



TECHNOLOGY AND INNOVATION MARKETPLACE

Profiles of technologies showcased by exhibitors during the RDFS Forum

Fostering Youth Leadership for Sustainable Development Goals with Convergent of Knowledge, Strategic Communication, and Entrepreneurship

The Science, Technology, Arts, and Mathematics (STEAM) Platform empowers the youth in Asia in acquiring science, technology, engineering, and mathematics (STEM) knowledge and strategic communication skills and supporting entrepreneurship practices for co-creating innovative solutions toward the Sustainable Development Goals (SDGs) and a smart circular economy.

Overview

Since its inception in June 2018, the STEAM Platform has established global partnerships with governments, the Asian Development Bank (ADB), Global Initiatives, the United Nations Development Programme (UNDP), and other organizations in driving youth leadership toward Circularity 2030. It has empowered over 300 university students in Thailand and influenced more than 3,000 youths globally through various channels, including topical workshops on STEM, personalized mentorship, innovation showcase, and technology competition. It incorporates peer-to-peer and experiential learning with emerging technologies including Industry 4.0 and circular economy to create global impact.

Summary

In developing countries in Asia, particularly in non-English speaking countries such as Thailand, most of the youth lack confidence and are not very adept in communicating in English. This low capacity in language has had adverse effects on the youth's overall performance and achievements especially in setting goals, being motivated to achieve them, and planning and executing initiatives to reach their goals, all of which have impacted the youth's confidence and accomplishments. This, together with other cultural reasons, have resulted in the lack of motivation and goals and poor planning and systematic execution among the youth.

[Link to ADB Agriculture and Natural Resources Subsectors](#)

- Agriculture policy, institutional, and capacity development
- Agriculture production
- Agriculture research and application

[Link to ADB Sectors and Themes](#)

- Agriculture and natural resources
- Capacity development
- Climate change
- Education
- Energy
- Private sector development
- Regional cooperation and integration
- Information and communications technology
- Health

[Link to Sustainable Development Goals](#)

- Goal 4: Quality Education
- Goal 5: Gender Equality
- Goal 7: Affordable and Clean Energy
- Goal 8: Decent Work and Economic Growth
- Goal 9: Industry, Innovation and Infrastructure
- Goal 10: Reduced Inequalities
- Goal 12: Responsible Consumption and Production
- Goal 13: Climate Action
- Goal 17: Partnerships for the Goals

To address these challenges, the STEAM platform was created in June 2018 at KMUTT in Bangkok, Thailand with the goal of building youth leadership by promoting excellence in research, innovation, education, and entrepreneurship (RIEE) with a focus on young researchers, including undergraduate and graduate students.

STEAM Platform's Three Pillars

The STEAM Platform consists of three pillars: knowledge convergence, skills and mindsets, and entrepreneurship (Figure 1). It focuses on four sectors: food and agriculture, energy, materials, and healthcare. It empowers youth in Asia to become global leaders equipped with a convergence of STEM knowledge, life cycle thinking and strategic communication skills and entrepreneurship practices toward SDGs and the smart circular economy transformation. This creates a positive cycle of motivation, goal-setting, planning, execution, performance, accomplishment, and confidence.

The STEAM Platform adopts a unique approach in transforming students and young researchers and faculty in KMUTT who have represented Thailand's global leadership in sustainable development through smart circular economy at various global forums. The approach involves (i) globalization coupled with localization; (ii) digital coupled with physical; (iii) peer-to-peer coupled with senior-to-youth entrepreneurship driven by convergences of STEAM knowledge and business model designed according to sustainable development principles, the circular economy model, and the SDGs; and (iv) skills and mindset developed experientially through STEAM Platform internships.



Science, Technology, Engineering, Arts and Mathematics (STEAM) Platform Framework.

What the STEAM Platform Provides

The platform provides internship, workshop training, and one-on-one mentorship for youths by forming teams of STEM students and researchers with diverse technical backgrounds and design or communication expertise who are guided by technical experts and entrepreneurs. The STEAM interns are provided opportunities to showcase their activities in RIEE at global forums, exhibition, workshops, and seminars where we are able to communicate their ideas and output to their peers overseas as well as to experts from all over the world (Figure 2).



Figure 2. Participation in events sponsored by the ADB.

The output of the STEAM Platform includes confident and excellent communicators of STEM knowledge and motivated and passionate techno-preneurs who transform the perception of Asia as global leaders in the 4th Industrial Revolution and Circular Economy Transformation. The STEAM Platform builds partnership with stakeholders and global players in transforming the world for sustainable development. STEAM integrates AI, biotech, nanotech, ICT, and communication with a sustainable business model (ethics in responsible development) in solving problems and empowering young entrepreneurs to become drivers of the green economic transformation.

The STEAM Platform's progress is updated at its website, www.steamplatform.org, and social media accounts: STEAM Platform (Facebook) and STEAM KMUTT (YouTube).

The STEAM Platform focuses on the goal of promoting excellence by conducting the following:

- (i) short-term, goal-oriented, and contemporarily relevant technology innovation contests and showcases at global forums (Austria; Hong Kong, China; Singapore; the Republic of Korea, and the Philippines within a year) focusing on enabling technologies for Industry 4.0 and the circular economy. Specific fields are as follows:
 - for Industry 4.0, advanced robotics, digital factory, big data analytics, IoT, and machine learning; and
 - for the circular economy concept, energy (solar PV, bio-energy, and system solutions), food and agriculture, and materials;
- (ii) strategic communication training for young researchers to enhance visibility and impact, build confidence, acquire presentation skills, and develop global perspective;
- (iii) skills and mindset training on life cycle and critical thinking, media communication skills, and entrepreneurship and global mindset;
- (iv) build strategic partners with global organizations (including the Asian Development Bank [ADB], World Bank, and the United Nations) to create impact and further enhance motivation and goal of the youth;
- (v) piloting a general education module GEN352 to scale the STEAM platform program to undergraduate students within KMUTT; and
- (vi) internship to foster learning by doing.

Moving Forward

Within a year, the STEAM Platform has benefitted more than 10,000 people worldwide digitally, and over 3,000 physically through events and training workshops (Figure 3). It provided personalized training for over 300 students and researchers and connected with more than 100 companies globally and showcased over 50 innovations from KMUTT at global forums.

The STEAM Platform has positioned KMUTT as a regional and global leader in the areas of Industry 4.0 and circular economy in research, innovation, education, and entrepreneurship. KMUTT youths have been transformed to become confident, motivated, more innovative, and entrepreneurial with a global mindset.

The STEAM Platform has established the following industry and global partnerships:

- ADB Education Sector Group: Sustainable & Smart Agriculture and Food Processing;
- GIZ: Sustainable Energy and Smart Mobility;
- UNDP Youth Co-lab and UNEP: Industry 4.0 and circular economy and youth entrepreneurship and leadership; and
- Leave a Nest: youth entrepreneurship, food and agriculture, robotics and drone technology, and bio or green materials.

STEAM seeks partnerships to scale up the platform to empower more youth in developing countries and enable them to transform the global economic and social dynamics for a sustainable future.

STEAM PLATFORM

established May 2018

Global Outreach

60,000 people

engaged digitally through the website,
Facebook, YouTube, and newsletter

6,000 people

engaged through face-to-face seminars,
workshops, and training

500 people

number of young researchers, students,
and faculty members engaged

Figure 3. Building the capacity of youth and educators.

CONTACT



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Lerwen Liu specializes in business development with technical expertise in emerging technologies including nanotech, quantum technologies, solar photovoltaics (PV), AI and others. She is an advocate of sustainability through innovation and entrepreneurship education (with biz model design guided by the SDG). She also specializes in policy, technical, and market/impact assessment in emerging technologies. Together with Seeram Ramakrishna, she is a co-editor of "An Introduction to Circular Economy," the first textbook of its kind to be published by Springer Nature in October 2020.

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Panitsara Nakseemok has acquired knowledge in advanced materials and manufacturing as well as smart sensors. She is also talented in design and trained in entrepreneurship program at KMUTT. During her undergraduate studies, she successfully developed innovative materials based on graphene-TiO₂ composite for treating water pollution, the first research project to do so. Her work was published in international journals and her technology was also tested in the wastewater treatment system at her home town public health center.

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Piengpen spearheads strategies and programs to provide effective means to support startups and industry development through technology and innovation. She is designing and developing a venture building platform that will provide an enabling ecosystem for start-ups and businesses. Her wide range of expertise includes science, technology and innovation policy; technology transfer; legal framework; extensive network of partners; and a deep knowledge of innovation ecosystem. Piengpen obtained her doctorate in Juridical Science from the University of Wisconsin-Madison.

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Crop Procurement Planning under Disruptions and Fulfillment Uncertainty

Applying science and engineering practices in agriculture production

Overview

Thailand has been successful in advancing its social and economic development. As its gross domestic product rose, incidences of poverty fell. However, some marginalized groups, which include hill-tribe people, border villagers, and farmers with small landholdings in rural areas, have been left behind and do not have the capacity to catch up with Thailand's economic prosperity.

Agriculture is the main economic activity for most people in Thailand's rural areas. Farmers cultivate crops in traditional ways, which mostly depend on uncontrollable factors and environments. Appropriate technologies can help farmers manage and control their crops' growth conditions.

King Mongkut's University of Technology Thonburi (KMUTT) is a leading science and technology university inspiring to promote technology for rural development. The university Social Lab is a key mechanism to match community demands and technology opportunities. The mechanism focuses on three main strategies to improve the beneficiaries' quality of life. These include food security, income generation, and human resource development. The concept of 3E4A (Engineering, Energy and Environment for Agriculture) is implemented. To adapt these technology transfer efficiently, however, capacity building for rural people is key to enable villagers to acquire, adopt, and adapt knowledge and technologies for poverty alleviation.

Summary

Even though Thailand has been able to achieve economic development and decreased poverty, marginalized people still live in poor conditions and below the poverty line. Most of them lack opportunities to access basic services and infrastructure necessary for everyday life. These include access to quality food and nutrition, transportation, electricity, good schools and hospitals, and market access.

Agriculture is their main economic activity and they rely on traditional farming methods that are dependent on uncontrollable factors and environment. Many highland farmers still do swidden farming with three or four plots of land. They move and grow crops along these

[Link to ADB Agriculture and Natural Resources Subsectors](#)

- Agricultural production
- Agriculture research and application
- Rural water policy, institutional and capacity development

[Link to ADB Sectors and Themes](#)

- Agriculture and natural resources
- Capacity development

[Link to Sustainable Development Goals](#)

- Goal 3: Good Health and Well-being
- Goal 10: Reduced Inequalities
- Goal 17: Partnerships for the Goals

fields every year. Farmers lack knowledge in selecting and collecting quality seeds, managing suitable fertilizer, and improving soil quality. Farm equipment tools and technologies are also widely unavailable. In recent years, due to the promotion of corn farming, farmers began expanding cultivation areas, causing forest and environmental destruction.

To improve the quality of life of these marginalized groups, KMUTT focuses on the following strategic goals:

- **Food security.** Ensure that people have capability to produce enough food for their local consumption.
- **Income generation.** Farmers should learn new technologies and skills to seek new jobs and products, so they can generate more income.
- **Human resource development.** Make sure that community members and youths are able to get good education and learning.

KMUTT implements “Social Lab” as a platform that academic people can apply their knowledge and develop technology to meet community demands. By doing so, academic staff and students are encouraged to do field work researches and create solutions for real world problems. The mechanism also encourages varied parties and strategic stakeholders to work hand-in-hand with the community. This mechanism benefits both academic people and rural communities. The academia will understand real world problems, and villagers find solutions to improve their quality of life.

To develop technology for rural development, KMUTT implements 3E4A concept (Engineering, Energy and Environment for Agriculture). The following are examples of projects that have been implemented and create technology transfers to solve community problems:

- Collection of quality rice seeds to increase productivity of field rice production for high-land areas. Village farmers increase rice production yield from an average of 329 kilograms (kg) per hectare (ha) to 633 kg/ha.
- Pre-cooling system to prevent damage of vegetable storage and reduce logistic costs for the Royal Project Foundation. Minimized losses from product damages caused by fluctuating temperature during transport.
- LED lighting for chrysanthemum flower growing. This reduces the time and cost of chrysanthemum flower growing process.
- Design and development of low-cost greenhouses for small farmers.
- Food processing, e. g., pumpkin oil from unqualified pumpkin products. This creates value addition for unqualified products.
- Sciences in Rural Schools (SIRs). This project helps strengthen rural students’ learning capability using a problem-based-learning approach.
- Computer and ICT literacy for remote schools (in Mae Hong Son and Nan province). Students improve ICT literacy and enhance learning opportunity.
- Renewable energy for remote areas (PV for lighting and water pumping, and water turbine for electricity generation).

Capacity building for rural people is undertaken to make sure that community members can utilize these technology transfer efficiently, capacity building for rural people. KMUTT emphasizes on strengthening villagers’ capabilities to acquire, adopt, and adapt knowledge and technologies. Working hand-in-hand and respecting all parties will enhance people’s standard of living and happiness.

Keywords: technology transfer, social lab, policy innovation, rural development, engineering, energy and environment for agriculture

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Surain Thapanangkun has over 20 years of experience in rural development focusing on capacity building and biodiversity-based economy development for sustainability. He also specializes in policy research in energy, education, and politics. He has been a social economic specialist and researcher at KMUTT after he obtained his master's degree in Applied Economics in Griffith University (Australia) in 1998.

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KMUTT’s Food Circular Economy—Innovation and Entrepreneurship for the Sustainable Development Goals

The King Mongkut’s University of Technology Thonburi (KMUTT) has a multidisciplinary team of experts that can provide technical support and training for efficient, safe, and sustainable food production and distribution.

Overview

KMUTT has a long history of working with agricultural and food industries in Thailand. The university started in the 1980s by being responsible for the technical management of the Royal Project food processing plants located in rural areas; the plants were established by His Majesty the late King Rama IV to assist poor rural people by promoting cultivation and processing of agricultural produce.

Having had more than 30-year experience in providing technical assistance and management to the Royal Project food plants, KMUTT staff are well-equipped with technical knowledge and skills required to ensure sustainable, safe, and efficient food production. In addition, we have been investing in various pilot plant facilities that cover the full circle of food supply chain from production to consumer as well as waste management. KMUTT has been working closely with its partners to bring about technologies and innovations that can solve real-world problems and create collective impacts.

Summary

Sustainable Bioeconomy is one of KMUTT’s strategic research themes that apply science, engineering, and technology in value adding natural resources for economic and social advancement. KMUTT has expertise in various fields to advance precision farming and sustainable agriculture; post-harvest technology and food processing; innovative “foods for the future” (functional foods and nutraceuticals); biofuel production, biomaterials, biochemical production; animal feed and animal vaccines, biopharmaceutical development and production, and conservation and sustainable utilization of biodiversity.

In the field of Food Circular Economy, KMUTT has various technologies to leverage the capability of food and agriculture sectors along a value chain that comprises of farming, harvesting, processing, food safety, food security, quality management, consumption, and

Link to ADB Agriculture and Natural Resources Subsectors

- Agricultural production
- Agriculture research and application
- Agro-industry, marketing and trade

Link to ADB Sectors and Themes

- Agriculture and natural resources
- Capacity development
- Urban development

Link to Sustainable Development Goals

- Goal 2: Zero Hunger
- Goal 3: Good Health and Well-being
- Goal 6: Clean Water and Sanitation
- Goal 9: Industry, Innovation and Infrastructure
- Goal 12: Responsible Consumption and Production
- Goal 17: Partnerships for the Goals

Resources

- [Food Engineering](#) | [About Us](#)
- [Systems Biology and Bioinformatics](#)
- [Geospatial Engineering and Innovation Center](#)
- [Pilot Plant Development and Training Institute](#)

waste management and/or waste utilization. Figure 1 shows the parts of KMUTT's Food Circular Economy, which are agriculture; food processing; food safety, security, and quality management; consumption; and waste.

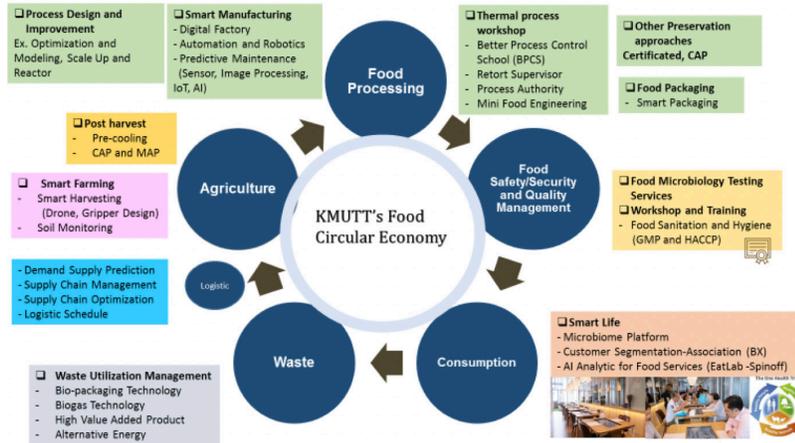


Figure 1: KMUTT's Food Circular Economy.

The following are some examples of KMUTT competencies:

(i) Automation technology and post-harvest technology

- Drone for pest detection. Drones with infrared cameras and image processing technology, are used to detect and search for coconut trees that are being attacked by coconut beetles.
- Crop health monitoring system. Satellite data and satellite imagery are used to develop a plant field monitoring system for evaluating crop conditions.
- Post-harvest technology. KMUTT has post-harvesting experts ranging from molecular level, biochemistry, and physiology including quality and storage system.

(ii) Food Processing Pilot Plant and Engineering Unit

The pilot plant has the following facilities (among others) for food processing, and expertise in optimization condition and scale-up processing: freeze dryer (cold processing), vacuum cooling (cold processing), rotating tray dryer (hot processing), vibro-fluidized bed dryer (hot processing), pneumatic dryer (hot processing), spray dryer (hot processing), and retort machine (hot processing)(Figure 2).



Figure 2. State-of-the-art facilities.

(iii) Food safety, security, and quality management

KMUTT provides various trainings and workshops for food industries to equip them with technical knowledge and know-how needed to ensure the safety and quality of food products. The courses have been designed in compliance with Thailand and United States' food safety regulations.

KMUTT experts also play an important role in providing affordable solutions to enable SMEs to improve their productivity through the use of cloud-based monitoring and control platforms. KMUTT also provides consultation for food industries during transformation to digital culture.

(iv) Consumption and market analysis

EATLAB is a KMUTT deep tech spin-out that provides AI analytic service to improve food service quality. AI and smart sensor technology is being used to predict customer buying decisions.

(v) Waste management

KMUTT's Excellent Center of Waste Utilization and Management (ECoWaste) emphasizes the use of anaerobic technology such as wastewater from cassava starch, rice starch, palm oil mill, food, and canned fruit industries for the treatment of agro-industrial wastewaters. Biogas technology is one of ECoWaste's expertise to utilize food industry waste as a renewable energy source. ECoWaste also provides a consulting service on the design and implementation of full-scale anaerobic systems for agro-industries.

KMUTT services include consultancy, facilities for physical and chemical analysis, process design and development, scale up and pilot plant, demonstration site for food automation, work-integrated learning for exchange students, and talent mobility.

KMUTT also conducts trainings and workshops in better processing, retort supervision, retort authority, mini-food engineering, energy conservation, Good Manufacturing Practices and Hazard Analysis Critical Control Points (Figure 3).

Keywords: food circular economy, food security, food safety, food processing, pilot plant, innovation, entrepreneurship

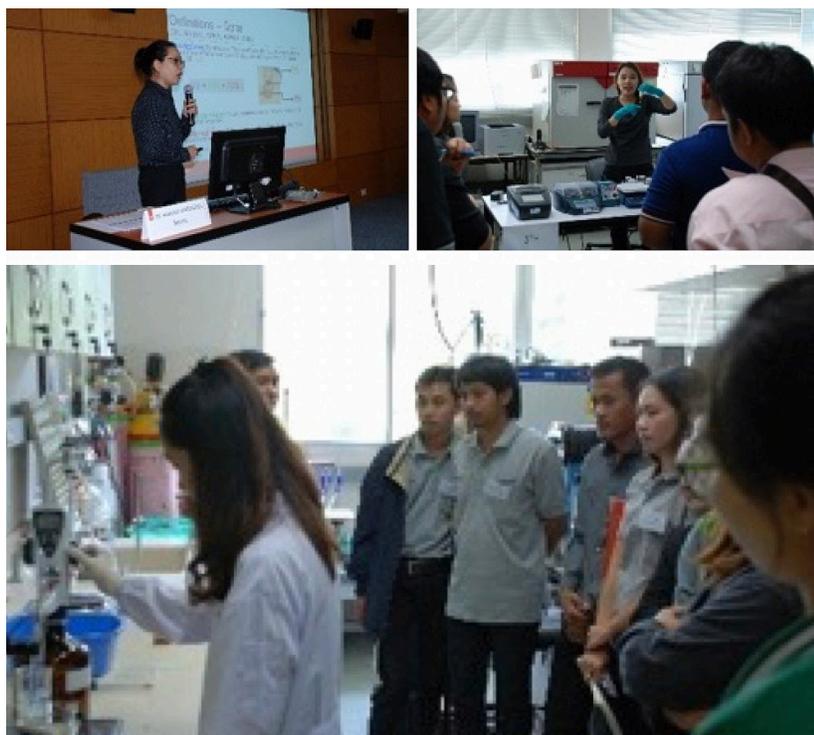


Figure 3. Trainings and Workshops.

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