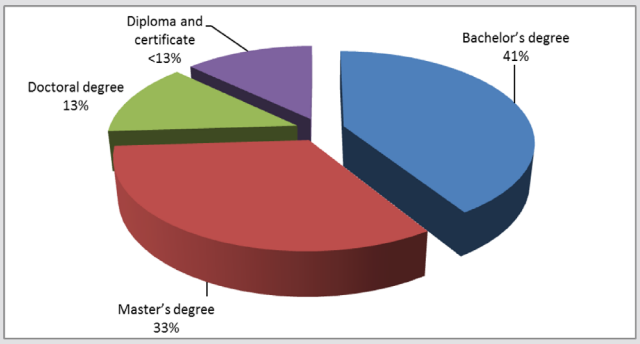
An improvement of laws, rules and regulations related to TISTR could increase the flexibility and efficiency of organisational operation.

Human Resource

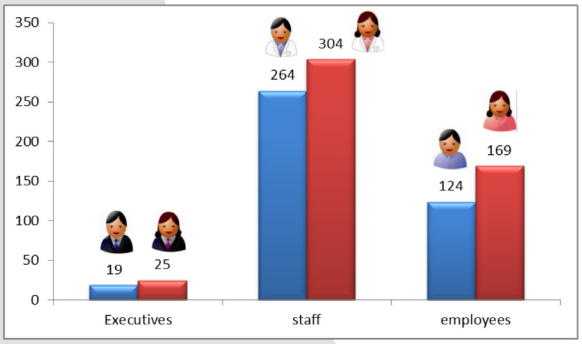
As of September 2014, there were totally 905 staffs comprising 612 permanent staff and 293 employees: 477 males (44.97%), 498 females (55.3%). The total numbers of staff and employees could be categorised according to cluster, function group, and educational degrees as follows:

	Cluster					
Function Group	Bio-industries R&D	Sustainable Development R&D	Industrial Services	Under Governor	Administration	Total
1. Administration	6	4	14	9	11	**44**
2. Research/Service	127	99	114	2	4	**346**
3. Technical/Support	-	-	-	32	30	**62**
4. Operation	13	22	23	32	70	**160**
Total						**612**

Proportion of TISTR's staff by educational degrees



Numbers of staff and employees



Administration

At present, TISTR is capable of managing the integrated R&D, technology transfer and provision of S&T services through these following clusters:

1. Bio-Industries Group

The Bio-Industries Group is responsible for creating and adding value to agricultural, natural and bio based products. The R&D of this Group corresponds to the national policy and demands of the business sector and niche markets in order to increase national competitiveness.

2. Sustainable Development Group

The Sustainable Development Group is responsible for adding value to natural resources and wastes. The R&D of this Group has been conducted to support the economy sufficiency and the policies for energy and environmental conservation, ecosystem restoration, and innovation creation using material technology and engineering to achieve self-reliance and sustainable development.

3. Industrial Services Group

The Industrial Services Group is responsible for improving local products up to international standards and promoting the use of quality management systems to enhance competitiveness in the global markets.

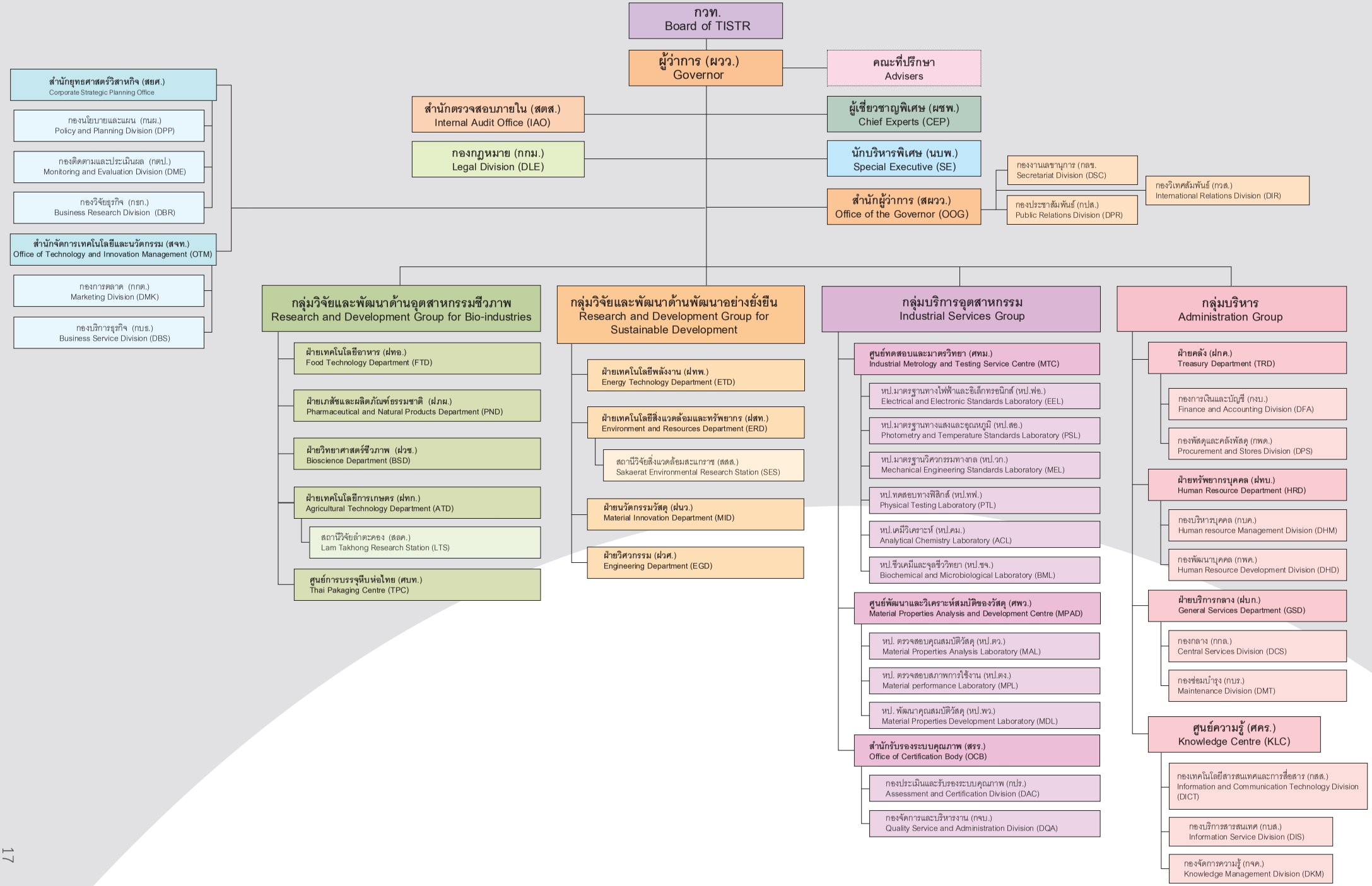
4. Administration Group

The Administration Group is responsible for improving efficiency and effectiveness of organisational management to support the core business according to good governance.

5. Departments under the Governor

The Departments under the Governor are responsible for supporting operational effectiveness of the Governor, making management most rapidly and cutting of red tape. These Departments are also in charge of supervising for legal affairs, regulations, and orders, which are responsive to the Government's policies, the cabinet resolution and good governance.

แผนภูมิโครงสร้าง วว.
Organisation Chart of TISTR



TISTR's Achievements


"Tree Growth"

TISTR's Achievements of 2014

The 1st "Elongational Stress Tester for Ultra High Molecular Weight Polyethylene (UHMWPE)" in Thailand

The Engineering Department, TISTR, in collaboration with IRPC Public Company Limited successfully conducted R&D on the "Elongational Stress Tester for Ultra High Molecular Weight Polyethylene (UHMWPE)" for testing UHMWPE plastic physical properties on its elongational stress following the ISO 11542-2 and ASTM D4020-05 standard testing.

The prominent feature of elongational stress tester is reduction of test time. It allows 6 parallel formative tests to be performed at the same time, taking only 30 minutes for one completed test. This can save by 6 times or 3 hours per one test, thus increasing testing capacity per day. Besides, it can run a standard testing procedure automatically and display data while operating, evaluating and giving testing results. The record function of this equipment allows for convenient operation and reduces human errors when several testing conditions are required. Testing results can be anticipated or traced back.

Ready-to-eat mushroom products

The Food Technology Department, TISTR, developed ready-to-eat mushroom products, namely, mushroom soup and spicy mushroom soup, in a modern packaging design, convenient to eat, good tasting, hygienic, high nutritional, easy to prepare and less cooking time. It is truly a suitable product for a hurried and busy lifestyle.

Mushroom is considered a fat-free vegetable, containing low amount of sugar and salt, full of protein when compared to other vegetables. It tastes and smells good, has high nutrition and medicinal properties, boosts the immune system and helps lower the risk of various diseases. Giving the new choice to consumers, TISTR has already transferred the production technology of ready-to-eat mushroom products to SCI Center (Thailand) Co., Ltd.

Ready-to-eat food to improve the quality of life of the elderly group

The Food Technology Department, TISTR, developed a successful ready-to-eat food targeting at the elderly group to improve their quality of life. TISTR conducted research and developed the ready-to-eat food consisting of main meal, snack, and drink which were safe, healthy and had good nutrition suitable for the elderly with diabetes, cardiovascular disease, gout, osteoporosis, and brain and nerve disease. This project was conducted to integrate research with a marketing survey, product development, packaging design and development, and market testing for product commercialisation. It gives a good choice of safe and healthy ready-to-eat food for health-concerned consumers. It was considered that the project had a major impact on the country's social and economic development in terms of decreasing government's medical and health-related expenses in the elderly group while increasing export value of ready-to-eat food for the elderly in foreign markets and adding value to the agricultural products from locally found raw materials.

Newly discovered plant species in the Gesneriaceae family

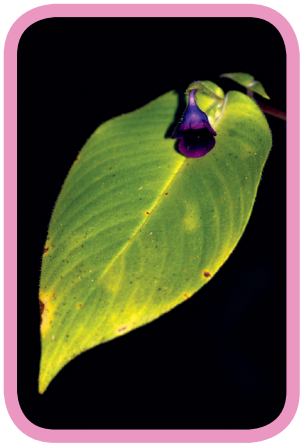
Dr. Pramote Triboun, a researcher from TISTR's Agricultural Technology Department discovered 6 new plant species in the Gesneriaceae family.

(Kao Tog Yonok)

Scientific Name: ***Microchirita albiflora*** **D. J. Middleton & Triboun**

Khao Tok Yonok is an annual herb, stems fleshy, pale green, sometimes dark violet or brownish at base. Leaves opposite except for enlarged and solitary basal cotyledon; blades ovate; base cordate, apex acute to shortly acuminate. Inflorescence epiphyllous; pedicels 0.5-1 cm long. Calyx green, corolla white throughout or sometimes with thin vertical yellow line ventrally in tube, tube flaring fairly evenly from lower tube to upper tube, slightly curved downwards, outside glabrous in lower half of tube and pubescent in upper half and on lobes, all lobes broadly orbicular, apices rounded; tube 0.65-1.3 cm long. Distribution: Thailand, Northern, Chiang Rai. (Mae Fah Luang district and Mae Sai district), in shade on limestone boulders and outcrops in mixed evergreen and deciduous forest, or disturbed area on concrete at 500-1,000 m altitude. Flowering: from early August - late October.

(Net Muang)



Scientific Name: ***Microchirita purpurea*** **D. J. Middleton & Triboun**

Net Muang is an annual erect herb, 0.25-1 m tall. Leaves opposite; base cordate, apex acuminate. Inflorescence epiphyllous, pedicels 2-3 cm long. Calyx pale green, 5-lobed to base; lobes narrowly ovate, apex long acuminate. Corolla dark purple, tube campanulate upper tube and hardly spreading lobes, all lobes broadly orbicular with rounded apices. Distribution: Thailand, South-eastern, Chanthaburi (Kaeng Hang Maeo district), in exposed karst limestone cliffs and more shaded cave entrance. Flowering: from August - October

(Bunga Karaket)

Scientific Name:***Microchirita karaketii*** **D. J. Middleton & Triboun**

Bunga Karaket is an annual herb to 60 cm tall. Leaves opposite, petioles 0.5-2 cm long; blades ovate, apex acuminate, base cordate. Inflorescence epiphyllous, pedicels 4.5-9 mm long. Calyx pale green, 3 lower lobes free, upper 2 lobes variously and irregularly fused for 1-5 mm. Corolla white outside and inside with a yellow stripe ventrally on tube inside with a single purple patch each side of this stripe, all lobes broadly orbicular, apices rounded to bluntly obtuse. Distribution: Thailand, Northern, Chiang Mai (Chiang Dao district), in mixed deciduous forest on karst limestone at 530-750 m altitude. Flowering: from late August - November.

(Malai Fon Lep)

Scientific Name: ***Microchirita woodii*** **D. J. Middleton & Triboun**

Malai Fon Lep is an annual erect herb, to 50 cm tall. Leaves opposite; blades ovate, apex acute, base cordate. Inflorescence epiphyllous. Calyx of 5 free lobes, narrowly ovate. Corolla tube very pale green, lobes yellowish white or pale yellow, all lobes broadly orbicular to ovate. Distribution: Thailand, Northern, Nan (Muang district), in dry evergreen or deciduous forest on karst limestone. Flowering: from early August - late October.

(Suddee Dao)

Scientific Name: ***Microchirita suddeei*** **D. J. Middleton & Triboun**

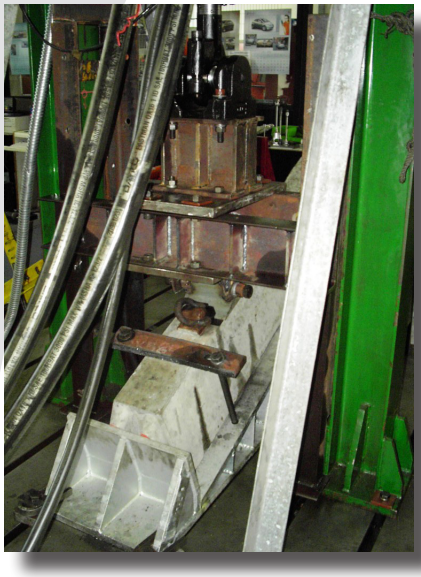
Suddee Dao is an annual erect herb, to 40 cm tall. Leaves opposite except for enlarged solitary cotyledon; blades thin, ovate, apex acuminate, base rounded to cordate. Inflorescence epiphyllous at petiole/blade junction with immature flowers held down towards the midrib with the pedicels curving upwards as the corolla matures and opens and then continuing to curve back away from leaf blade as corolla. Distribution: Thailand, Northern, Phrae (Rong Kwang District), Lampang (Ngao, Jae Hom, Bansa), in Dry evergreen or mixed deciduous and bamboo forest on karst limestone at 200–600 m altitude. Flowering: from August - October

(Sawet Daen Sruang)

Scientific Name: ***Paraboea middletoni*** **Triboun**

Sawet Daen Sruang is a lithophytic perennial herb, stem erect, 10-13 cm tall. Leaves opposite decussate, congested at the apex of the stem; blade coriaceous, oblong, elliptic or ovate, base cordate, cuneate or obtuse, apex acute, margin serrate or crenate, densely covered with multicellular glandular hairs above, densely covered with brown hairs beneath. Inflorescences 1-6, axillary near apex, compound dichasia, densely covered with brown arachnoid hairs, bracts leafy, orbicular to elliptic. Distribution: Thailand, Northern, Nan, in shade on limestone rock at 1,000-1,300 m altitude. Flowering: from early August - October.

Engineering testing and consultancy services on assessments of the railway systems and railway parts



Material Properties Analysis and Development Centre (MPAD) provided engineering testing and consultancy services on assessments of railway systems and railway parts such as railway sleeper, railway, rail fastening system, guard rail set, rail joints and rail coach in compliance with the State Railway of Thailand Standards, Thai Industrial Standards, and AREA (American Railway Engineering Association) Standards of the United States. MPAD also provided performance and life cycle assessments of bridge expansion joints in case of earthquake according to international standards. These services could save the cost of shipping out railway parts for testing abroad. So far, TISTR has provided railway testing services to the top railway system companies in Thailand, which could make benefits from using standard parts for railway construction either in Thailand or other countries such as Singapore and Australia.

TISTR is capable of providing engineering testing and consultancy services on railway systems, railway parts, motor parts, machinery and engineering part assessments, which could enhance the quality of industrial products to meet international standards.

Awards Received

Awards Received in 2014

Organisational Award Category

Award of Excellence in Standards of Services

TISTR received the Award of Excellence in Standard Services, " Provision of Scientific and Technological Services up to International Standards to Enhance Competitiveness of Entrepreneur (Good Performance 2013)", from the Office of the Public Sector Development Commission (OPDC), Thailand. Dr. Anucha Leksakundilok was a representative to receive the award at Royal Thai Navy Convention Hall, on December 13, 2013.

TISTR has provided scientific and technological services to the Thai industrial sector with the aims to improve products up to international standards through the application of the quality management system, to enhance Thai entrepreneurs with competitive advantages in the global market, and to promote the environment of learning science and technologies at all levels. TISTR's services include Industrial Metrology and Testing Service Centre (MTC), Material Properties Analysis and Development Centre (MPAD), and Office of Certification Body (OCB), all of which have been accredited with international standards of ISO/IEC 17020 for an Inspection Body, and ISO/IEC 17021 for Certification Body, and ISO/IEC 17025 for Analysis, Testing and Calibration Laboratory Performance in Metrology. Working under these work standards has proved TISTR's quality of work and recognition in service provision. One field of services provided is packaging technology by Thai Packing Centre (TPC) concerning analysis, testing, and consultancy services for industry.

Award of Excellence in Certification Body (CB) 2014

Office of Certification Body (OCB), one of TISTR's industrial service units, received the Award of Excellence in Certification Body (CB) 2014, from the National Bureau of Agricultural Commodity and Food Standards (ACFS), Thailand. Dr. Jittra Wannawichitra, Director of OCB, was a representative to receive the award at ACFS's Meeting Room 212, on October 9, 2014.

TISTR's OCB aims to provide services in the assessment of quality assurance systems, in compliance with the international standards, including ISO 9001, ISO 140001/OHSAS 180001, ISO 22000, ISO 50001, GMP (Codex), HACCP (Codex). OCB's services include provision of joint audits with TV SUD and Certification International (UKAS), pre-audits, the second-party audits, the assessment and certification of Thailand tourism standard in cooperation with Department of Tourism of Thailand, for 9 standard recreation tourism activities, namely hiking, bird-watching, rafting, Canoe – Kayak, rock climbing, diving, camping, elephant camp for tourism, eco-lodge for tourism, in-house and public training.

Award of Excellence in Science 2013

TISTR received the Award of Excellence in Science 2013, Government category, from the Committee on Science, Technology, Communications and Telecommunications of Senate. Captain Srisak Trangwacharakul, Director of Food Technology Department, and Dr. Prapaipat Klungsupya, Senior Researcher of Pharmaceuticals and Natural Products Department, were representatives to receive the award at the Thai National Assembly, on September 2, 2014. The awards granted to TISTR for the 2 outstanding science projects which were:

"Innovation on Long Kong Processing Products", a collaborative project between Food Technology Department and Pharmaceuticals and Natural Products Department of TISTR. The project concerned innovation on Longkong stalk puller machine, Longkong juice extractor, Longkong processed products such as jam, dried Longkong preserved in syrup, fresh Longkong preserved in syrup, and cosmeceutical products from Longkong.

"Native Protein Extraction Technology from Angola Pea, Congo Pea (*Cajanus cajan* (L.) Millsp.)" for food and cosmetic industries, conducted by Dr. Thanchanok Muangman, Researcher of Pharmaceuticals and Natural Products Department.

TISTR as a state enterprise of good governance in transparency of procurement information via website

According to the survey results of 59 Thailand state enterprises' websites in 2013 conducted by the Thailand Development Research Institute (TDRI), TISTR was recognised as "excellent" for its transparency and disclosure of the governmental procurement procedure. The criteria were set for 3 issues: homepage presentation, information quality, and data storage and retrieval. TISTR was ranked of excellent transparency together with the other two state enterprises: Thailand Tobacco Monopoly and Provincial Waterworks Authority (PWA), which were considered as fair practices and integrity in its governmental procurement process according to the Official Information Act B.E. 2540.

Individual Award Category

Person of the Year 2013

Dr. Piya Chalermglin was awarded 'Person of the Year 2013' in National Resource and Environment Conservation from the representative of Her Royal Highness Princess Maha Chakri Sirindhorn, at Sala Dusidalai, Chitralada Palace, on March 25, 2014.

Dr. Piya Chalermglin has hold outstanding performance in agricultural technology, and was the first person to receive a royal grant from Her Royal Highness Princess Maha Chakri Sirindhorn for conducting scientific research projects in plant conservation and development of the tree in the family 'Champaca'. He has been working as a conservationist of rare and endangered species, including endemic plants in Thailand. He also discovered new world flora species such as *Magnolia sirindhorniae* Noot & Chalermglin, *Mitrephora sirikitia* Weerasooriya, Chelermglin & R.M.K. Saunders , and *Jasminum bhumibolianum* Chalermglin, the species which were named in honour of the royal family, HRH the King, HRH the Queen, and HRH Princess Maha Chakri Sirindhorn. Dr. Chalermglin has focused on the natural conservation and sustainable development throughout his work life, for example, performing ecological surveys of 33 plant species firstly reported in Thailand and increasing awareness of Thai people in conserving rare and indigenous plants and species via training and lecturing. He is a high competent staff who TISTR is proud of and appreciated by his dedication to the success and development of the science and technology society in Thailand.

Thammasat Honorary Plaque 2014

Dr. Suparp Artjariyasripong, Deputy Governor of Research and Development of Bio-Industries of TISTR and a representative of Ministry of Science and Technology (MOST), received Thammasat Honorary Plaque 2014 from Prof. Dr. Noraniti Sethabutr, President of Thammasat University Council, on the auspicious occasion on the 80th Anniversary of Thammasat University, held on June 27, 2014, at Sri Burapha Auditorium, Thammasat University, Tha Prachan campus, Bangkok. The award is given annually to the selected persons/organisations greatly and continuously supports the work of Thammasat University. In 2014, 32 awards were presented to those as mentioned.

TISTR's Researchers invited as an Expert in International Science Committees

Three TISTR's researchers were selected and invited to be experts in the international committee concerned with scientific disciplinary as follows:

-In August 2014, Dr. Aparat Mahakhant, Research Expert of Biotechnology Department, was selected by the World Energy Council (WEC) to join in World Energy Committee on Energy-Water-Food Nexus Knowledge Network.

-In May 2014, Dr. Paramee Pengpreecha, Director of Analytical Chemistry Laboratory, Industrial Metrology and Testing Service Centre (MTC), was selected by the ASEAN Food Testing Laboratory Committee (AFTLC) to join in the Expert Panel Leader on Food Additives, as a head of expert team on assessment of the ASEAN reference laboratory for food additives.

-In August 2014, Dr. Suwit Auchariyamet, Researcher of Engineering Department, was selected by the World Energy Council (WEC) to join in the WEC Work Programs on Work Energy Perspective and World Energy Scenarios, under the theme of 'Renewable Energy System Integration', as a developing member.

International Collaboration

In order to promote and strengthen close relationship with the prominent R&D institutes overseas and to improve institute's R&D capability, TISTR signed the MOUs/Agreements with several international institutes to establish collaborative activities in the form of information and knowledge exchanges, training, workshops, seminars, etc.

In fiscal year 2014, there were 33 collaborative projects with the international institutes, of which 10 were new, and the other 23 were on-going projects. These can be divided into the following groups:

•Bilateral collaboration : 31 projects (24 projects were the projects with ASEAN+6 member countries);

•Trilateral collaboration : 2 projects (Asia-Pacific Metrology Programme (APMP) and ASEAN-Korea Working Group of Economic Cooperation).

Examples of international collaboration

Korea Collection for Type Cultures (KCTC), Korea

TISTR executives and researchers visited KCTC on 15 November 2013 to discuss potential of collaboration related microorganism and biotechnology. Besides, TISTR researcher participated in the 1-month training course on Microbial Taxonomy at KCTC, Korea in 2014.

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

TISTR executives and researchers visited BPPT, Indonesia during 12-13 December 2013 to discuss potential of collaboration and to have a site visit to agricultural industry, biotechnology, renewable energy, materials technology, and industrial technology.

- SIRIM Berhad, Malaysia

TISTR and SIRIM Berhad signed the Collaboration Arrangement in 2013, then had the collaborative activities as follows:

- Dr.Fazilah Fazan, Senior Principle Researcher, Medical Technology Flagship provided a special lecture on Powering R&D to Commercialisation on 11 November 2013 at TISTR.

- TISTR researchers visited the National Metrology Laboratory, SIRIM Berhad to calibrated the PRT at -80C (Interlaboratory Comparison) during 3-7 March 2014.

- TISTR researchers paid a site visit to the Advanced Materials Research Center (AMREC), SIRIM Berhad, and SIRIM Berhad HQ during 5-7 May 2014.



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

TISTR and YASTD signed the MOUs in agricultural technology and in ISO 9001 Certification. By that result, YASTD coordinated with the companies in Kunming to allow TISTR researchers to learn their cultivation technology of chrysanthemum. On the other hand, TISTR provided the training courses for YASTD on management system of ISO 9001.

CSR Co., Ltd., China

The Governor and TISTR team participated in the 1st Meeting of Joint Committee under China-ASEAN S&T Partnership Program (STEP) in Beijing, China and paid a site visit to production of high-speed train and vibration test in Qingdao, China during 20-26 March 2014. In addition, TISTR researchers also had a survey and study in details of vibration test at CSR Co., Ltd., Qingdao during 23-28 March 2014.

Institute of Material Science (IMS), Vietnam

TISTR organised a seminar on Increasing Reliability of Plants through Maintenance and Failure Investigation in Da Nang, Vietnam on 25 July 2014. There were 60 Vietnamese participants in the seminar.

Food Industries Research Institute (FIRI), Vietnam

TISTR researchers paid a site visit to the pilot plant of probiotic production at FIRI during 15-18 September 2014. They also experienced the system and GMP-standard-approved equipment for microbe production.

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

TISTR and National Metrology Institute of Japan (NMIJ) under AIST implemented the collaborative project on Arsenic Speciation Analysis in Food and Proficiency Testing Program. Both sides had several activities as follows:

- TISTR researchers participated in the metrology seminar held by NMIJ, Japan during 17-24 February 2014.

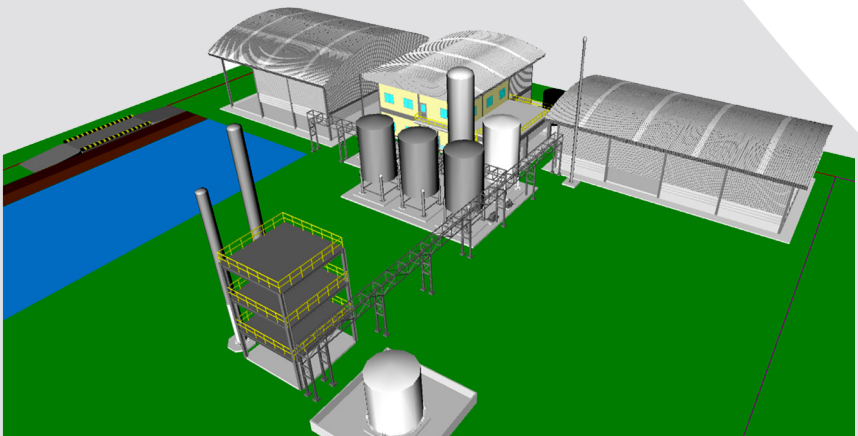
- TISTR researchers participated in the training courses held by NMIJ related to chemical analysis and testing during 18 February – 16 June 2014, and training on speciation of arsenic in rice and seafood during 19 May – 13 June 2014.

- Collaborative activities among NMIJ-National Institute of Metrology, Thailand (NIMT)-TISTR on Proficiency Testing for Trace Element Analysis of Brown Rice Flour during 5-6 March 2014 at Sukosol Hotel, Thailand.

Massey University and UniServices, New Zealand

The Governor signed Collaboration Arrangements with Massey University and with UniServices on behalf of Department of Nutrition, University of Auckland, New Zealand on 30 July and 1 August 2014 respectively. The interested areas of TISTR to the 2 institutes were food and nutrition technology, life science, and natural products.

Flagship Projects



Flagship Projects in 2014

TISTR has formulated an organizational strategic plan which covers all keywords declared in the Thai Government's policies on national science, technology and innovation development, and the State Enterprise Policy Office (SEPO)'s policies. TISTR's strategic plan is used as a steering wheel for implementation and a driven force for management all over the organization towards the vision "ASEAN's leading organization in research, development and service in science, technology and innovation". In the fiscal year 2014, the Board of TISTR, along with TISTR's executives and TISTR's Strategic Planning Committee, reviewed the operating results and set the 10-year-Strategic Plan, which was divided into 2 phases: Phase I (2012 - 2016) and phase II (2017 - 2021). The strategic plan was based on the course of change and factors which could affect the core mission, support TISTR in facing global challenges, or even fulfill needs of the stakeholders. The mechanisms for improvement and development of TISTR's working processes were also included in order to achieve the vision and organizations sustainability. The vision 2021 was identified as follows:

1) Be competitive in R&D investment jointly with the public and community sectors not less than 20 percent of all activities.

2) Be competitive in scientific and technological services at the ratio of S&T service revenue to budget revenue 35:65.

3) Be capable of technology transfer and commercialization, evaluated by 2 criteria:

- Increasing number of science and technology personnel working collaboratively with the private sectors not less than 50 percent;

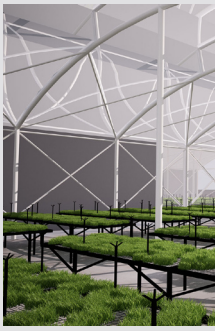
- Increasing number of R&D results which could be applied in commercial and social utilization not less than 30 percent.

4) Be competitive in improving basic R&D to advanced technology and innovation for technology/knowledge transfer to the private sectors not less than 40 percent of all activities.

5) Be capable of developing infrastructure for science, technology and innovation via the establishment of Excellent Centers in health products innovation, food technology and renewable technology, including the establishment of 6 Appropriate Technology Centers.

Implementation of TISTR's Strategic Plan

TISTR's Strategic Action Plan 2014 was set up in coverage of entire working programs/ projects which could serve the core missions and organizational policies and to be in response to the Thai Government's policies on science, technology and innovation. This plan aimed to drive national economy and society based on science, technology and innovation. It consisted of 4 strategies as follows:



Strategy I: Increasing the efficiency of TISTR's science, technology and innovation (STI) to support the knowledge-based society and response to lifestyle of most Thai people

Strategy II: Increasing TISTR's performance in science, technology and innovation (STI) to support national economy growth

Strategy III: Increasing TISTR's performance in science, technology and innovation (STI) to support national energy and environment stability

Strategy IV: Increasing the efficiency of organizational management

•Budgeting by Strategic Issues

In fiscal year 2014, TISTR received budget from the Government at amount of 1181.3394 million Baht to support its 3 core missions, namely, 1.) Science and technology research and development, 2.) Science and technology transfer and 3.) services in science and technology.

•Strengthening capability of infrastructure development for science, technology and innovation and striving towards excellence in particular scientific fields.

The Strategic Plan for Excellence, combined with the investment and development plan for science, technology and innovation will lead to the success of the Excellent Centers. Vice versa, this success will support the development of scientific research and technology by building expertise, providing more chances for Thai entrepreneurs to easily access Thai-based technologies in the future, and accelerating national development while preparing the nation to join into the ASEAN Economic Community (AEC). The plan was driven by the committee and working group members of the Excellent Centers, by setting up framework and operational plans as well as manpower and investment plans, which could bring success to the missions. The goal of the establishment was to enhance personnel potential and develop personnel capacity in S&T research and development. The Action Plan Phase focused on 3 scientific research areas as follows:

Agriculture: focusing on agricultural technology for economic crops, herbs, and new community economic crops. Meanwhile it promotes organic agriculture technology and good agricultural practices (GAP) for green technology. This could be counted as technical preparation for achieving in green innovation and enhancing TISTR's competitiveness in AEC.

Project on Quality Seedling Technology Center for Expanding Areas of Economic Community Forest

The project was designed to create job, increase income, and generate sustainable conservation of community forests environment for the local people in the North-Eastern part of Thailand. A laboratory was set up for research on propagation of economic species in the community forest and also a pilot plant for quality seedling cultivation at Lam Takhong Research Station (LTS), Pak Chong district, Nakhon Ratchasima province. The purposes of the project were to produce and provide good quality of sprouts to the local communities, to increase number of grown plants/trees in a large amount within a short period, and to transfer technologies to the local communities so that the members can produce these seedlings commercially.

Project on Shelf-Life Extension of Exported Longan: S&T for Solving the problem of Oversupply (in Lamphun Province)

The project was carried out to extend the shelf-life of exported Longan products and to solve its oversupply problem using sulfer dioxide (SO2) fumigation method and developing packaging for Longan products. The project provided exported Longan entrepreneurs and farmers with standard management systems of the good manufacturing practice (GMP). The technology transfer projects were transferred to prepare Longan farmers on a self-sufficiency basis in the future, building a network of partnership for them together with locating other information resources such as, marketing and logistic providers, universities and research institutes.

Food: focusing on research and development in health food products for the consumers from variety sources of fruits, vegetable, flour, herbal ingredient, or meats, with the advanced technology for its shelf-life extension while its nutritional property are still maintained.

Project on the Establishment of Innovation Centers of Microorganism Production for Probiotic and Prebiotic Industry

TISTR developed S&T infrastructures of a laboratory and pilot plant for microorganism production, fully equipped with advanced instruments and reassured with the international bio-security standards for the advanced probiotic and prebiotic research and development. These infrastructures aimed to serve and support the market need and the future industry with suitable technology and innovation, and to create a network of cooperation among the ASEAN countries, through various activities such as information and/or personnel exchange, or workshops for entrepreneurs and communities.

Project on Pilot Plant for Production Line Standard: Drinking and Dried Fruits

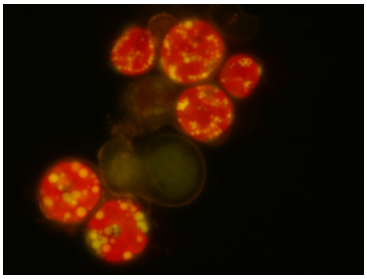
The project was aimed at promoting research results of processing technology and value added products, and to increase reliability of process and possibility of success when it was implemented in industrial or commercial production. Moreover, TISTR helped set up the factories to receive GMP standard certification, which enable entrepreneurs to distribute the products to the market legally. The plant was used as a demonstration center of the production line to entrepreneurs in order to increase their self-confidence and reduce any risk if they decided to invest on their own for the new plant.

Project on Enhancement of OTOP Entrepreneurs' Competitiveness by STI in 5 Regions

In fiscal year 2014, TISTR implemented this project in 3 regions, namely North, Northeast, and South of Thailand, focusing on the provinces affected by the Government's 300 baht daily minimum wage policy, or on the occupations affected by the intensive supply of the OTOP labours. TISTR worked in cooperation with local agencies to raise the entrepreneurs' awareness that productivity development could be accomplished by science, technology and innovation development, not only by labour factor. The supportive factors of the accomplishment of the productivity development also included scientists and researchers from the government sectors working to solve direct problems and to improve internal management for the entrepreneurs and the private companies. The infrastructure was also utilised effectively to maintain current target markets and expand new ones. This could help compensate the increasing cost of labour, and to enhance sustainable development of business, finally leading to the nation's economy growth in the long run.

Renewable energy : focusing on research and development of renewable energy development integrated with multidisciplinary subjects: agriculture, environmental and engineering sciences, for the green innovation.

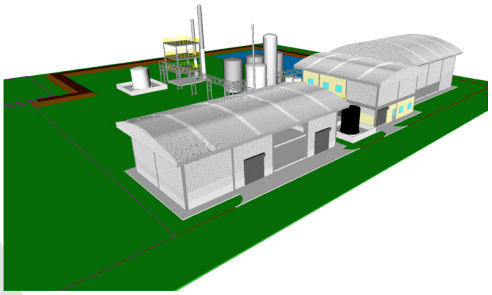
Project on Research and Development of Oil Production from Potential Algae



TISTR has continually conducted research on renewable energy and alternative energy. Recently, the advanced technology of genetic engineering for algae strain selection was developed together with its property improvement for high potential results of oil production after it was successfully conducted at laboratory scale or outdoor experimental scale. This research was performed in cooperation with other organisations through national and international networks, of which results were aimed at technology transfer for commercial utilisation and development into advanced scale of industrial production.

Project on TISTR's Excellent Center on Microalgae

TISTR initiated a construction project of an excellent center on microalgae, to develop STI infrastructure for enhancing TISTR Algal Culture Collection (TISTR ACC). The excellent center was designed to be TISTR Algal Research Resource Center (TISTR ARRC), to be operated in compliance with the Organization for Economic Co-operation and Development (OECD)'s standards. Its missions will be to upgrade microalgae research and development progress, to promote its technology transfer to the public sectors and private sectors, domestically and internationally, and to provide technical services of microalgae research in order to gain recognition as the excellent center on microalgae in the ASEAN region.



Project on Value-added Cassava as Feedstock for Ethanol Production

TISTR, in cooperation with Kamphaeng Phet province, established a pilot plant of ethanol production from Cassava for the communities, with a production capacity of 5,000 litres per a day. Waste from this pilot plant would be treated in a waste processing plant for the communities to convert the waste into animal feeds, bio-fertiliser or bio-gas. The plants were designed to serve as learning centres for the technology transfer of ethanol fuel in a completed business management.

Research and Development Projects Achieved in 2014

In fiscal year 2014, forty-six R&D projects were achieved as follows:

1. Research Development and Promotion of Commercial Cultivation of Edible Fern
2. Research Development and Promotion of Melientha Based Cropping System
3. Research Development and Promotion of Commercial Cultivation of Sweet Bamboo
4. Varietals Development, Cultural Practice and Promotion of Commercial Cultivation of Moonflower Plant (I*pomoea alba*)
5. Varietal Development and Promotion of Commercial Cultivation of Sour Tamarind
6. Development of Organic Vegetable Production Based on Multiple Cropping Systems in Limited Space
7. Research and Development on Convenience Food Products for the Elderly Group with Diabetes
8. Research and Development on Convenience Food Products for the Elderly Groups with Cardiovascular Diseases
9. Research and Development on Convenience Food Products for the Elderly Group with Gouty Arthritis Diseases
10. Research and Development on Convenience Food Products for the Elderly Group with Osteoporosis Disease
11. Research and Development on Convenience Food Products for Preventing the Brain and Nerve Disorders (Alzheimer's disease) in the Elderly Group
12. Development of Retail Packaging for Convenience Food Products for the Elderly Group
13. Research and Development on Health Foods and Beverages From Local Fruit Trees (Mamao, Ceylon oak and Kho Laen)
14. Research and Development on Production Technology of Soluble Dietary Fiber from Mango Peel
15. Research and Development on Production Technology of Soluble Dietary Fibers from Oyster Mushrooms
16. Research and Development on Production Technology of Soluble Dietary Fiber from Native Fruits and Vegetables
17. Development of Laboratory to Pilot-Scale Production Process of Soluble Dietary Fibers from Agricultural Produce of Thailand
18. Development of a Portable Paddy Rice Moisture Meter
19. Research on Suitable Energy for Reducing Moisture Content of Paddy Rice for Farmers
20. Research and Development on Lipid Absorption Inhibitory Activity Product for Weight Control/Loss from Fibers
21. Premium Raw Material Production for Nutraceuticals
22. Research and Development on Adaptogenic Memory Enhancing Phytomedicine for Alzheimer's Disease from Thai Medicinal Plants
23. Innovation of Processing Technology for Increasing Yield of Medicinal Plants
24. Study on Endophytic Fungi from Thai Medicinal Plants for Pharmaceutical Bioactive Production
25. Pilot-scale Production Technology of Standardised Extract from Plant Pigments
26. Research and Development on Production Technology of Standardised Botanical Extracts from Saponin-containing Plants
27. Research and Development on Production of Standardise Bioactive Extracts in the Autonomic Nervous System

28. Research and Development on Extraction Technology and a Bioactivity Study of Peptides From Legumes
29. Process Development of Aroma Extracts from Thai flower, Spices and Medicinal Plants by Using Supercritical Fluid Extraction (SFE) Method
30. Development of Ultrasound and Hot/Cold Therapy Devices
31. Development of Denture Adhesive
32. Development of a Telemedicine System for Vital-Sign and ECG Diagnosis
33. Development of an Energy Dispersive X-Ray Fluorescence Analyser
34. Development of Geophysical Instruments for Groundwater Investigation by Resistivity Measurements
35. An Emergency Tap Water Unit by Natural Underwater Sand Filter
36. Development of A Cooling Unit For High Precision Metal Cutting
37. Synthesis of a Catalyst for Bio-Fuel From Tar
38. Synthesis of Catalysts for Bio-Oil Production from Pyrolysis Process
39. Development of Technology in Catalyst Production from Bagasse Ash for Hydrogen Reforming from Ethanol
40. Development of Technology for Production of Gas Adsorbent Molecular Sieve from Bagasse Ash from Sugar Industry
41. Development of Technology in Catalyst Production for Partially Steam-hydrogasification
42. Production on Automotive Utilisation of Biofuels from Non-Food Biomass
43. Research and Development on Chinese Tallow Tree and Non-Food Crop for Bio-Diesel Production
44. Research and Development on Ethanol Production Technology from Sugarcane Shoots and Leaves
45. Bioaugmentation of Residual Agricultural Chemicals in Canals of Economic Crop Plantation Using Bioreactor
46. Research and Development on Healthy Vegetable by Aquaponics Method in Closed System

Research and Development in Fiscal Year 2014

TISTR 's mandatory missions lie in 3 scopes: research and development (R&D), scientific and technological (S&T) services and transfer of technology or innovation. TISTR's Action Plan 2012-2016 stated the main objectives of TISTR as follows: to enhance competitiveness of the country in the conduct of R&D, to provide effective services in compliance with the direction towards green growth & technology; to develop the national ability in S&T infrastructure and competitive advantage of technology; to build a strong network for connecting R&D with S&T services, and human resource in S&T in order to serve the missions under the ASEAN Economic Community.

TISTR's R&D projects in 2014 included:

Research, Development and Innovation

In fiscal year 2014, fifty-six R&D projects in food, health products, medical appliances, renewable energy and environment were completed. The results of these projects are as follows:

Food Technology

1. Research and development on organic farming system for novel economic crops

To extend research findings of novel economic crops, namely, Phak-Kut (*Diplazium esculentum* Swartz), Phak-Wan-Pa (*Melientha suavis* Pierre), Phai-Wan (*Bambusa* sp.), Dok-Chom-Chan (*Ipomoea alba* Linn.) and Ma-Kham-Priao (*Tamarindus indica* Linn.) in the organic farming system for their utilisation, workshop training in agricultural practices by setting up a demonstration plot at Lam-Takhong Research Station as a study tour site for interested people and organisations. This project focused on processing of raw produce into value-added products, for instance, instant spicy curry and instant tea produced from Phak-Wan-Pa, of which production technology was transferred to the interested entrepreneur for commercialisation.

2. Research and development on health food and drink from local fruits

To develop healthy recipes of food and drink from local fruits having high nutritional value with the aim to promote the utilisation of local resources e.g. fruits to be produced into various products, such as dipping sauce, sauce, health drinks, concentrated drinks and salad dressing. Production technology transfer was carried out by demonstration activities through local communities and people who live in the remote areas in order to help create jobs and enhance better standards of living for people.

3. Research and development on ready-to-eat food products for the elderly group to enhance quality of life

To develop ready-to-eat food products including main courses, snacks and drinks suitable for groups of the elderly with the following diseases: diabetes, coronary heart disease, joints (gout) disease, osteoporosis, brain and the nervous system. These products were developed together with Consumer's Guideline Handbook.

4. Research and development on production technology of soluble dietary fiber from agricultural produce in Thailand

To conduct research and development on production technology of soluble dietary fiber from low-value fruit peels, obtained from fresh produce available in the country. Consumers can bring the soluble fiber product to mix with water and drink immediately, or add into foods without changing their taste. Small and medium entrepreneurs can make a request for technology transfer from TISTR for commercial use in future.

5. Development on drying technology of rice paddy for a small-scale farmer

To solve the farmer's problem on storage and control of moisture content for rice paddy within the recommended standards prior to distribution. Also, lower production costs on energy fuels can be achieved by using agricultural byproducts from individual local communities as fuel materials. TISTR developed a gasification reactor to generate gas, which was fed into a burner prototype for use in combination with the rice paddy dryer of a small scale farmer.

Health Products

1. Research and development on nutraceuticals from herbs and natural products

To develop extraction methods of herbs and the quality control system of extracts. Efficiency on inhibition of dietary fat absorption for weight control/reduction of neutraceutical products was tested from dietary fibers that could inhibit the lipase activity on fat absorption.

2. Research and development of natural products for adaptoginis

To study and develop best farming practices and technology for production of herbal plants of which extracts and components are used in the preparation of herbal medicine. Research and development were conducted on phytomedicine in memory enhancement for the elderly and/or Alzheimer's patients from Thai herbs. Scientific data were gathered to support their quality, safety and efficacy, which included clinical trials. This project could help in an increase of economic herbal plants in the future while imported volumes of synthetic medicines would be decreased; thus contributing to Thailand's competitiveness in herbal medicines.

3. Research and development on production of standardized extracts from natural products at pilot scale

To develop standardised extracts e.g. data on chemical quality, pharmacology, toxicology and their utilization on production of medicine products, medical supplies and health products. The development on production technology for standardized extracts at pilot scale to replace the imported standardised extracts from overseas indicated the value adding for Thai herbs and promotion of production standards for herbal products.

Medical equipment

1. Development on materials and health medical equipment for working age people

To facilitate medical care by means of self-massage therapy or self-physical therapy at home and in a daily life suitable for working age people. TISTR developed a prototype of massage therapy device with ultrasound and hot/cold packing. Not only enabling lower production costs, the project also boosted domestic production industry and reduced the imported medical equipment from overseas.

2. Development on materials and medical equipment to promote well-being of the elderly group

To get prepared for the upcoming aging society and strengthen the quality of health care in Thailand and to promote easy access to materials and medical equipment among disabled or low-income elderly groups so that they could have more chances in receiving good quality of health care services or using medical equipment

more conveniently in a daily life. The research accomplished was as follows: a prototype of denture adhesive having a similar quality to available products in the market; a telemedicine system for examination of vital signs and electrocardiogram, which was a prototype computer for online communication and could be further produced commercially.

3. Development on instrument, machine and equipment for utilisation in industrial factory and academic institution

To develop instrument, machines and equipment for the uses in industrial factories and academic institutions such as teaching aids, further R&D, and commercial production to reduce the imported prototypes. The R&D outputs were as follows: X-ray fluorescence spectrometer for elemental analysis, groundwater exploration instrument using electrical resistivity method in soil, emergency tap water supply set using sand filtration system and cooling equipment for computer numerical control (CNC) milling machine.

Renewable Energy and Environment

1.Synthesis of aluminosilicate group catalyst for producing fuel from biomass

To study suitable technology for synthesis of catalyst in order to produce various kinds of biomass fuel by inventing a prototype reactor and to develop technology for catalyst production in order to obtain knowledge and utilise technology for economic benefit in the future.

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

To study a suitable technology for synthesis of catalyst in order to produce fuel gas from a hydrogasification process and for producing biomass pellets from leftovers with standard quality of fuel pellets by chemical catalysis developed from metal in a partially steam-hydrogasification process, which could be used with a prototype producing high-performance synthetic fuel (Biomass steam gasifier).

3.Production of bio-fuel from non-food biomass

To study a production process of biodiesel from non-food energy crops of which parts could not make any use, and to develop technology for the production of bio-fuel using a fast pyrolysis technology which creates a full range of knowledge of technology for the production of bio-fuel such as ethanol, biodiesel, and bio-oil.

4.Value adding of waste water from agriculture and agro-industry sectors

To invent a prototype of apparatus for treating agricultural chemicals by using microorganisms in order to solve contaminants in the environment for the agricultural/industrial sectors and to treat residues of agricultural chemicals left in canals under raised beds of economic crops using a reactor at Damnoen Saduak district, Ratchaburi.

Research and Services for the Future

Research and services on biodegradable material

TISTR has established a testing laboratory for biological degradation in order to provide analytical/testing services of bioplastic products according to international standard ISO 17088 (Specification for compostable plastics) and developed a laboratory to be accredited according to ISO/IEC 17025 which will benefit the research and development of materials and bio-packaging for both the government and private sectors. Moreover, TISTR, by Office of Certification Body, has collaborated with the Thai Bioplastics Industry Association in issuing certifications to bio-degradation products. The certification of products must be in compliance with these international standards, namely, ISO 17088, EN 13432, ASTM D 6400 or equivalent Products which passed the inspection and certification can show a certified mark of Thai biodegradable products as specified.

Patents and Petty Patents, as registered in Fiscal Year 2014

Patents

1. Production process of dietary fiber from rambutan peels
2. Production process and formula of protein encapsulation from Pigeon peas in Liposome particle
3. Extractor for bioactive extracts from herbs using varied frequency ultrasonic waves
4. Production process of herbal mixture extracts from Indian Gooseberry and Anise pepper
5. Increasing efficiency of biodiesel production process using solid catalyst in a mixed system with micro/ nano buble formation
6. Sulfur dioxide production machine
7. Sulfur dioxide fumigation room with force draft controlled Sulfur dioxide fumigation system
8. Temperature controlled ultrasound therapy equipment
9. Fumigation process of Longan with force draft controlled Sulfur dioxide fumigation system
10. Multi photo bioreactor for algae cultivation using twinkle LED light source
11. Increasing efficiency of gamma-amino butyric acid formation in rice bran using glutamate solution
12. Process improvement of salt tolerance algae species for used in salt water for oil production
13. Process improvement of algae species for oil production using synthesis gene transformation
14. Production process of SSF ethanol from the tops and leafs of sugarcane
15. Production process of soluble dietary fiber from mango peels
16. Production process of fuel oil from tar
17. Catalyst synthesis for hydrogen increasing in biomass gasification process
18. Production process of glucose and xylose from the tops and leafs of sugarcane
19. Blood pressure monitor with Korotkoff method
20. The filter for removing fine sand particle from hot fuel gas
21. Production process and formula of dietary supple ment product from nut gall
22. Formula and encapsulation process of Thai blue berry using freeze drying technology
23. Gasifier reactor of rice husk fuel
24. The cross axis screw for capturing the solidified materials at hot temperature
25. Denture adhesive cream mix with green tea extract
26. Production process of reduced neurological disorder product using passion fruit extract
27. Production process of algae biomass with cell immobilization system using filter mat as substrate for oil production
28. Production process of algae biomass for oil produc tion in commercial outdoor growing
29. Production process of algae from astaxanthin pigment in Heamatococus lacustris algae
30. Spirulina production using waste from fruit juice factory

Petty Patents

1. Pak Waan Pa young plant with parasitic-root for planting
2. Formula and production process of facial cleansing soap from Indian Gooseberry and Anise pepper
3. Formula and production process of face and body cleansing gel from Indian Gooseberry and Anise pepper
4. Carton packaging for Longan
5. Production process of pesticides from Mytle grass
6. Production process of smoked salmon rice for pre-diabetes groups
7. Round bottle Type 2
8. Bottle packaging for beverage product

TISTR's International Publications

1. Dental zirconia can be etched by hydrofluoric acid.
Tool Sriamporn, Niyom Thamronganankul, Chumphol Busabok, Sushit Poolthong, Motohio UO and Junji Tagami. *Dental Materials Journal*, 2014; 33(1), p.79-85.

2. Toxicity studies on rambutan (*Nephelium lappaceum*) seed fat and oil extracts using acute oral, dermal and irritation assays.
Jirawat Eiamwat, Sareeya Reungpatthanaphong, Sarunya Laovitthayanggoon, Tuanta Sematong, Paramee Pengprecha, Benjaporn Tiensong and Patthanant Natpinit. *International Journal of Natural Product Research*, 2014 ; 4(2), p.36-39.

3. Lipase inhibitory effect of some ethanoliceExtrats from genus *Ocimum*.
Sirinan Thubthimthed, Tanwarat Kajsongkramand, Sarunya Laovitthayanggoon, Parkpoom Siriarchavatana, Tuanta Sematong and Chuleratana Bancchonglikitkul. The 3rd Current Drug Development International Conference (CDD), 1-3 May 2014, p.212-213.

4. Antioxidant activities, total phenolics and anthocyanin content of freeze dried fruits.
Tanwarat Kajsongkram , Sarunya Laovitthayanggoon, Kusol Iamsub, Vilailuk Chuennangchee, Penpan Srithong and Chuleratana Bangchonglikitkul . The 3rd Current Development International Conference (CDD), 1-3 May 2014, p 214-215.

5. The statistical recognition of walking, jogging, and running using Smartphone Accelerometers.
Ekachai Thammasat. The 2013 Biomedical Engineering International Conference, 23-25 November 2013, Krabi, Thailand.

6. Reconstruction of local volume-weighted drop-size distributions of a solid cone spray using Adaptive Tomographic Technique.
Songrit Tanchatchawan, Pumyos Vallikul, Pisit Yongyingsakthavorn and Christophe Dumouchel. The 16th Conference of ILASS-Asia, 18-19 December 2013, Nagasaki, Japan.

7. Evaluation of particulate sulfate dry deposition over tropical forest, Thailand.
Phuvasa Chanonmuang and Pojanie Khummongkol . The 6th Thailand-Japan International Conference, 9 November 2013, Osaka University, Japan.

8. Quantitative analysis of ligustilide in roots and stems of *Angelica sinensis* (Oliv.) Diels.
Pattra Ahmadi Pirshahid, Thongchai Hemthanon, Yaowaluk Khamphan, Phatsuda Chueboonmee and Chuleratana Banchonglikitkul. The 5th International Conference on Natural products for Health and Beauty (NATPRO 5), 4-5 May 2014, Phuket, Thailand, p.46-51.

9. Stimulation of dermal fibroblast collagen synthesis in vitro by saponin enriched extract from soybeans.
Sarunya Laovitthayanggoon, Siripen Jarikasem and Sarinthip Muensaen. The 5th International Conference on Natural Products for Health and Beauty (NATPRO 5), 4-5 May 2014, Phuket, Thailand, p.193-197.

10. Anti-oxidant and cytotoxic activity of *Cajanus cajan* (L) Millsp alkaline extracts.
Ubon Rerk-am, Sarunya Laovitthayanggoon, Bantika Kongsombat, Sinn Tangsatirapakdee and Chuleratana Banchonglikitkul. The 5th International Conference on Natural Products for Health and Beauty (NATPRO 5), 4-5 May 2014, Phuket, Thailand, p.198-201.

11. Chemical fingerprints and anti-inflammatory activity of polar fraction from *Cajanus cajan*. Siripen Jarikasem, Amonrat Khayankarnnawee and Sarinthip Muensaen. The 5th International Conference on Natural Products for Health and Beauty (NATPRO 5), 4-5 May 2014, Phuket, Thailand, p.213-216.

12. Fatty acid composition and acute oral toxicity of rambutan (*Nephelium lappaceum*) seed fat and oil extracted with SC-CO_2.
Jirawat Eiamwat, Paramee Pengprecha, Benjaporn Tiensong, Tuanta Sematong, Sareeya Reungpatthanaphong, Patthanant Natpinit, Sukit Kampruengdet, Nantaprecha Hankhunthod. The 5th International Conference on Natural

Products for Health and Beauty (NATPRO 5), 4-5 May 2014, Phuket, Thailand, p.312-316.

13. Evaluation of rabbit skin irritation of SC-CO_2 extracted rambutan (*Nephelium lappaceum*) seed fat and oil.
Tuanta Sematong, Jirawat Eiamwat, Sarunya Laovitthayanggoon, Patthanant Natpinit and Sukit Kampruengdet. Burapha University International Conference, 3-4 July 2014, Pattaya, Thailand, p.302-308.

14. Microstructure and properties of TCP/HA composite materials.
Laksana Kreethawate, Siriporn Tong-On, Parkpoom Siriarchavatana, and Siriporn Larpkiattaworn. *Key Engineering Materials*, vol. 608 (2014), p.259-263.

15. Preference, expectations, and opinions of consumers towards decision making in fiber food products purchasing: a case study in Bangkok, Thailand.
Seksak Chouichom. Burapha University International Conference, 3-4 July 2014, Pattaya, Thailand, p.23-31.

16. Appropiate host for edible hemiparasitic plant *Melientha suavis* Pierre (Pak Wanpa) cropping system.
Khanok-on Amprayn, Vachiraporn Supawong, Montree Keawdoung, and Sayan Tanpanich. Burapha University International Conference, 3-4 July 2014, Pattaya, Thailand, p.257-266.

17. Recovery of magnesium, ammonium and phosphate as struvite precipitation from anaerobic spent wash of ethanol wastewater.
Patthanant Natpinit, Rewadeee Anuwattana, Thitirat Ditkeaw and Tawee Sappinunt. Burapha University International Conference, 3-4 July 2014, Pattaya, Thailand, p.309-315.

18. Stability of pyrolysis oil-water emulsion
Pipat Subsuksumran, Prakorn Kittipoomwong, Monpilai Narasingha, and Wirachai Soontornrangson. Advanced Materials Research, vols. 953-954 (2014), p.1238-1241.

19. Optimization on pretreatment and enzymatic hydrolysis of sugarcane trash for ethanol production
Teerapatr Srinorakutara, Suthkamol Suttikul, Vishnu Panphan, and Nassapat Boonvitthya. *Journal of Food Science and Engineering*, vol.4 (2014), p.148-154.

20. Fabrication of ceramics membranes on porous ceramics supports by electrophoretic deposition.
T. Uchikoshi, L. Kreethawate, C. Matsunaga, S. Larpkiattaworn, S. Jiemsirilers, and L.Besra. *Advance in Applied Ceramics*, vol.113 (2014), no.1, p.1-7.

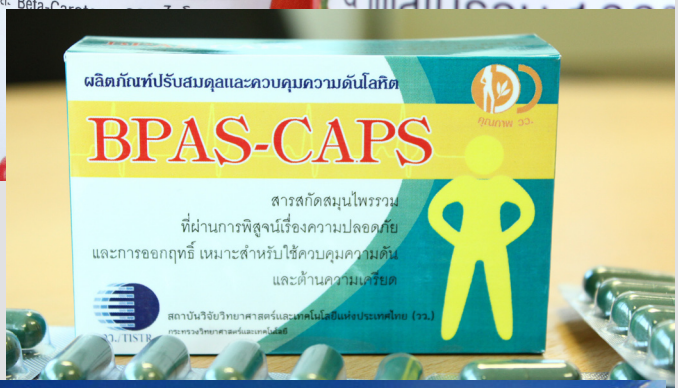
21. PES membrane performance for Triethylene Glycol (TEG) removal of wastewater from natural gas separation process.
Siriporn Larpkiattaworn, Chutima Eamchotchawalit, Julaluk Pannoi, Kanungnuch Keawsupsak and Romchat Rattanaudom. *Jurnal Teknologi* (Sciences & Engineering), 65:4 (2013) p.29-32.

22. Effect of MnCO3 doping on microstructure and electrical properties of PSZT ceramics.
Arjin Boonruang, Piyalak Ngernchuklin, Saengdoen Daungdaw, Nestchanok Yongpraderm and Chutima Eamchotchawalit. *Key Engineering Materials*, vol. 608 (2014), p.187-192.

23. Hydrothermal pyrolysis of food waste for bio-oil production over Ceria and H-ZSM-5.
Notsawan Swadchaipong, Nutnan Kanestitaya, Itsara Rojana, Tanes Utistham, and Unalome Wetwatana. The 4th International Conference on Biology, Environment and Chemistry IPCBEE (2013) C (2013), IACSIT Press, Singapore.

24. Methonal synthesis in a slurry phase reactor over Cu/ZnO/Al_2O_3 catalyst.
Kuntima Krekkeitsakul, Thanes Utistham and Unalome Wetwatana Hartley. *Advanced Materials Research*, vols. 931-932(2014), p.27-31.

Technology Transfer



Technology Transfer

With the core mission to develop its R&D into innovations so as to enhance competitiveness of the private sector, TISTR has transferred knowledge and technology to the main target groups including SMEs and OTOP entrepreneurs, people and communities. It has also developed a mechanism to drive and support such achievements to be utilised in the real situation.

Research, development and innovation for industries and SMEs entrepreneurs

TISTR pushed forward and transferred its technologies to SMEs, private entrepreneurs and enthusiasts for their commercialisation. Several R&D achievements of TISTR helped increase those SMEs and industries' capability and competitiveness to the ASEAN Economic Community (AEC). Such achievements are as below:

Machineries and medical equipment

– A fertiliser compressor Model FTC-54 to compress and produce organic fertiliser pellets was invented and qualification of fertiliser suitable to be compressed and coated by nanoparticles polymer was studied by TISTR for NANOTEC, National Science and Technology Development Agency (NSTDA), Thailand.

– A continuous mulberry juice extractor with 400-500 kg/hr capacity was designed, assembled, and installed by TISTR for the Asian Pacific International Limited for commercial production.

– An ultrasound therapy equipment Model UD 5704 was developed and a marketing trial was conducted for Pornkasem Clinic Company.

Foods and Drinks

– "Lyco M", mixed fruit juice rich of lycopene and beta-carotene from natural sources was developed and transferred to KIANG LONG PAGJU Fund for Education for commercialisation.

– Instant Spicy Mushroom Soup and Instant Creamy Mushroom Soup production technology was transferred to Sine Center (Thailand) Ltd.

Nutrition and Pharmaceutical Products

– TISTR transferred production technologies on "Kardiofit", cardio tonic extracted from plants and herbs, "BPAS CAP", balanced, anti-stress and anti-hypertension product, and "Braini-Tab", pharmaceutical product to boost the brain memory to Healthy Kingdom Co., Ltd. for commercialisation.

– Products from Ginger i.e. shampoo, lotion and spray for pets to eradicate ticks and fleas and ginger oil for anti-inflammatory were transferred to Mr. Somchai Jantipwong.

Research, development and innovation for social and community benefits

Realising the mission to transfer knowledge and expertise of STI to improve the quality of life of the society and to strengthen national economic growth sustainably, TISTR focused on transferring key technologies those target groups and communities as follows:

1. Organic fertiliser

TISTR transferred the production technology of high quality organic fertiliser to 40 groups of farmers or 3,089 persons in provincial and rural areas. It was notable that the fertiliser obtained was comparable to the quality standard one as specified by the Department of Agriculture, Thailand. Besides, the project to improve fertiliser plant in Northeast was initiated. The first fertiliser plant was set up in Yasothon to improve the production quality, and increase effectiveness on equipment repair and maintenance. In Yasothon, the fertiliser production technology was transferred to 22 groups or 414 farmers. Among those, 10 groups passed the requirements and were able to produce 327 tons of organic fertiliser. Thus, their income was increased from selling fertiliser and animal droppings accounting for 490,500 baht, reducing the cost of fertiliser totaling 1,831,200 baht.

2. Interlocking Block

TISTR organised a number of training courses in order to transfer technology on production of interlocking block for building construction and others such as water tank using curved interlocking blocks. The training courses were attended by 521 participants, 25 percent of which could earn more income and decrease household expenses. So far, a demonstration and technology transfer center of interlocking block has been established at TISTR Technopolis, Pathum Thani for provision of services and training, and demonstration of interlocking block production to the target groups and manufactures in all regions, or any interested public.

3. Food processing

TISTR transferred food processing and production technology to the household, community, or SMEs focusing on cleanliness, hygiene and quality control standards. The target groups included housekeeper agriculturist groups, vocational groups for women, and other interested parties in order to develop local products and expand the production scale up to small-and-medium industries. The technologies transferred were, for example, improvement of products from processed water chestnut, chili paste production, efficiency improvement of production process and shelf-life extension, jam products, food production according to the Good Manufacturing

Practice (GMP), Tri-Phala herbal juice, Longkong processed products, and processing technology for several fruits i.e. Longkong, rambutan, and mangosteen. The increasing income of the 5 housekeeper agriculturist groups resulted from technological transferred by TISTR accounting for 1,146,000 bath annually.

4. Packaging technology

TISTR transferred its packaging technology through 3 periods of training courses to the SME entrepreneurs and communities consisting of approximately 360 participants. Other workshops included i.e. packaging development, branding, logo design, and packaging improvement for products of the community enterprises. The income of three groups i.e. Pad-Mee-Muang-Pak Vocational Cooperative Group, Innovation Pharma Herbs Co., Ltd. and Kaew-Chao-Chom Group of Community Enterprise could be averagely increased up to 30,000 baht per year.

TISTR's promotion of innovative products in the communities

To implement the O-Z-O-N-E concept, TISTR has moved toward the green technology integrating various fields of knowledge to benefit the target customers. The products further developed by TISTR's innovation shall be certified under TISTR's brand.

Examples of products certified by TISTR's brand:

1.Longan Chocolate Rice Bar, AP Snack Ltd. Lampang.

2.i-Yha, Dried rambutan compote, Na-San Food Company, Surat Thani

3.Instant Sichuan pickle cup (DD Thai Pickle), DD Pak-Kad-Dong Co.,Ltd.

4.Herbal Paste

5.Uncle Boonmee, ready-to-drink rice powder mixed with cereal

Promoting STI for provincial development

TISTR has set its action plan to promote STI for provincial development. The collaboration with the provinces has begun since 2013, which was piloted in Prachuap Khiri Khan under the concept "Prachuap Model". It was to match STI to the needs or to solve problems of the province. TISTR brought its R&D personnel and expertise to improve production of provincial SMEs up to high quality and standard. In 2014, this project was also expanded to the northern and eastern regions of Thailand.

Prachuap Khiri Khan: The projects were carried out under the concept of "S&T and R&D for communities" in order to solve the problems concerning economic crops of the province such as coconut and pineapple. The success of collaboration was as follows:

– Solution finding for coconut problem by making an evaluation manual for chemicals injection in the coconut trees in order to control and eradicate coconut pest (black-headed caterpillar). The monitoring was also conducted according to the Cabinet resolution together with the Department of Agriculture and Provincial Agricultural Extension Office.

– Making a draft of criteria for product certification by TISTR. Currently, the virgin coconut oil, the product of the Community Enterprise of Organic Agricultural for Coconut Virgin Oil Baan Saeng Arun, was certified as TISTR Scientifically Tested Mark by TISTR.

– Solution finding for pineapple, the main product of Prachuab Khiri Khan. TISTR proved the identification and filed Leung-Sam-Roi-Yot to a species record with the Rai Kao Tambon Administrative Organization and Provincial Agricultural Extension Office (Prachuap Khiri Khan). Currently, such species was approved to be the identity of Prachuap Khiri Khan

Phrae: With the concept of innovative technology integrated with the local knowledge to raise quality of OTOP products, TISTR conducted R&D to improve the products of Phrae, such as improving quality of pickle products and processes up to standards. TISTR conducted a joint research with the entrepreneurs to improve the production, products' formula and packaging design. The success of the technology transfer was increasing productivity for a variety of value added products and the development of spa scrub products. In the case of scrub product, its problems were about the shelf-life duration, mold contamination, and beads size unsuitable to apply on face. TISTR then helped develop and improve new scrub from coffee grounds using local raw materials available in the province and nearby. This resulted in obtaining the value added products and marketing channel.

Rayong, Chanthaburi and Trat: With the concept to enhance fruit products' quality for AEC markets using processing technology, TISTR served as a project consultant on fruit processing technology to improve the quality of the products for the AEC markets. The implementation was to develop OTOP and SMEs community in the target area. The success obviously seen was increasing competitiveness and capability of entrepreneur groups while agricultural products were improved and value-added both in terms of quantity and quality. Besides, those entrepreneurs can generate the more income averagely 5 percent per year (average income increase 300 baht / month calculated by the base of income of the group 6,000 baht / month.)

Scientific and Technological Services

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.

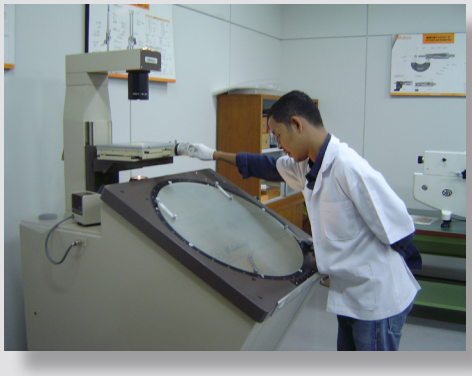
6. Inspection body service for boilers, liquefied petroleum gas tank and pressure gauge.

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 2014, TISTR provided S&T services to customers as follows:

-130,842 requests from customers in measuring, testing, analysis, and calibration;

-67 training courses with 2,091 attendants, 266 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 2,316 attendants.



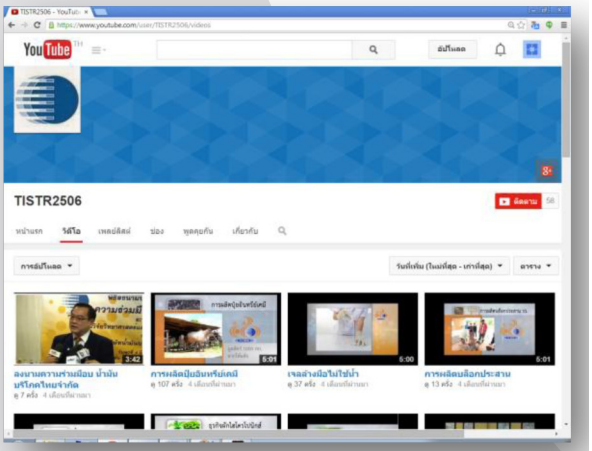
Examples of customers

- Dumex Ltd.
- TOA Paint (Thailand) Co., Ltd.
- Shell (Thailand) Co., Ltd.
- Sammitr Motors Manufacturing Public Co., Ltd.
- F&N Dairies (Thailand) Ltd. - Pak Chong Factory
- Cho Heng Rice Vermicelli Factory Co., Ltd.
- Expressway Authority of Thailand
- Saraburi Construction Technology Co., Ltd.
- Electricity Generating Authority of Thailand
- IRPC Public Co., Ltd.

Information Services

TISTR provided S&T information services such as in-house research reports, research articles and other TISTR's publications including online databases to our target groups, mainly researchers, staffs, students, and the interested public. These S&T information services were provided under the responsibility of the Knowledge Centre (KLC). In fiscal year 2014, TISTR provided services to 22,074 requests via e-Library on TISTR website (http://www.tistr.or.th) or library website of the Knowledge Centre on http://klc.tistr.or.th. The record showed that 21,457 had accessed the KLC website.

TISTR also offers more communication channels to provide more information services such as organisational news, public relations activities via a popular social media such as facebook fanpage (www.facebook.com/tistr.or.th), recently followed by more than 3,000 followers, and YouTube channel (www.youtube.com/tistr2506) to broadcast TISTR news and demonstration of technology transferred via video clips. It was countered that more than 20,000 users had clicked to see the video clips in our YouTube channel.



FINANCIAL REPORT

FINANCIAL REPORT

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH
BALANCE SHEET
AS OF SEPTEMBER 30, 2014

Unit : baht

	2014	2013
ASSETS		
Current Assets		
Cash and Cash equivalent	366,076,990.02	219,091,379.88
Current Investments	981,870,364.18	908,596,753.44
Account Receivables – Net	5,851,560.44	5,266,683.93
Advance Receivable	13,579,548.96	12,239,844.03
Revenue Department Receivable	5,164,928.03	4,969,318.94
Accrued Interest Receivable	6,831,895.68	6,229,637.49
Other Current Assets	31,672,032.95	15,786,068.81
Total Current Assets	**1,411,047,320.26**	**1,172,179,686.52**
Non – Current Assets		
Long-term investment	491,473,449.40	491,473,449.40
Account Receivable Pension Fund	46,336,343.00	44,197,793.00
Property Land and Equipment–Net	1,815,268,804.08	1,817,537,862.45
Intangible Assets	7,497,959.23	11,574,812.51
Other non-Current Assets	407,468.75	1,045,568.75
Total non-Current Assets	**2,360,984,024.46**	**2,365,829,486.11**
Total Assets	**3,772,031,344.72**	**3,538,009,172.63**

The financial Report 2014 is on audits by the Office of the Auditor General of Thailand.

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH
BALANCE SHEET
AS OF SEPTEMBER 30, 2014

Unit : baht

	2014	2013
LIABILITY AND EQUITY		
Current Liability		
Project Service Income	66,685,725.02	74,153,193.69
Trade Account Payable	32,120,586.72	53,667,434.35
Accrued Expenses	20,131,767.19	3,824,326.06
Accrued Bonus Payable to Employees and Board of Director	26,622,500.00	25,872,500.00
Revenue Department Payable	2,018,948.81	1,576,013.64
Deferred Revenue	8,046,164.45	3,688,585.14
Other Current Liability	121,910,440.22	35,056,547.34
Total Current Liabilities	**277,536,132.41**	**197,838,600.22**
Non – Current Liabilities		
Deferred Income	96,622,187.83	92,188,101.73
Accrued Bonus Payable to Employees and Board of Director over 1 Year	25,872,500.00	26,100,000.00
Deferred Government Subsidy	1,588,411,669.99	1,592,926,304.59
Employee Benefit Payable	**507,436,944.29**	**452,366,998.40**
Total non-Current Liabilities	**2,218,343,302.11**	**2,163,581,404.72**
Total Liabilities	**2,495,879,434.52**	**2,361,420,004.94**
EQUITY		
Over Balance Accumulated Expenses	1,276,151,910.20	1,176,589,167.69
Total Equity	1,276,151,910.20	1,176,589,167.69
Total Liabilities and Equity	3,772,031,344.72	3,538,009,172.63

The financial Report 2014 is on audits by the Office of the Auditor General of Thailand.

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH
STATEMENT OF INCOME AND EXPENDITURE
AS OF SEPTEMBER 30, 2014

Unit : baht

	2014	**2013**
REVENUES		
Government Subsidies	981,240,987.25	899,917,963.46
Research Income	79,774,532.38	75,968,396.97
Other Income		
Interest Income	51,378,013.73	46,873,383.26
Other Income	20,894,782.84	31,656,229.66
Total Revenue	1,133,288,316.20	1,054,415,973.35
EXPENSES		
Cost of Personnel	490,570,317.02	481,179,928.23
Administrative and Other Expenses	348,333,008.87	262,242,762.20
Project Expenses	45,479,584.85	45,531,201.54
Depreciation and Amortization	146,159,484.87	142,212,168.58
Total Expenses	**1,030,542,395.61**	**931,166,060.55**
Net Income	**102,745,920.59**	**123,249,912.80**

The financial Report 2014 is on audits by the Office of the Auditor General of Thailand.

Events of the Year 2014

Biomass Open Innovation Forum

TISTR in collaboration with the National Science and Technology Development Agency (NSTDA) organised the Biomass Open Innovation Forum (BOIF) on 18 November 2013 at Centara Grand at Central Plaza Ladphrao, Bangkok, Thailand to exchange information and ideas among the Thai and Japanese concerned agencies. It was to set policies, activities, and budget mechanisms for the establishment of Biomass Open Research Center (BORC) in Thailand.

Announcement of a new plant species

On 18 December 2013 at Miracle Grand Hotel, Bangkok, TISTR hold a press conference on its discovery of the new 6 plant species in the Family Gesneriaceae i.e. Sawet Daen Sruang (*Paraboea middletonii* Triboun), Kao Tog Yonok (*Microchirita albiflora* D.J.Middleton & Triboun), Bunga Karaket (*Microchirita karaketii* D.J.Middleton & Triboun), Net Muang (*Microchirita purpurea* D.J. Middleton & Triboun), Sadudee Dao (*Microchirita suddeei* D.J. Middleton & Triboun), Malai Fon Lep (*Microchirita woodii* D.J. Middleton & Triboun). Such plants were expected to become the economic and ornamental plants in the future. The bioactive compounds of those plants were studied by TISTR in order to find their effectiveness in medical treatment and body balance.

MOU Signing Ceremony on the Establishment of a Learning Center of Ethanol-Related Business Management

TISTR signed a MOU with Kamphaeng Phet Province, and the Office of Vocational Education Committee (VEC) to establish The Integrated Learning Center for Technology Transfer and Business Management on Ethanol". It was under the national policy and strategy to empower provincial level such as Kamphaeng Phet. The Center shall gather information about cassava production and processing to be utilized as alternative energy to reduce the use of natural gas and oil of the country. The ceremony was held on 22 January 2014 at the Kamphaeng Phet College of Agriculture and Technology.

Joint Training Course on "Management and Application of Microbial Data Resources"

TISTR in collaboration with the World Data Center for Microorganisms (WDCM), China hosted a joint training on "Management and Application of Microbial Data Resources" on 18 February 2014, at TISTR Technopolis, Pathum Thani, Thailand.
The objective of the training was to gain insight understanding of microorganisms and database management, as well as to establish networking among agencies of Thailand and overseas.

MOU Signing on the Establishment of Learning Center for Innovation to Extend the Longan Shelf-life

TISTR signed a MOU with Lamphun Province and Tambon Lao-Yao Administrative Organization on 13 August 2014, in Lamphun to launch the first Learning Center on Innovation to Extend Longan Shelf-life. The Center has a first prototype sulfur dioxide control system to control residues in Longan. This is to help the export of Longan and to enhance capability of agriculturists by using the appropriate technology as well as to reduce the environmental impact of the country.

Seminar on “Asian Fermented Food: The Sources of Novel Functional Food”

TISTR organized the international seminar on “Asian Fermented Food: The Sources of Novel Functional Food” during 17-19 July 2557, at TISTR Technopolis, Pathum Thani, Thailand. Several invited guest speakers and experts came from ASEAN member countries and other countries outside ASEAN including Japan, South Korea, Australia and the Netherlands to provide knowledge and share experience on R&D on health products, fermented food in Asia, utilization of fermented technology and micro-organisms in functional food. The participants were TISTR researchers and representatives from the concerned institutes in Thailand.

Workshop on “Research, Development and Regulation of Herbal Medicines of the Indian Ocean Rim Association (IORA) Member Countries”

TISTR organized the workshop on “Research, Development and Regulation of Herbal Medicines of the Indian Ocean Rim Association (IORA) Member Countries” during 24-25 July 2557 at Century Park Hotel, Bangkok, Thailand to exchange and share R&D knowledge and regulations related herbal medicines, as well as to establish collaboration among the IORA member countries, such as, Iran, India, Sri Lanka, Indonesia, Tanzania and Thailand.

Special Lecture on “The Role of Open Innovation in Value Creation and Value Capturing”

TISTR organized the special lecture on “The Role of Open Innovation in Value Creation and Value Capturing” at Pathumwan Princess Hotel, Bangkok, Thailand on 29 August 2014. The invited speaker was Dr. Kjell Håkan Närfelt, Chief Strategy Officer, VINNOVA - Swedish Governmental Agency for Innovation Systems. The feature of his lecture was about the foundation and experience to establish the Open Innovation Center and how to apply with the Biomass Open Research Center (BORC) to be established in Thailand.

TISTR and Friends 2014

TISTR organized the event “TISTR and Friends 2014 : Creative Innovation for Sustainable Business” during 8-9 September 2014 at Central Plaza Ladphrao, Bangkok in collaboration with the six alliance partners i.e. the Office of Small and Medium Enterprises Promotion (OSMEP), Ministry of Industry , Krung Thai Bank, Government Savings Bank, and Thai Credit Guarantee Corporation (TCG), Ministry of Finance, Thailand Post Co., Ministry Information and Communications Technology, and the Department of International Trade Promotion, Ministry of Commerce. The mission was to enhance capability of Thai SMEs/OTOP enterprises by using research, development, and innovation (RDI) for their future business and society. The event featured with the exhibition and seminar titled “Thai Style Value added – Agriculture, Food, and Energy”.

TISTR’s Mascot Contest

TISTR organized a mascot design contest to be used as an organization’s symbol representing TISTR’s profile and RDI achievements. The mascot was also used as a public image to young generations and people around the country. The winner, 1st runner up, and 2nd runner up of the contest were Miss Silalai Padbok, Pohchang College; Miss Tipnapa Phalee, Wat Si Chan Pradit High School, and Miss Wanida Suwandeja, Wat Si Chan Pradit High School, respectively.