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Fostering Innovation: A Case Study of Eastern Economic Corridor of Innovation in Thailand

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Abstract:

Thailand is struggling to escape the middle-income trap within 2037 as set forth in the National Strategy (for the Year 2018 - 2037). As the innovation is both an imperative basis and a rapidly driven factor of a country's development, especially in the area of economic development, the "Eastern Economic Corridor of Innovation (EECi)" has been established with the aims for research and development of innovation in Thailand. It is envisaged that the EECi will help upgrade technology and promote the utilization of advanced technology of entrepreneurs to create innovation in order to add value to Thai products and consequently increase export value. This study employs a documentary research methodology to dissect the missions, development plans, and strategies of the EECi of Thailand. In addition, case studies of the special zones for science, technology, and innovation in the developed countries, such as Germany, Taiwan, and South Korea are criticall explored and analyzed to determine whether there are common key success factors for the special zones entailing the innovation fostering.

Keywords:

Economic Development, EEC Thailand; Innovation; Innovation Promotion Policy; Quadruple Helix; Special Zones for Science Technology and Innovation

1. Introduction

Over the past decades, Thailand's economic development takes advantage of existing fundamentals, including labour, natural resources, importing technology from other countries rather than accumulating knowledge to develop its own technology. Consequently, most share of value-added technology falls to the countries that own the technology. Therefore, in order to increase the country's competency and competitiveness, Thailand needs to put more investment in research and development. It is also necessary to adapt and learn to focus on technology and innovation to sustain its economic development and be competitive at the global level.

According to Strategy No. 8 of the Twelfth National Economic and Social Development Plan regarding the development of science, technology, research, and innovation in the next phase, it is essential to adjust the development model to focus on the collaboration between government and private sectors to invest in research and innovation by determining the national research agendas that help improving potential and productivity of agricultural, manufacturing, and services sectors. Moreover, an intensive effort on the expansion of the existing markets through innovative products and services is vitally required. Then, Thailand will not merely be an importer and a user of technology from

abroad but will be able to develop its own technology in the future.

Section 65 of the Constitution of the Kingdom of Thailand has stipulated that the government should determine the National Strategy as a goal for sustainable development of the country adopting good governance. The National Strategy is a framework for devising various coherent plans to be a driving force to achieve the predetermined goal. The National Strategy Act B.E. 2560 (2017 C.E.) has been enacted and it specified that there must be a National Strategy Committee (NSC) mandated to formulate the National Strategy (for the Year 2018 - 2037). The objective of the National Strategy is to enable Thailand to advance its development to achieve its vision that Thailand is stable, prosperous, and sustainable, as a developed country through the exploitation of science, technology, research, and innovation in accordance with the sufficiency economy philosophy of His Majesty King Bhumibol Adulyadej the Great.

Therefore, to transform the country into an innovative society and prepare to advance into a high-income country in the future, it is imperative to utilize scientific knowledge, research and development (R&D), advanced technology, innovation and creativity in all sectors, including government and civil society. The country needs to pay attention to the enhancement of favourable environment and infrastructure, including investment in research and development (R&D), development of researchers, scientific and technological infrastructure and management that can help driving the country's development towards the aforementioned goal.

The development approaches of most developing countries have a similar pattern based on the advantage of the low cost of labour and basic raw material, large domestic demand, and tax incentives. These factors can evidently attract foreign investment and upgrade the country to be a production base for export. Therefore, these countries are highly dependent on foreign countries, both for trade and investment. Having determined the National Strategy, Thailand aims to develop advance and sustain the economic growth in the next decade by focusing on the development of the industry with advanced technology and innovation, which can create more value than the existing ones. Thus, this is the origin for the development of "Eastern Economic Corridor of Innovation (EECi)" that can assist the country to upgrade the current industries and transform into new industries. Furthermore, the EECi is expected to help in upgrading technology and promoting the utilization of advanced technology of entrepreneurs to create innovation in order to add value to Thai products and consequently increase export value (NSTDA, 2017a).

At present, Thailand has been experiencing sluggish economic growth for the past decade. Therefore, the production of products and services of the country should be upgraded to a higher level to improve economic growth. Thailand is placed in Upper Middle-Income economies according to the World Bank classifications. Given the present production process and the technological level, it would take a lengthy period to escape from the Middle-Income Trap to advance to High-Income economies.

This study employs a documentary research methodology based on pertinent academic documents available in Thailand and other countries, e.g. articles from various journals, theses, researches, newspapers, meeting minutes, etc. in both Thai and foreign languages, as well as cabinet resolutions, government policies,

the Constitution of the Kingdom of Thailand, The National Strategy Act B.E. 2560 (2017 C.E.), National Strategy (for the Year 2018 - 2037), especially National Strategy on Competitiveness Enhancement, National Strategy on Public Sector Rebalancing and Development, National Strategy on Developing and Strengthening Human Capital, and National Strategy on Social Cohesion and Equity. The objective of this paper is to provide the recommendations for the formulation of policies and strategies regarding the fostering of innovation as well as the recommendations for driving and implementing such policies.

2. Review of special zone for Science, Technology, and Innovation

The success of several countries in term of industry development is ensued from the establishmentof a special zone for science, technology, and innovation to promote research and development. Moreover, the special zone for science, technology, and innovation can help in multiplying technology and innovation to other entrepreneurs and industries in the country. The examples of the establishment of a special zone for science, technology, and innovation are as follows.

A. Germany - Berlin Adlershof Science City

Berlin Adlershof Science City is the special zone integrating science and business. The area has been designed and planned in the form of science and technology cluster of universities, research institutes, and companies utilizing advanced technology, as well as the advanced infrastructure system. There are 1,189 businesses with total employment of 23,500 people in the area around 4.2 square kilometres. Berlin Adlershof Science City could generate annual revenues approximately 2 billion Euro or around 2.24 billion USD in which are mainly from the science and technology park and commercial businesses and services (Adlershof, 2020).

Berlin Adlershof Science City is an outstanding example of spatial economic policy in the form of the science and technology park so as to develop innovative companies and competitive clusters (Kukle, 2015). The establishment of a new science and technology centre like Berlin Adlershof Science City could help in creating new jobs, especially in the local region. The promotion of small and medium enterprises of Berlin Adlershof Science City through various packages of aid and assistance could help in promoting SMEs in the local area (Moulaert, Rodriguez, & Swyngedouw, 2003).

B. Taiwan - Hsinchu Science Park

Hsinchu Science Park is the first science park in Taiwan. The main objective is to enhance the technological capability of the industrial sector with technology and human resources from other countries using the knowledge transfer mechanism to the industrial sector as the foundation of advanced technology industry in Taiwan. Hsinchu Science Park is an integration of industrial estates with science in the area of 6.5 square kilometres that can be labelled as research estates. There are approximately 513 companies within the area of Hsinchu Science Park that could generate total annual revenue more than 1.09 trillion TWD or 37 billion USD with the employment of more than 152,000 people (Hsinchu Science Park, 2020).

The development of Hsinchu Science Park can be viewed as the development of high technology

benchmark in Taiwan with an outstanding global reputation. It is the first science park model in Taiwan that could help in stimulating research and development and investment for innovation. Therefore, Hsinchu Science Park can be the model for the high technology development plan (Lee & Yang, 2000). Moreover, the various promotion and motivation of Hsinchu Science Park can attract more than 4,000 Taiwanese specialists around the world to return to set up their own businesses in Taiwan (International Business Publication, 2016).

C. South Korea - Daedeok Innopolis

Daedeok Innopolis which is formerly known as Daedeok Science Town is a science city designated as a centre for research and development in the area of 67.4 square kilometres. There are more than 1,763 companies in Daedeok Innopolis that could create employment more than 69,000 people with total annual revenue of 4.46 billion USD. There are 1,974 technology transfer projects and can generate total technology transfer fees of approximately 72.74 billion USD (Innopolis Foundation, 2020).

Daedeok Innopolis can be considered to be an initial example of the development for a planned technology-based area following the success of unplanned technology-based area like Silicon Valley. An additional reason behind this development is the intention of the policymakers who would like to relocate the research and development cluster out of the crowded capital and try to attract entrepreneurs, businesses, and researchers to shuffle accordingly (Hassink & Berg, 2014).

Another example of the special zone in South Korea is Songdo International Business District. Songdo has been used as the experimental city for the prototype community in which all information is linked to the same network by the internet, such as water supply, electricity, telephone, traffic, etc. It is also designed under the concept of sustainable development, energy efficiency in buildings, infrastructure and open spaces design, and residences that are safe and environmentally friendly for all livings (Canonico et al., 2015; Rugkhapan & Murray, 2019)

The key information of special zones for science, technology, and innovation can be summarized as in Table I.

TABLE I: Comparison of Special Zones for Science, Technology, and Innovation

	Adlershof Science City	Hsinchu Science Park	Daedeok Innopolis
Size	4.2 sq.km.	6.5 sq.km.	67.4 sq.km.
Revenue	2.24 billion USD	37 billion USD	4.46 billion USD
Employment	23,500 people	150,000 people	69,000 people
Objective	To be the area integrating science and business that can bring science and innovation to industry and market, as well as attract new companies with innovation and creativity to create new technology or innovation in the area.	To upgrade the technological capability of the industrial sector with technology and personnel from abroad through the knowledge transfer to the industry	To be the center of technological innovation, the global hub of advanced integrated industrial technologies
Target industries	- Photonics and Optics - Renewable Energies and Photovoltaics - Microsystems and Materials, - IT and Media - Biotechnology and Environment.	- Integrated circuits - Optoelectronics - Computers & peripherals - Telecommunications - Precision	- IT convergence - Biomedical - Nano convergence - Precision machinery

3. Development of Eastern Economic Corridor of Innovation

A. Establishment

Eastern Economic Corridor of Innovation (EECi) has been established with the objectives for research and development of smart technology and innovation in Thailand. This smart technology is developed by the utilization of agricultural bases and biodiversity, including biotechnology and geoinformatics for target industries as well as the linkage between the industrial sectors in Thailand and the global market through the use of intelligent technology throughout the supply chain (End-to-End Intelligent Supply Chain).

The establishment of Eastern Economic Corridor of Innovation (EECi) is expected to help in elevating the country's economy, promoting the Eastern Economic Corridor as the centre of trade and investment in intelligent technology, as well as promoting start-up businesses concerning intelligent technology and innovation.This development will be the foundation to support the growth of the Eastern Economic Corridor in the future by linking the research and development of technology and innovation in the country with other countries in order to create an innovative society of the country to support the demand of advanced technology in the form of Triple Helix and extended Quadruple Helix with the public contribution to drive Thailand towards an innovation country.

The mission of the Eastern Economic Corridor of Innovation (EECi) as the centre for research and innovation development in every sector and the assemble of infrastructure to support the commercialization of research or Translational Research Infrastructure as well as the centre for national quality testing and standardization or National Quality Infrastructure. Moreover, it is the centre to transfer technology, either from domestic or foreign sources, to industrial sectors through technology demonstration, licensing, and other appropriate mechanisms and the centre for science, technology, and innovation workforce development to support the industry restructuring in Thailand. It is also the source of the innovation cluster development to support the target industry of the country by connecting innovation producers with users both within and across the supply chain from both domestic and abroad adopting diverse mechanisms. Finally, it promotes start-up businesses to strengthen service providers in technology and innovation to support the growth of the Eastern Economic Corridor in the future (NSTDA, 2017a).

The Ministry of Science and Technology of Thailand has stipulated that the Eastern Economic Corridor of Innovation (EECi) is a hub for carrying out economic activities through research and development (R&D) by researchers, research activities, and innovation of research organizations from private sectors, government agencies, and higher education institutions. There are public and private research laboratories, prototype factories, field test zones, technology demonstration zones, and top testing centres. Moreover, it assembles all supporting activities related to research and development (R&D), innovation, and start-up businesses using technology business incubation. Last but not least, it provides all relevant services and facilities, including the development and management of public utility system and other facilities.

Zhao, Song, and Li (2018) has concluded that the Innovation was the major rapid driven factor for both supply and demand capacity observed by many areas in China. Thus, "Eastern Economic Corridor of Innovation (EECi)" is the special zone that has been intelligently designed and managed through the development and

integration of infrastructure, institutional, scientific, technological, educational, and social resources. Moreover, it has provided value-added services that can lead to sustainable economic development.

B. Development Plan

The development plan of the Eastern Economic Corridor of Innovation (EECi) is divided into 4 phases and each phase spans over 5 years; so that it is consistent with the 20-year strategic plan of the country. Ineach phase, the implementation of the operation plans incorporates the neighbouring communities as one of the key stakeholders and resource providers so that the communities will be stable, prosperous, and sustainable (NSTDA, 2017a).

The first phase is under the theme "Strengthening Existing Industries" focusing on the utilization of science, technology, and innovation (STI) to solve problems and strengthen existing industries, coupled with preparation of infrastructure and human resources for science, technology, and innovation. There will be the technology transfer from both domestic and foreign experts, testing and certification services. In addition, diverse government support mechanisms will be employed to motivate entrepreneurs to adopt science, technology, and innovation in improving production capability. The output from various research should be developed for commercialization (Translational Research Infrastructure). Furthermore, there will be an acceleration in the development of the Centre of Excellence in the target field by collaborating with foreign research institutes or universities as well as the development of manpower at all levels to support the development in the next phase. The zoning master plan for the Eastern Economic Corridor of Innovation needs to be determined to ensure a suitable environment and infrastructure that can support all relevant parties.

The second phase is under the theme "Modern Industries Focusing on Research and Development" concentrating on the improvement of capability for innovation to add more value to products and services. The investment will be expanded as a result of a higher level of testing and certification services by private sectors, coupled with the investment by government and collaboration with industries to determine industrial standards that are suitable for the environment of Thailand and ASEAN. This will help in raising the quality of Thai products in the world market. The infrastructure and environment are developed to facilitate the high-level testing of new products and services, promote system integrators and innovation service providers, and to support the transfer of technology to system integrators and innovation service providers to meet the needs of the industry. There will be a mechanism to connect government scholarship students studying abroad with the industrial sector to add new knowledge and knowhow into the industrial sector in Thailand. Moreover, the development of vocational education institutions will be promoted and supported to supply capable manpower that meets the demand of the industry.

The third phase is under the theme "Advancement of Thai Products and Innovation". The government will focus on the industry clustering to facilitate and accelerate the development process of product and service to meet the pace of global competition. Moreover, there will be additional investments in the infrastructure for product design and industrial design. The private sector will also participate in the development of technological infrastructure through Triple Helix mechanisms (Government, Industry, and Academia).

The fourth phase is under the theme "Prosperous Thai Economy with Strong Innovation". In this phase,

most industries will utilize advanced technology without depending on foreign technology. Thailand will start investing in advanced products in other countries and exporting automatic tools and machines.The research works will be collaboratively produced by government, universities, industry, and society or community (Quadruple Helix). The community will earn benefits from the existence of industry whereas the industry can create value-added to the country with environmental awareness.

C. Key Success Indicators

In accordance with the EECi Development Master Plan (NSTDA, 2017a), the key success factors of the project are innovation ecosystem, leading public and private research institutes, the number of knowledge workers, facilities and infrastructure including transportation system, and the continuity of the government policy.

In term of the indicators for an innovation ecosystem, the economic and social impact from the output of science, technology, and innovation in Eastern Economic Corridor of Innovation should be considered. To promote the innovation ecosystem, there should be a collaboration amongst all related parties. Therefore, an additional indicator can be the proportion of the number of collaborative projects to a total number of projects. Other indicators include total investment amount, number of employments, and number of individuals carrying out activities about science, technology, and innovation in the area.

In term of the indicators for the improvement of the use of science, technology, and innovation including the economic and social impact from the services and supporting mechanisms of Eastern Economic Corridor of Innovation. It can be measured by the number of workforces who have been developed for future industry, the number of service providers for science, technology, and innovation (STI service providers) and system integrators, the number of start-up businesses, as well as the number of local entrepreneurs or communities that gain benefits from this mechanism. In additions, there needs to be the monitoring and evaluation of the overall strategy in order to identify its efficiency and effectiveness, as well as possible problems and obstacles.

4. Discussion and recommendation

A. Key Performance Indicator

The previous study documented the role of Science, Technology, and Innovation Zone which played a crucial role in term of investment in R&D and innovation and ultimately it would drive the economy of the country (Kohl & Hashemi, 2011; Lamperti, Mavilia, & Castellini, 2017). To formulate the plan with proper milestones for the development of the Eastern Economic Corridor of Innovation (EECi), the suitable and accurate key performance indicators should be carefully defined. The indicators and corresponding targets should be flexible, suitable, and able to adjust in accordance with the dynamic world situation or the changing condition of the country due to the government policy. The indicators should also be reviewed and adjusted to be consistent with the context for both national and global level, including economy, society, environment, technology, and government policy. Currently, the indicators specified in the Development Master Plan are determined in term of both efficiency indicators (Output) and effectiveness indicators (Outcome). The comparison of efficiency or output indicators of EECi and other science, technology, and innovation zones are shown in Table II.

TABLE II: Comparison of Output Indicators

EECi Thailand	Adlershof Science City	Daedeok Innopolis
- Total Investment in science, technology, and innovation	-Total Investment in science, technology, and innovation	- Total Investment in science, technology, and innovation
- Number of collaboration projects in science, technology, and innovation compared to total number of projects	- Number of collaborative research projects and supporting funds	
- Number of workforces in science, technology, and innovation	- Number of employments	- Number of employments
- Number of participants in science, technology, and innovation projects	- Number of research institutes, universities, and companies utilizing science, technology, and innovation	- Number of research institutes, universities, companies, start-up companies, and incubated companies utilizing science, technology, and innovation
		- Supporting fund from the private sector
- Economic and Social Impact from science, technology, and innovation projects	- local tax collection - Revenue of companies - Revenue from rent and service fees.	- Revenue from technology licensing and intellectua property - Revenue of companies. - Number of companies listed in KOSDAQ

Comparing EECi with other of science, technology, and innovation zones, all have emphasized on the amount of investment in science, technology, and innovation, the number of employments, and the number of participants in the zone. For EECi, there is a specific indicator about the number of collaborative projects similar to Adlershof Science City whereas Daedeok Innopolis has focused on the amount of supporting fund from the private sector instead. In term of impact, EECi has specified in general term as the economic and social impact from science, technology, and innovation projects whereas other zones have specified those indicators clearly. Adlershof Science City has indicated in term of local tax collection, revenues of companies, and revenues from rent and service fees. Daedeok Innopolis has indicated in term of revenues from technology licensing and intellectual property, revenues of companies, and the number of companies listed in KOSDAQ.

B. Critical Success Factors

Having critically explored the attributes of the special zone for science, technology, and innovation overseas, the critical success factors of fostering innovation through Eastern Economic Corridor of Innovation (EECi) in Thailand can deduced into the followings,

1) Implantation of an innovation DNA into research institutes, universities, companies, start-up companies, and incubated companies located in the EECi through robust reinforcement from government agencies.

2) Collaborative networking with the successful special zone for science, technology, and innovation worldwide.

3) Efficient and well-functioning labor market for knowledge human resources.

4) Appealing residential ecosystem for knowledge human resources.

If the aforementioned factors are implemented adequately and efficiently, the chance of successful innovation fostering would multiply.

C. Driving and Implementing Recommendations

To ensure that the development of the Eastern Economic Corridor for Innovation Project (EECi) is continuous and consistent with the national strategy, which is reviewed and updated every five years, there should be the efficiency indicators (Output) that can be

evaluated every five years in all four phases. The project should be monitored, evaluated, and reviewed in term of the progress of the project. In addition, there should be qualitative indicators together with quantitative indicators so that the performance can be precisely evaluated, and the revision must be undertaken accordingly and promptly if the project underperforms.

Besides innovation development, the infrastructureis also crucial to attract people to live in the special zones. Bellgardt et al. (2014) focused their study on residential development in Adlershof Science and Technology Park and revealed that the important factors attracting people to work and live in the locality of the science & technology park are the infrastructure in term of transportation, energy efficiency plan, recreational spaces, etc. Therefore, the establishment of EECi in Thailand has been implemented parallelly with the establishment of Eastern Economic Corridor (EEC). This can ensure the readiness of infrastructure that helps attracting parties including investors, entrepreneurs, professors, and researchers to work and live in the area of EECi.

Moreover, Park and Lee (2015) have conducted a study concerning government policy literacy and the attitude towards government policies related to innovation. They discovered that higher level of policy literacy leading to higher support, especially for a civil servant group. Therefore, the policy communication and understanding of the government policy are critical success factor leading to the success of government innovation policies.

In term of the legal environment, the innovation-friendly regulations should allow innovators or entrepreneurs to have sufficient flexibility for experiments. Therefore, the regulatory environment should be in the form of innovation-friendly that is flexible and helps supporting innovation (Ranchordas, 2015). The lawmakers should consider removing unnecessary regulations that can be an obstacle for innovation and updating related regulations by balancing between regulating and supporting the innovation.

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