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Contribution by Thailand

to the CSTD 2021-2022 priority themes on "Industry 4.0 for inclusive development" and "Science, technology and innovation for sustainable urban development in a post-COVID world"

PRIORITY THEME 1: INDUSTRY 4.0 FOR INCLUSIVE DEVELOPMENT

United Nations Commission on Science and Technology for Development (CSTD)

1. What are the national strategies, policies, laws, programmes and initiatives concerning Industry 4.0 in your country?

- *National Higher Education, Science, Research and Innovation Policy Council (NXPO)*

- Thailand has implemented a number of policies to harness the potential of the fourth industrial revolution known as Thailand 4.0 Policy. At the beginning, Thailand 1.0 (1961) focused on Agriculture and Handicraft. In 1982, Thailand moved to develop the Light Industry (import substitution, consuming natural resources, low-cost labour) and expanded to Heavy Industry (export led, promoting FDI, importing hi-technology) in 1997. "Thailand 4.0" is a concept that is used in 2018. It is a visionary scheme with the aim of transforming the country into a valued-based and innovation-driven economy. Thailand 4.0 is applied and implemented in conjunction with the twelfth national economic and social development plan and the 20-year national strategy, aiming at promoting annual GDP growth rate about 5% to become developed country.

- The 20-year Industry 4.0 Strategy (2017-2036) was written by Ministry of Industry to drive Thailand 4.0 policy under the vision of "Move toward the intelligence industrial and link to global economy". This strategy aims to promote industrial GDP growth rate at least 4.5 percent per year, investment in industrial sector growth at least 10 percent per year, export growth at least 8 percent per year and Total Factor Productivity (TFP) growth at least 2 percent per year. This is the rate of expansion that will allow Thailand to move to a high-income country by 2036 according to the goals of the national strategy.

- *National Science and Technology Development Agency (NSTDA)*

- Ministry of Industry is responsible for the national strategy and plan concerning industrial development. The revised 2017-2021 National Industrial Development Plan sets the vision for Thai industry to be driven by innovation, eco-friendliness and global economy by 2021. The plan outlines strategies in four areas:

1. Enhance capacity and foster growth of Thai industry by promoting the use of science, technology, innovation and digitalisation in product development and production efficiency improvement; developing skills - management, technology and innovation - of entrepreneurs, workers and all players in the value chain; encouraging value addition of domestic raw materials and effectively managing local supply to fulfil the demand of raw materials; improving product standards and inspection process to enhance industrial competitiveness and provide consumer protection; increasing efficiency of logistics and supply chain management; and elevating national target industrial clusters to ASEAN industrial clusters.
2. Strengthen an industrial ecosystem to support the transformation to Industry 4.0 by creating a conducive legal and regulatory framework for businesses; developing economic and industrial intelligence for policy setting and early warning for industrial development; designing urban planning for industrial development; and establishing and strengthening design and inspection centres for industrial products and processes.
3. Promote responsible production by designing compliance and enforcement mechanisms; supporting the development of eco industrial town; establishing integrated industrial waste management systems with the focus on waste utilization; upgrading potential industrial clusters to eco industry; promoting eco-efficiency and the creation of eco-friendly products;

and advocating for environmental impact monitoring and management organisations with public engagement.

4. Improve industry-related service efficiency of government agencies by promoting ethics, good governance and anti-corruption; improving process efficiency and ensuring adequate resources and IT tools; strengthening human resource development; and striving to provide quality services.

- *Digital Economy Promotion Agency (DEPA)*

- The National Strategy (2018-2037) is the core development strategy of Thailand. Under the plan, Thailand 4.0 initiative is implemented as a new economic model based on innovation, creativity, high-quality services, and new technology that are employed for boosting the quality of life. This Thailand 4.0 initiative is a stepping stone in the advancement of the country's development, especially through future industries and services that can be key growth engines designed to push Thailand to become a developed country. The digital industry, including data technology and artificial intelligence, is one of the 10 Thai S-curve Industries to attain the Thailand 4.0 policy.

- Furthermore, in line with the National Strategy, the Ministry of Digital Economy and Society (MDES) has launched the Digital Economy and Society Development Plan as a framework to utilise digital technology as a key mechanism for national economy and society development. Within this context, the Digital Economy Promotion Agency (DEPA), a government agency under MDES, has also launched the Digital Economy Promotion Master Plan, focusing on transforming traditional industry to industry 4.0 through technology development and adoption on both supply and demand sides. In particular, the agency aims to drive development in value-based industries such as high value-added hardware and software, platform economy, and creative digital content, along with helping traditional hardware and software industries to adapt themselves into the industry 4.0 era.

- *The Board of Investment of Thailand (BOI)*

- Thai strategies, policies and laws concerning Industry 4.0 can be found in Thailand's National Strategy (2018 - 2037) under the second strategy: National Strategy on Competitiveness Enhancement. Besides, there are Thailand Industrial 4.0 Development Strategy (2017 -2036), Master Plan under National Strategy: Future Industry and Service and the cabinet resolution, dated 17th November 2015, on the Proposal of 10 targeted S - curve Industries: New Engine of Growth.

- *Bank of Thailand (BOT)*

- The BOT strongly believes that technology will play an instrumental role in helping us achieve 3 key policy objectives, namely (1) productivity, (2) inclusivity and (3) immunity for Thailand to thrive in VUCA world. These objectives have guided our approach towards digitalization of financial services and given rise to several initiatives to develop relevant digital infrastructure, promote innovation and enhance adoption by the public. Some examples of the key initiatives include:

  - Regulatory Sandbox and Own Sandbox Framework: BOT's Regulatory Sandbox allows financial institutions and FinTech companies to test out innovative financial products/ services within a well-defined scope and duration under the BOT's supervision. To be eligible for testing under the BOT's Regulatory Sandbox, the products / services must be those that are regulated under the BOT, use new innovation or different technologies to improve efficiencies, and either (1) could be developed into infrastructure or (2) are required by law/ regulation to participate in BOT's Regulatory Sandbox. In other cases, the companies wishing to enter BOT's Regulatory Sandbox must consult the BOT on a case-by-case basis or, alternatively, test out their projects in a controlled environment of "Own Sandbox", which is a sandbox

run by the companies themselves, but is monitored by the BOT through periodic reports. Since sandbox regime's inception in 2016, many projects have been launched, such as:

- Adoption of biometric technology for customers' cross-bank identity verification through National Digital Identity (NDID) platform to strengthen Know Your Customer (KYC) process; and
- Issuance of electronic letters of guarantee on BCI's Blockchain platform to shorten process from 7 days to less than a day

- Guidelines on the use of technology by financial service providers: The BOT developed and issued various guidelines on the use of technology, such as Blockchain[1] and Biometrics, by financial service providers under the BOT's supervision to ensure efficiency, security, and public confidence in relation to services that utilize these new innovations.
- Central Bank Digital Currency (CBDC):
  - Wholesale CBDC: The BOT completed three phases of "Project Inthanon" in which DLT was tested in enhancing payment efficiency, bond tokenization, streamlining workflows and cross-border interbank settlements via a wholesale CBDC. Wholesale CBDC is now being tested in a multi-jurisdictional context with Hong Kong Monetary Authority, Central Bank of the United Arab Emirates and the People's Bank of China under "m-CBDC bridge" initiative supported by BIS Innovation Hub.
  - Retail CBDC: The BOT has established guidelines for the development and testing of Retail CBDC and expects to proceed with the pilot test in 2022[2].
- DLT Scripless Bonds: The BOT successfully launched an infrastructure platform leveraging Blockchain technology for government saving bond issuance in 2020 and expects to further expand the platform to cover other types of government bonds[3].

2. What are the key industries that are pioneer Industry 4.0 innovation in the country? List the key actors in the national ecosystem of innovation related to Industry 4.0 in your country (firms, universities, financial institutions, regulators)? What are the key networks of the ecosystem in your country (including online networks, innovation hubs, forums, etc.)?

What are the key industries that are pioneer Industry 4.0 innovation in the country?

- *National Higher Education, Science, Research and Innovation Policy Council (NXPO)*

- Ten newly targeted industries were selected with a hope to serve as new and more sustainable growth engines. These ten industries are equally divided into two segments, 5 S-curved and 5 new S-curved industries. The five S-curved industries include new-generation automotive, smart electronics, affluent, medical and wellness tourism, agriculture and biotechnology, and food for the future. The new S-curved industries are nascent high-tech industries slated to become significant long-term growth drivers. The five new S-curved industries include manufacturing robotics, medical hub, aviation and logistics, biofuels and biochemicals and digital industries.

List the key actors in the national ecosystem of innovation related to Industry 4.0 in your country (firms, universities, financial institutions, regulators)?

- *National Higher Education, Science, Research and Innovation Policy Council (NXPO)*

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[1] https://www.bot.or.th/English/PressandSpeeches/Press/2021/Pages/n5264.aspx
[2] More info: https://www.bot.or.th/Thai/digitalcurrency/documents/bot_retailcbdcpaper.pdf
https://www.bot.or.th/English/PressandSpeeches/Press/2021/Pages/n6064.aspx
[3] More info: https://www.bot.or.th/English/PressandSpeeches/Press/2020/Pages/n5963.aspx

- Currently, Thai-government agencies are key actors for driving the industry 4.0, but they work closely with education and private sectors to develop many important actions. The key actions can be divided into 6 activities as follows:

1. Promote R&D investment, social adoption, and commercialization
    - Invest in R&D and technology in competent industries
    - Invest in R&D and technology, resulting a leap in the growth
    - Invest in R&D and technology for society to promote inclusive growth and quality of life
    - Accelerate R&D and technology transfer to farmers, community enterprises and SMEs
    - Develop the Thai technology and market for innovative product
    - Promote a world class IP system and National Quality Infrastructure
2. Develop Technopreneurs
    - Enhance entrepreneurs to play a key role in innovation and technology development, and co-lead direction with government, academia, etc.
    - Promote innovation, especially in design and technology development
    - Promote culture for IPR Protection
    - Facilitate start-ups and SMEs to access capital and funds
    - Provide a proper environment for districts and communities to learn and develop creative thinking
3. Develop proper environment for the promotion of science, technology, research and innovation (STRI)
    - Develop human resource with STEM (Increase HR in STEM education / Enhance researcher capability / Use tax incentive to attract specialists from abroad)
    - Science and technology infrastructure (Improve effective research system / Promote quality infrastructure system / Accelerate government ICT / Support new financial tools / Promote the sharing of R&D facilities / Encourage and accelerate Regulatory Reform)
    - Develop public management systems (Restructure public organisations / Improve government budgeting systems / Launch a Technology Development Roadmap / Encourage knowledge exchange)
4. Attract investments in future industries and services
5. Promote Eastern Economic Corridor (EEC) as growth engine
    - Drive the country's investment in up-lifting innovation and advanced technology for the future generation
6. The Industry Transformation Centre (ITC): Enhancing the productivity and capability of the industrial sector
    - ITC is an integrated service centre that aims to develop products, processes, and people of Thai industries by connecting private manufactures and SMEs with innovation and research and creating opportunities, especially sharing knowledge on product development, business management, and innovation.
    - Currently, the ITC network consists of 23 centres in across the country, with ITC in Kluaynamthai, Bangkok as the headquarters. Among these are 11 regional industrial promotion centres.

- The 20-year industry 4.0 strategy (2017-2036) by Ministry of Industry
- Industrial 4.0 Measurement Guidelines by The Federation of Thai Industries and Partner
- Industry 4.0 Platform by The Federation of Thai Industries and Partner

- *National Science and Technology Development Agency (NSTDA)*

- Automobile industry is expected to pioneer Industry 4.0 as Thailand is the production base of several auto makers.

- *Digital Economy Promotion Agency (DEPA)*

- For driving towards industry 4.0, MDES acts as the key actor providing both hard and soft infrastructures to the country. The ministry aims to enhance the available, accessible, and affordable broadband across the country by rolling out broadband to every village nationwide. The soft infrastructure, such as right regulatory framework, is also promoted through amending existing laws (i.e. Electronic Transactions Act and Computer Crime Act) or putting in place new act to ensure trust and confidence of both general public and business entity (i.e. Personal Data Protection Act: PDPA).

- Also, DEPA has been specifically assigned by law to focus on promoting the development of digital technology and innovation, the building of digital ecosystem through supporting the supply side such as digital providers and digital startups, and the adoption of digital technology or the digital transformation in all sectors (including industries and businesses), to achieve Thailand 4.0 goal in economic aspect. While the National Science and Technology Development Agency (NSTDA) and the National Innovation Agency (NIA) under Ministry of Higher Education, Science, Research and Innovation are the main actors in supporting and promoting the broad-based technology and innovation development of the country.

- Moreover, private sector has been playing a part of complementing the ecosystem in both demand side (i.e., Digital Council of Thailand (DCT)) and supply side (i.e. the Federation of Thai Industries (FTI)).

- *Board of Investment of Thailand (BOI)*

- Key industries for Industry 4.0 innovation in Thailand comprise of 10 S-curve industries, namely:

1. Next-generation automotive
2. Smart electronics
3. Affluent, medical and wellness tourism
4. Agriculture and biotechnology
5. Food for the future
6. Robotics
7. Aviation and logistics
8. Biofuels and biochemicals
9. Digital
10. Medical hub

- There is no specific regulatory body designated to be the key actor for the national ecosystem of Industry 4.0 innovation in Thailand as it is a national issue which requires cooperation from all stakeholders, including public sectors, private sectors, academic institutions, and research centers, in order to drive Thai industry towards Industry 4.0.

- *Bank of Thailand (BOT)*

- For the financial sector, Thailand's financial regulators, including the BOT, take a proactive approach in enabling innovations and encouraging active participation by both incumbents and FinTech startups. This is done by providing more supportive regulatory framework that aims at striking balance between stability, consumer protection and innovation, facilitating development of digital financial infrastructure that are open, inclusive and interoperable (e.g. NDID and BCI

initiatives mentioned earlier, as well as PromptPay and standard QR payment), setting standards for the use of technology in the context of financial services and supporting consumer education.

- Thai financial institutions, as well as non-bank and FinTech players, are active in exploring how technology can be incorporated into their business models for better efficiency and how they can cope with / adapt to the disruptive changes that technology will bring, especially in the areas where disintermediation / decentralization is likely to occur. Many banks / FinTech firms regularly engage with the BOT to discuss new developments and ideas, either directly or through industry associations, such as the Thai Bankers' Association and the Thai FinTech Association.

3. What are the challenges that your government have faced or may face for promoting Industry 4.0 in your country to contribute to national development priorities and accelerate the progress towards the SDGs?

- *National Science and Technology Development Agency (NSTDA)*

- New skill development of Thai workforce.

- *National Higher Education, Science, Research and Innovation Policy Council (NXPO)*

- The revolution into Industry 4.0 is a major alteration to shift from industrial workforce to the use of innovation. According to research from the International Labor Organization (ILO), it is predicted that in the next two decades at least 44% of jobs and employment in Thailand (over 17 million) are at high risk of being replaced by automation. What the government should prepare to deal with is the preparation of workers' skills must be consistent with the development of technology enabling Thai workers to develop their skills and compete with the labor market in foreign countries.

- *Digital Economy Promotion Agency (DEPA)*

- Since before the Covid-19 pandemic, the Thai government has faced with the challenge of pushing industries, especially small and medium-sized businesses to recognize the importance of digital adoption and start the process of digital transformation. With the emergence of Covid-19, however, a number of both industries and businesses are becoming more aware of the necessity of digital adoption for maintaining and operating businesses during the new normal situation.

- *Board of Investment of Thailand (BOI)*

- Preparation of Thai human resources as well as capacity and skills development for Industry 4.0 both in terms of quality and quantity, especially in sciences and technology, digital technology, and foreign languages

- Infrastructure development especially in digital technology for the industry 4.0

- Distribution of socioeconomic growth at regional levels thoroughly

- *Bank of Thailand (BOT)*

- <u>Lack of skilled workforce for technological research and development</u>: More in-depth technological skills are greatly needed to drive Industry 4.0 as current supply of adequately skilled professionals in Thailand is limited. In addition, there are not enough incentives to retain skilled Thai professionals or attract skilled expats to work in Thailand.

- <u>Inadequate upskilling/reskilling</u>: More focus should be placed on helping people whose jobs are affected by disruptive technologies to become more skilled and acquainted with innovation.

- <u>Ability to keep pace with rapid and complex innovation</u>: Policy and legal / regulatory changes often require lengthy processes and collaboration among many agencies, which may have conflicting/ competing priorities. This can be a major challenge in the digital age that requires speed and scale.

- Data sharing: Access to data in sufficient volume and quality is a key success factor for AI/ ML, but currently data silos are still prevalent within and across organizations.

- Technology misuse that affect people's asset, privacy and trust: e.g. crypto scams / money laundering and fake news spread by AI tools.

4. What should governments, the private sector, labour unions and other stakeholders do so that developing countries can benefit from these technologies?

- *National Higher Education, Science, Research and Innovation Policy Council (NXPO)*

  - Enhance productivity, standard and innovation of developing countries

  - Reduce the use of resources and increase the commercial value of the produce

  - Increase the export of high-value products

- *National Science and Technology Development Agency (NSTDA)*

  - Manpower development to produce workforce - ranging from universities to vocational school graduates - with skills required by Industry 4.0

- *Board of Investment of Thailand (BOI)*

  - All stakeholders should collaborate closely. Inputs from private sectors and labour unions can very well assist government sectors to launch effective policies and measures. Meanwhile, policy implementation requires active cooperation from private sectors and labour unions.

5. What actions can the international community, including the CSTD, take to help your country take advantage of Industry 4.0 for inclusive and sustainable development?

- *National Higher Education, Science, Research and Innovation Policy Council (NXPO)*

  - Disseminate knowledge of Industry 4.0 for sustainable development

  - Encourage Thailand's MSMEs and enterprises to enter the globe supply chain

  - Educate or support industrial machinery for universities to be international demonstration

- *National Science and Technology Development Agency (NSTDA)*

  - Advocate and support human resource development actions to prepare for Industry 4.0-ready workforce

- *Digital Economy Promotion Agency (DEPA)*

  - Thailand welcomes support from international community and CSTD in upgrading industries, both digital and non-digital industries, to increase number of high technology productions and exports. Support could come in the form of knowledge exchange/ transfer, RDI projects, and business matching and joint ventures. Thailand is willing to partner with technology companies in the areas of cloud, data science, AI, robotics, blockchain, quantum computing and other emerging technologies.

- *Bank of Thailand (BOT)*

  - Facilitate exchange of knowledge, experience, success stories, researches and best practices with leading innovators, policymakers and regulators in other countries.

6. Could you suggest some contact persons of the nodal agency responsible for projects/ policies and international collaboration in this context as well as any experts (from academia, private sector, civil society or government) dealing with projects in this area? We might

contact them directly for further inputs or invite some of them as speakers for the CSTD inter-sessional panel and annual session.

- *National Higher Education, Science, Research and Innovation Policy Council (NXPO)*

  - Natthakit Buato, Policy Analyst, NXPO, natthakit@nxpo.or.th

7. Do you have any documentation, references, technological assessments, future studies or reports on the priority theme in your country or region?

- *National Higher Education, Science, Research and Innovation Policy Council (NXPO)*

  - The 20-year National Strategy

  - Thailand 4.0 Policy

  - Industry 4.0 Strategy (2017-2036)

  - Thailand 4.0: The Fourth Industrial Revolution Strategy from the National Perspective, National Economic and Social Development Council (NESDC)

- *National Science and Technology Development Agency (NSTDA)*

  - http://www.oic.go.th/FILEWEB/CABINFOCENTER19/DRAWER039/GENERAL/DATA0000/00000052.PDF

  - https://www.ftpi.or.th/download/member-file/productivity_world/pw119/P-world-issue119-Nov-Dec-15-Future.pdf

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PRIORITY THEME 2: SCIENCE, TECHNOLOGY AND INNOVATION (STI) FOR SUSTAINABLE URBAN DEVELOPMENT IN A POST-COVID WORLD

United Nations Commission on Science and Technology for Development (CSTD)

1. What are the concrete challenges that your country has encountered in transition towards sustainable urban development to make cities productive, inclusive, and liveable?

- *National Science and Technology Development Agency (NSTDA)*

- The challenges for sustainable urban development in Thailand lie in the inability to enforce urban planning laws and regulations and the lack of understanding and awareness of people in the society concerning responsible production and consumption, which all lead to explosive growth of urbanization, environmental degradation, declining quality of life and vulnerabilities to climate change impact such as major flood.

- *Digital Economy Promotion Agency (DEPA)*

- What has become clear during the pandemic as a concrete challenge is an overreliance on a single or only a handful of industries. For example, the economic value lost because of the disrupted tourism industry is incalculable. The most important lesson to be learned here, then, is the need for a coordinated effort to consistently innovate to avoid this type of loss getting repeated. New products and services should be innovated using the new value proposition brought about by the power of digital technology. While being calamitous on a global scale, the pandemic has also pushed us to innovate and tackle the issues that we did not think were manageable, such as rapid digital transformation. Undeniably, companies and organizations have been pushed to digitally transform to safeguard themselves from the rapid decline and possible bankruptcy.

2. How has the Covid-19 pandemic so far impacted on sustainable urban development, and what lessons could we draw from the Covid-19 pandemic on sustainable urban development?

- *National Science and Technology Development Agency (NSTDA)*

- Overcrowded housing/city contributes to the spread of COVID-19 and makes it difficult to implement home isolation. The pandemic also causes a dramatic increase in waste, both medical-related wastes as well as packaging waste due to online shopping. Urban poverty and overcrowded city are among top priorities that policy makers should look into in order to alleviate the pandemic effects.

- *Digital Economy Promotion Agency (DEPA)*

- The main lesson learned from the situation is that cities cannot afford to have the negative experience of this pandemic repeated. As the engine of growth and home to a large dense population, cities are the cornerstone of every economy. Cities, therefore, must no longer prolong the effort to create preventative measures so that they are prepared for unpredictable events, especially those with potentially severe consequences. In other words, every city must prioritize the budget to test its resiliency. Demonstratively, digital technology appears to have the capability to mitigate problems with speed, agility, and affordability, especially when compared to building physical infrastructure. Hence, such prioritization should emphasize digital technology. Moreover, this pandemic has created a new value proposition for the "cashless, contactless, paperless, office-less, and school-less" services. All of these have the potential to change how we work, learn, live and play for good, prompting the post-pandemic urban development agenda to shift from a compact city oriented around a central-business-district (CBD) to a more diverse form of settlement.

3. What projects/policies has your country implemented to use science, technology, and innovation to make cities productive, inclusive and liveable? What are the main outcomes? What are the main challenges confronted while trying to implement these projects/policies?

- *National Higher Education, Science, Research and Innovation Policy Council (NXPO)*

- BCG Economy Model Policy is an economic model towards sustainability that combines bioeconomy with circular economy and green economy. This development model emphasises on inclusive and sustainable development focusing on food and agriculture, health and medicine, bioenergy, biomaterials and biochemicals, and tourism and creative economy. The BCG model will lead Thailand to overcome the middle-income trap and the effect of COVID-19 pandemic to improve social inequality by linking knowledge on science, technology, innovation to biodiversity and cultural diversity to build internal strength of the country and distribute benefits to community equally.

    - Bioeconomy focuses on efficient utilization of natural resources along with natural balance protection, by using technological advancement in various disciplinary to increase efficiency and innovation.
    - Circular Economy is an economic system that all resources can be restored and re-utilized to avoid resource scarcity.
    - Green Economy is an economic development model that concerned balanced development between economy, society and environment.

- Moreover, Targeted Poverty Eradication (TPE)[4] is an innovative strategy which is suitable for overcoming the effect of poverty. TPE is one of the policies which Minister of Higher Education, Science, Research and Innovation keeps pushing forward. Program Management Unit on Area-based development (PMU A) was set up under Ministry of Higher Education, Science, Research and Innovation to link between science technology, innovation and rural area, with the aim of improving the quality of life, employment and economic activities, and resolving social inequality for local people.

- The definition for TPE policy consists of 6 keys: including (1) accurate identified objects, (2) accurate use of fund, (3) accurate dispatching of person in charge, (4) accurate aiding measure, (5) accurate arrangement projects, and (6) accurate Poverty reduction results.

- Due to the effect of COVID-19 pandemic, Minister of Higher Education, Science, Research and Innovation set up the University to Tambon (U2T) project or one sub-district, one university project, funded by the stimulus package for COVID-19 recovery loan. TPE strategy has been applied to conduct U2T projects. U2T project aims to hire 60,000 jobs in 3,000 Tambons by working with a local university as a manager of the project for data collection and problem identification especially poverty root causes in rural area. One university is responsible for one Tambon. A university hires 20 positions for one Tambon including 5 Local people, 10 graduated students, and 5 higher education students. These people are now reskilled and upskilled, for entrepreneurial, digital skill and English skill in order to be well prepared for requirement of the 21st century job market.

- *National Science and Technology Development Agency (NSTDA)*

- In 2017, the National Electronics and Computer Technology Center (NECTEC) introduced Traffy Fondue, a municipality complaint reporting and management system. The system enables citizens to report city problems to and get an update on the case from the city administration via a mobile application. People can send a report of city problems - ranging from waste to potholes, broken footpath and streetlights - accompanied with photos and GPS location. The report will then be

[4] China's policy named Targeted Poverty Alleviation; Targeted poverty alleviation and its practices in rural China: A case study of Fuping county, Hebei Province (2019).

directed by the system to concerned departments to fix the problems. The department in charge provides an update on the case, which can be viewed by the person who files the report. The system comes with a management and monitoring feature that allows government authorities to access statistical data for performance efficiency improvement as well as budget and manpower planning.

- Traffy Fondue can improve city management efficiency and increase citizen engagement. Its main users are local administration offices that provide public services to its citizens.

- In addition, the National Science and Technology Development Agency (NSTDA) has been working in the area of modern transport, focusing on human resource development and capacity building in rail system and future mobility with international partners such as Japan.

- *Digital Economy Promotion Agency (DEPA)*

- Thailand recognizes the importance of productive urbanism that incorporates every member of the society. To extend the equality of opportunity to everyone, DEPA resorts to the national strategic plan known as "Smart City Thailand," emphasising the use of digital technology to create opportunities, distribute growth, and therefore close the gap between the regular beneficiaries of the economic system and those outside of it. To do so, the provision of proper tools, skills, and infrastructure, the so-called "ecosystem," is needed and therefore key to the central policy. Moreover, the promotion of a viable and competitive market is key to the introduction, adoption, and marketability of technology; all of which will play a role in making cities more productive, inclusive, and livable.

4. Can you provide examples of policies/projects/initiatives aimed at strengthening national STI capabilities for sustainable urban development? For example, how does your country build technology and innovative capabilities through investments in R&D and human capital? What institutional and regulatory arrangements are in place to stimulate R&D and innovation, and to effectively address unintended consequences of technological innovation, such as privacy, ethical, gender and other concerns?

Can you provide examples of policies/projects/initiatives aimed at strengthening national STI capabilities for sustainable urban development?

- *Digital Economy Promotion Agency (DEPA)*

- Smart City Thailand is the key policy strengthening national science, technology, and innovation (STI) capabilities, unifying resources, efforts, and innovation to tackle common urban problems such as urban waste management, energy inefficiency, mobility, and environmental degradation. Supported by depa, a governmental agency responsible for promoting nationwide smart city development, many smart city projects across the country are being designed, catapulted and tested in the Proof-of-Concept (PoC) phase. Particularly in the "smart city promotional zones," municipal and provincial governments welcome problem-solving innovations, such as digital transactional platforms, geographical tracking and monitoring, and cloud-based data analytic system. The uniqueness of these smart city projects lies in the incorporation of STI capacities from all sectors, notably startups whose innovative solutions to urban problems have proven to be capable of swiftly and efficiently solving problems on a large scale.

How does your country build technology and innovative capabilities through investments in R&D and human capital?

- *National Higher Education, Science, Research and Innovation Policy Council (NXPO)*

- According to the Strategic Plan of BCG Economy 2021-2026 that involves the use of science, technology, and innovation to enhance national competitiveness in 4 strategic industries, namely, food and agriculture, health and medicine, bioenergy, biomaterials and biochemicals and tourism and

creative economy. The total Gross Domestic Product (GDP) of the strategic industries is THB 3.4, accounting for 21 percent of the total GDP, and 16.50 million people are employed in these sectors (50% of total employment). The driven strategy of BCG Economy for building technology and innovative capabilities consists of 5 approaches as follows:

1. Focusing on applying science, technology, and innovation to ensure a balance between conservation and sustainable consumption of the resources;
2. Focusing on manpower (worker and high skill knowledge workers) production especially in specific fields including engineering, biorefinery, advanced medicine, synthetic biology and transportation;
3. Utilising the potential of the local along with strengthening the potential of the communities. The BCG model capitalizes the country's strengths in biological diversity and cultural richness and employs technology and innovation to transform Thailand to a value-based and innovation-driven economy;
4. Enhancing the competitiveness of the traditional manufacturing and service sectors to be able to sustainably grow by applying science technology and innovation to efficiently improve productivity complying with circular economy concepts, such as recycling, zero-waste, and value-added of waste product;
5. Building resilience in the face of crises by investing in various infrastructures, especially science technology and innovation infrastructure - for example Eastern Economic Corridor of Innovation (EECi) - in order to support products and services development in respond to market demand in an environmentally friendly manner.

- *Board of Investment of Thailand (BOI)*

- Prescribing investment promotion measures to stimulate investment in R&D and human capital as follows:

  - Merit-based Incentives provides additional rights and privileges for investment in competitiveness enhancement for projects that (1) include Investment and expenditures on research, technology development and innovation or (2) donate to Technology and Human Resource Development Fund for educational institutes, specialized training centres, research institutes or government agencies in the field of science and technology. (3) include advanced technology training for developing new knowledge and specific technical capacities of Thai personnel, or Thai companies
  - Investment Promotion Measures in the Eastern Economic Corridor (EEC) provides rights and incentives for projects collaborating with educational institutions such as the Work-integrated Learning (WiL), cooperative education and dual vocational training program, or collaboration in developing Thai personnel in science and technology as approved by the Board of Investment.
  - Corporate Income Tax Exemption for Expenditures on Research, Technology Development, and Innovation

- Prescribing activities for investment in R&D and human capital as follows:

  - R&D Supported Activities such as Research and Development, Electronics Design, Engineering Design, Scientific Laboratories, as well as Targeted Core Technology Development (Biotechnology, Nanotechnology, Advanced Material Technology, and Digital Technology)
  - Human Capital Supported Activities such as Vocational Training Centres, High potential Academies and Institutions for Higher Education

What institutional and regulatory arrangements are in place to stimulate R&D and innovation, and to effectively address unintended consequences of technological innovation, such as privacy, ethical, gender and other concerns?

- *National Science and Technology Development Agency (NSTDA)*

- In 2019, Ministry of Higher Education, Science, Research and Innovation and Ministry of Interior entered into a collaborative agreement to drive smart city initiative with science, technology and innovation (STI). Among the action plan is the implementation of Traffy Fondue in the local administrative offices responsible for city management at district level throughout Thailand. Since then, Traffy Fondue has been expanded to include reporting on forest fire incidents.

- *Board of Investment (BOI)*

- Thailand's Board of Investment (BOI) promotes tax investment incentives for foreign companies to stimulate R&D and innovation especially in key sectors such as biotechnology, nanotechnology, advanced material and digitalization. In 2019, the Thai Government announced a wide range of tax and non-tax incentives from bio-based industries. Tax-based incentives include the exemption of corporate income tax for up to 8 years, with an additional 50% reduction for 5 years and the exemption of import duties on machinery and raw material. Non-tax incentives include renewable smart visas and work permit facilitation allowing international talent and investors in key sectors to work and stay in Thailand for up to 4 years. The BOI also supports companies by helping establish industrial linkage, sourcing of local suppliers and business matching. The strong political support is the Eastern Economic Corridor of innovation (EECi) which planned biorefinery pilot plant in cooperation with Bio Base Europe Pilot Plant has been positively noted and is promising. However, it has been concerned about the regulation of genetically modified organism (GMOs) for bio-based industry due to some contradicting information which could later be clarified and improved.

- *Digital Economy Promotion Agency (DEPA)*

- The three components of digital connectivity are the ecosystem, viable market, and open innovation. These components work synergistically to promote digital connectivity. A delay in establishing any of these components will certainly result in roadblocks piling up. Looking closely, what ties them together is cybersecurity. The issue of personal data protection has become the most important "trust issue" in the innovation ecosystem that needs to be monitored with agility to keep the negative externalities in check. Moreover, hacking, spamming, ransomware etc., are threats to positive digital exchange and transaction. Thus, Thailand's Ministry of Digital Economy and Society has put a remarkable effort in establishing the Office of the Personal Data Protection Commission (PDPC) and in implementing the Personal Data Protection Act (PDPA) which will come into action in 2022. In the process, Thailand is building Thailand Digital Valley in the Province of Chonburi as the hub of digital innovation in the ASEAN region, in which consultations and ethical training will play a leading role in its business incubation ecosystem.

5. Could you share case studies of regional and international cooperation that have helped your country in strengthening STI capacities? Can you provide success stories in this regard?

- *National Higher Education, Science, Research and Innovation Policy Council (NXPO)*

- In 2020, local and international companies applied to invest as much as USD 1.7 billion in Thailand in more than 300 projects in the sectors listed as "BCG", or Bio-Circular-Green Economy Model activities focused on environmental protection and sustainability, according to data collected by the Thailand Board of Investment (BOI). Japanese biotech startup Spiber Inc also had the confidence to choose Thailand's EEC for its first factory outside Japan. The USD 100 million Thailand factory,

would be the world's largest structural protein fermentation facility, producing 700 tonnes a year. It will use sugar sourced in Thailand and will serve as a base for research and development. Thailand not only by the availability of sugar, but also the incentives, reliable infrastructure, good access to, and relationship with Japan and strong supply chains in industries of interest. Spiber Inc has created an international buzz by pioneering and becoming the global market leader in environmentally friendly synthetic spider silk, replicating spider silk DNA using brewed protein created from micro-organisms fed with sugar. The material is stronger than steel, lighter than aluminum and more flexible than carbon fiber and can be used in the fashion industry as a fiber, or in construction, the auto industry and the manufacture of medical devices.

6. Could you suggest the contact person(s) of the nodal agency responsible for projects/policies or international collaboration related to the theme? We might contact them for further inputs.

- *National Higher Education, Science, Research and Innovation Policy Council (NXPO)*

  - Natthakit Buato, Policy Analyst, NXPO, natthakit@nxpo.or.th

- *National Science and Technology Development Agency (NSTDA)*

  - Department of Public Works and Town & Country Planning under Ministry of Interior and the National Science and Technology Development Agency (NSTDA) under Ministry of Higher Education, Science, Research and Innovation.

- *Board of Investment of Thailand (BOI)*

  - Thailand Board of Investment (BOI) - E-mail: head@boi.go.th

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