Opening Remarks and Keynote Address on 'Thailand 4.0: From Local to Global'
by
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for 'TISTR's From Local to Global International Forum: Food Industry 4.0'
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Dear Colleagues from the Ministry of Science and Technology,

Distinguished Participants,

Ladies and Gentlemen,

Good Morning.

First and foremost, I would like to express my heartfelt congratulations to Thailand Institute of Scientific and Technological Research, or TISTR, for their 54 years of dedication and strong passion toward science, technology and innovation development in Thailand. I could say that TISTR is one of the most important parts for the national development, particularly, from their involvement to bring in benefits from science, technology and innovation or STI for SMEs, Startups, OTOPs, and local communities nationwide. Obviously, TISTR is one of our key organizations playing a major role in major economic sectors of the country, in order to efficiently drive the national economy to achieve its

goal. Also, these supporting schemes will also help move Thailand toward the sustainable development society.

With the national strategy of 'Thailand 4.0' that will encourage the transition of Thailand to a new era of growth through value - added goods and services by capitalizing on its enhanced and sustainable competitive advantages, TISTR has enhancing their research competencies by offering a complete range of research studies and services, especially on food production and certification to meet the need of local, regional, and global markets through the 'Food Innopolis' project. By using their expertise from over 30 years of experience to support and enhance the competitiveness of Thai food industry, a wide range of research, development and services was covered, ranging from raw material to product commercialization. I am delighted to learn that TISTR's forum this year has many notable speakers in food industry from Thailand and many countries in their global network.

Currently, the Government is focusing on the area-based development policy in its economic reform to move the country toward Thailand 4.0. This initiative will help prepare Thais for the 21st century and strengthen the local economy through clusters and mechanisms in all provinces toward globalization. Again, TISTR can support this initiative so well. I have appreciated to learn of their contribution through related projects and programs with local and international partners in related sectors. They do include many intensive works from up-to-down streams to utilize their knowledge and facilities to serve the demand and decrease the problems of our country. **Obviously, today forum is another important approach to the enhancement of Thailand's competitiveness 'from local to global'.**

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The Industrial Revolution, which has taken place from the first Industrial Revolution: Industry 1.0 in 18th centuries, which focused on mechanisation, to the fourth Industrial Revolution: Industry 4.0 starting from 2011, which has proposed automation connected by the internet of things, has marked a significant change to power resources, special-purpose machinery, factories, mass production, systems of transportation, communication and banking. The Revolution of Industry has not only brought about a greater volume and variety of manufactured goods, but has also raised the standard of living for people around the world.

"Industry 4.0" was first introduced in 2011 at the Hannover Messe trade fair of an Industry 4.0 working group established by the German Federal Government. According to Germany Trade and Invest, "Industry 4.0" represents "the technological evolution from embedded systems to cyber physical systems" that encourages manufacturing leaders to combine information technology and operation technology to create value in new ways, which will transform industry, production value chains and business models. Key elements of Industry 4.0 comprise of Cyber Physical System (CPS), Internet of Things, Additive Manufacturing, Automated Machines, System Integration and Mass Customization.

From the past up to the present, Thailand has passed through 3 influential economic development models which have transformed Thailand into middle-income nation, starting form "Thailand 1.0" which emphasized agricultural sector, "Thailand 2.0" where developed light industries that moved Thailand

towards middle-income country, through to, “Thailand 3.0” which is focusing on more complex industries, exports and attracting foreign investments. At present, Thailand is facing significant challenges, including middle-income trap, inequality trap and imbalanced development between society and environment, which are blocking the country from continuous economic growth. Therefore, Royal Thai Government is taking major steps to reform the nation's entire system with the establishment of “Thailand 4.0 Policy”.

“Thailand 4.0 Policy” is a new economic model proposed to overcome such difficulties and push the country towards a high-income country driven by value-based economy with competitive advantage in order to bring prosperity, stability and sustainability to the country and Thai citizens.

The aims of the policy are to create a value-based economy through innovation, technology and creativity, to create an inclusive society that moves ahead without leaving anyone behind through realization of the full potential of all members of society, to transform Thais into “Competent human beings in the 21th Century” and “Thais 4.0” in the first world and to become a livable society that possesses an economic system capable of adjusting to environment and society change. “Thailand 4.0 Policy” has 3 key elements, which are anticipated to encompass the reforms of Thailand’s industries in every sector and successfully tackle the systematic challenges, resulting in significant change across the country, are becoming a high-income nation: building economic prosperity through innovation, knowledge, technology and creativity “competitive growth engine” to pull the country out from middle-income trap, moving towards an inclusive society: building social security through an equity with the principle of “moving forward together without leaving anyone behind” to unlock the country from disparities and focusing on a sustainable growth and development: creating sustainability through environmentally friendly development to unlock the country from imbalance trap. Besides, “Thailand 4.0

Policy" has followed the directions of the 20-Years National Strategic Plan by building strength from within and connecting the country to the global community under the principle of "Sufficiency Philosophy", in accordance with the United Nations' Sustainable Development Goals.

In order to efficiently transform Thailand's comparative advantage into competitive advantage and to move the country towards value-based and innovation-driven economy, Royal Thai Government has established 10 targeted industries as a long term goal of development, which can be divided into two segments: 1) The First S-Curve which is building upon 5 existing industries that already have solid foundation but still require further improvement by adding value through advanced technology and innovation, as well as keep up with competition in global trade: Next Generation Automotive; Smart Electronics; Affluent, Medical and Wellness Tourism; Agricultural and Biotechnology and Food for the Future and 2) The New S-Curve which is developing the 5 new industries to accelerate future competitiveness at international level: Robotics; Aviation and Logistics; Biofuels and Biochemical; Digital and Medical Hub.

"Super Clusters" and "Clusters for Innovation and Startups", which are business groups of advanced technology and future industries, are prioritized by the government as they can potentially move the country ahead with creativity and innovation. "Innovation and Startups Clusters" include Food, Agriculture and Bio-Tech, Health, Wellness and Biomedical, Smart Devices and Robotics – Mechatronics, Digital, Internet of Things (IoT), Artificial Intelligence and Embedded Technology, Creativity, Culture and High-Value Services, when "Super Clusters" comprise of Automotive and Parts, Electrical Appliances, Electronics and Telecommunication Equipment, Eco-friendly Petrochemicals and Chemicals, Digital-based Cluster, Food Innopolis and Medical Hub.

Practical strategies for successfully shifting Thailand 3.0 to Thailand 4.0 focus on development of human resources, technologies, connectivity-based, resource-based and intellectual infrastructure. The strategies support transformation of traditional farming into smart farming, conversion of small-medium enterprises (SMEs) into innovation enterprises, training low-skilled workers to become knowledge workers, adding value to traditional services and developing appropriate technology instead of buying technology.

Food Industry is one of the global fastest growing industrial sectors. The value of world food exports averaged $1,486 billion, according to The World Trade Organization 2014 Data. World's population was 7.3 billion, including 900.9 million of the elderly, as per United Nations 2015 Statistics. Due to climate and environment change, demographic, consumer behavior and economic aspect, global food trends shift towards food products which are healthy, fresh, convenient for consumption, tasty, along with information and traceability.

As Thailand is rich in food culture and natural resources, food and agriculture industries are the country's major economic sectors and inclusive targeted industries of the Cluster Development Plan implemented by the government. Moreover, Thailand ranks one of the top global major food producers and earns billions in revenues from food exports annually. In 2016, Thai Ready-to-eat foods and food ingredients from 34 major manufacturers of Thai's Food Processor Association averaged $1.38 billion with top exports including soya sauce, tomato ketchup and sauce, as well as chilly sauce, according to Ministry of Commerce Data. Moreover, because foreigners become more familiar with Thai dishes and Thai food ingredients, demands for Thai Ready-to-eat foods are growing overseas. In addition, since there were 1.7 billion of Muslims around the world in 2016, as per Board of Investment Data and the

needs for halal foods has been rising, halal food exports have been challenging for Thai Food Manufacturers. As per Global Trade Atlas Data, in the first half of 2016 global halal food exports were valued $486.5 billion. Thailand ranked 13th among global halal food producers, with the market share of 2.7%. Top halal food exports were rice, corn, cassava flour and sugar, respectively. Due to world population ageing and health awareness among consumers, global opportunities for Thailand's food industry include foods for the elderly, personalized foods and health foods: functional foods, functional dietary supplements as well as health ingredients.

To pursue global opportunities by introducing Thai products to international market, Thai private sectors whose business related to "10 targeted industries (new engine of growth)" and "Clusters for innovation and startups" under "Thailand 4.0 Policy" are suggested to consider the following approaches: create unique products that serve mass customization and meet international standards and regulations; apply science, technology and innovation to development of product and process; utilize digital technology for marketing; improve communication skills in foreign languages; incubate entrepreneurship which is well prepared for industrial scale-up when it comes to mass production and seek international collaboration through networking. As a partnership between public and private sectors is crucial to seal collaboration gap, "Pracharat" or "Public-Private-People Partnership" mechanism has been recently created by the government to enhance integration of research, academic and public-private assets across Thailand.

According to National Research Management System Ongoing and Monitoring Data, in 2016 there were 3,677 researchers working in food,

agriculture and biotechnology research area. Out of 3,677 researchers, 466 researchers worked in 1,132 food-related research projects, with 268.58 million baht from government support.

The government allocated 1,610.97 million baht for research funding towards food, agriculture and biotechnology industry in 2016. When research type of the funding was focused, it was found that applied research received the most government funding, which was 1,179.51 million baht, nearly 73% of the total government funds for food, agriculture and biotechnology industry. The fundamental research and experimental research obtained 224.94 million baht and 206.52 million baht, respectively. Regarding research utilization aspect of the funding, it was presented that 1,209.07 million baht, roughly 75% of the total funds, was granted for research utilized for economic and commercial aspects. The government addressed 298.18 million baht for research used for academic purposes, 85.06 million baht for research relevant to society and community, as well as 18.66 million baht for policy-related research.

The research funding 1,610.97 million baht can also be divided into two categories, which are funding for academic institutions and funding for non-academic sectors. It was shown that universities received 672.64 million baht, approximately 43% of the total funds, when the rest were granted to other sectors.

In order to contribute to business development of private sectors, Ministry of Science and Technology (MOST) provides various types of supports through its government agencies. Technical Supports include human resources, research, development and innovation services, infrastructures for industrial scale-up, advanced analysis and testing, calibration services, certification and accreditation, database and information as well as professional training and

consultancy. To financially support business sectors in conducting research, development and innovation investments and activities, different mechanisms through tax deduction, incentives package and supportive funds are created and offered. Both domestic and international networking for ease of doing business are also available.

Food Innopolis under Ministry of Science and Technology (MOST) aims to become global research, development and innovation hub for food industry. It is located at Thailand Science Park (TSP), the country's first science park fully-equipped with research and development hub for science and technology and managed by National Science and Technology Development Agency (NSTDA). Furthermore, research and academic institutions are accounted for "Central Extensions" for Food Innopolis. Regional Science Parks as "Regional Extensions" are underway, in order to stimulate utilization of science, technology and innovation across the country.

Innovative examples for development of food value chain are LCA/carbon/water footprint for food production, advanced delivery systems for health ingredient production, non-thermal processing automation and robotics for food manufacturing, food safety consistent with updated international standards and regulations, as well as big data analysis and internet of things (IoT) for food chain management.

Technical Services, including human resources, professional training and consultancy, are provided through National Science and Technology Development Agency (NSTDA), Food Innopolis, Thailand Institute of Scientific and Technological Research (TISTR), Department of Science Service (DSS), Synchrotron Light Research Institute (Public Organization) (SLRI), National

Institute of Metrology (Thailand) (NIMT) and Thailand Institute of Nuclear Technology (Public Organization) (TINT).

Research, development and Innovation activities are serviced by Food Biotechnology Research Unit and Food and Feed Innovation Center of NSTDA, Expert Centre of Innovative Health Food and Thai Packaging Centre of TISTR, Talent Mobility Program of Food Innopolis, Research in Biological and Medical Science of SLRI and Nuclear Research and Development of Agricultural Procedures of TINT.

For Industrial Scale-up facilities, Pilot Plant for Microbial Fermentation of NSTDA are available and Pilot Plant for Food and Beverage Production of TISTR will be ready for service soon.

Advanced analysis and testing service providers are NSTDA Characterization and Testing Center of NSTDA for advanced chemical analysis and complex-structure visualization by high-technology instruments, TISTR-Industrial Metrology and Testing Service Centre for food safety testing, such as food additives and food allergens testing as well as analysis antibiotics and pesticide residues in food products by advanced mass spectrometers and Thai Packaging Center for materials and package testing and DSS-Biological Program for nutritional value evaluation and biochemistry analysis, as well as DSS-Center for ASEAN Food Contact Materials Testing for properties testing of food contact materials. Synchrotron Beamline Services for Food Applications are available at SLRI and Radiation of Food Products can be obtained through Irradiation Center of TINT.

MOST Agencies which serve customer requirements for quality and safety system certification and accreditation are TISTR-Office of Certification Body and

Laboratory Accreditation Section as well as Center for ASEAN Food Contact Materials Testing of DSS. Calibration services are available at TISTR-Industrial Metrology and Testing Service Centre and National Institute of Metrology (Thailand).

Database of Laboratory and Scientific Equipment Network are available through Science and Technology Infrastructure Databank as well as Thailand Scientific Equipment Center Network online website.

For financial supports, MOST offers 300% tax deduction program to private sectors whose business re, Talent Mobility Program and Competitiveness Funds through Food Innopolis, Science Technology and Innovation Matching Program for SME (STIM for SME) and Science Technology and Innovation Coupon for OTOP (STI for OTOP Upgrade) through TISTR, Industrial Technology Assistance Program (ITAP) and Research Gap Funds through NSTDA and Innovation Coupon through NIA.

In addition, there is networking of academic units and institutions supporting food industry sector, for instance, Kasetsart University, Mahidol Tehnology, King Mongkut's University of Technology, Prince of Songkla University and so on.

Examples of private sectors supporting food industry are CP, Thai Beverage, SCG, Betagro and so on.

Not only Ministry of Science and Technology provides such supports, but other government agencies are also willing to contribute to business achievement of Thai private sectors in order to strengthen Thailand's industries and elevate national competitiveness in global market, in accordance with "Thailand 4.0 Policy" implemented by Royal Thai Government to bring prosperity, stability and sustainability to the country and every Thai citizen.

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And last but certainly not least, TISTR's effort revealed well of strong commitment to utilize and apply R&D in the real business world, **and of course, to push forward Thai food industry 'from local to global'**. I do have no doubt that TISTR's deliberations will go a long way in the national development by utilizing science, technology and innovation to strengthen SMEs and local communities.

With all of these remarks, I declare this 'From Local to Global International Forum on Food Industry 4.0' open and wish you all fruitful deliberations.

Thank you for your kind attention.