



## THAILAND INNOVATION PERFORMANCE AND TREND

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<https://doi.org/10.26782/jmcms.2020.07.00007>

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### Abstract

*Despite the world's 20th largest economy, Thailand's innovation ecosystem is questionable, ranked the world's 43rd in Global Innovation Index 2019 report. The paper aims at investigating the innovation performance and trend of Thailand based on 7 aspects of innovation inputs and outputs. Referred to the data dated back to 2011, knowledge and technology outputs, human capital and research, institutions, and creative inputs are considered Thai strengths with progressive improvement. Market sophistication is strong but there has been no significant improvement. Business sophistication is considerably weak but there is a sign of improvement. Infrastructure is the most concerning issue.*

**Keywords :** Thailand, innovation performance and trend, Global Innovation Index

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### I. Introduction

Thailand is currently the world's 20th largest economy by GDP reported by the International Monetary Fund. As a newly industrialized country, Thailand is highly dependent on manufacturing and exports. The industrial sector alone contributes up to 31.0% of Thailand's GDP [XXXIV]. Electronics and automotive industries are among the top benefactors, sharing up to 29.3% of gross export [XLVI]. Thai industry is now developing toward the Industry 4.0 advancement [II], [VI], [XIX], [XLIII]. However, Thailand's competitiveness is comparatively low at

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Sakgasem Ramingwong et al*

the world's 40th rank per the World Economic Forum's Global Competitiveness Report 2019 [XLI]. Supportment of the organization and management of Thailand is among what is to be concerned [XLII].

In addition, of interest of this paper, Thailand is positioned as low as the world's 43rd in global innovation rank, out of 129 economies in the assessment, according to the Global Innovation Index 2019 report [XIII]. This information is concerning whether Thailand's socioeconomic infrastructures are adequate for national development since innovation is undoubtedly a key driver to economic growth [XXVIII].

The paper aims to examine innovation performance and the trend of Thailand based on 7 innovation perspectives, reported in the Global Innovation Report. The period of the investigation is 2011-2019.

## **II. Innovation: A Driver of Economic Growth and Development**

Innovation is a driver of economic growth and development. It is an enabler that allows firms to compete in the global market. Whilst innovation can be referred to as a new idea or an improvement that can be commercialized or implemented [XXV], innovation can be product, service, process, marketing, business model, supply chain, or organizational innovation [XXVII], [XXXII], [XLV].

Innovation is difficult to measure [XL], as it involves vast influences such as institutional, cultural, technology, and human resources [XIV], [XLII]. Besides technology advancement, the innovation ecosystem requires human resources, infrastructure, modern management and support from the government to successfully execute the full spectrum [XVIII], [XXIX], [XXXI], [XXXVIII]. Furthermore, a relationship between universities and firms as well as national innovation policy could support knowledge creation and knowledge diffusion effectively [III], [XVII], [XXXV], [XXXVII].

### **Innovation Policy and Initiatives in Thailand**

There are several agencies, responsible to promote innovation or strengthen innovation ecosystem of Thailand, for example, Thailand Research Funds (TRF), Board of Investment of Thailand (BOI), National Science and Technology Development Agency (NSTDA), Office of SMEs Promotion (OSMEP), National Innovation Agency (NIA), SMEs Venture Capital Fund (SMEVC). However, the Thai national innovation system was reportedly weak and fragmented [XXXVI]. Whilst universities have played a major role in the Thai innovation ecosystem, yet there are gaps in innovation execution between firms and universities [XV], [XVI]. There were also noticeable gaps between innovation policy and execution that hold back the innovation ecosystem of Thailand [V], [XXVI]. Recently, Office of the National Economic and Social Development Board of Thailand has announced a strategy for the development of science, technology, research, and innovation in the 12th national economic and social development plan 2017-2021 that addressed creativity and innovation to generate a new value-added economy [XXXIII]. NIA's framework of innovation diplomacy, NSTDA's Thailand Science Park (TSP), and Regional Science Park (RSP) program by the Ministry of Higher Education, Science,

Research and Innovation are examples of Thai government measurements to upgrade the innovation ecosystem. The model of Quadruple Helix is now used to link government, academia with industry, and civil society [XVII], [XXX].

### **Global Innovation Index and Indicators**

Global Innovation Index (GII) reports are a series of annual reports ranking of countries' innovation performance. The first report, GII 2007, was issued in 2007, started with 107 economies and 8 pillars of innovation. This paper focuses on the innovation performance of Thailand between 2011-2019 [VII], [VIII], [IX], [X], [XI], [XII], [XIII], [XX], [XXI], [XXII], [XXXIX].

Indicators used in GII reports are slightly different from the year 2009 to 2019. There have been updated regularly. The numbers of the economy are also marginally different in each report. Still, 7 main pillars and their sub-indices are consistent. GII uses 5 innovation pillars to represent innovation input, i.e., (1) institutions, (2) human capital and research, (3) infrastructure, (4) market sophistication, and (5) business sophistication. Then, there are 2 pillars representing innovation output, i.e., (6) knowledge and technology outputs, and (7) creative outputs. Each pillar comprises of 3 sub-pillars. Then sub-pillars comprises of several indicators related. In GII 2019, there are 80 indicators, which are either hard data, composite from third-party data providers, or the survey [XIII].

GII ranks are taken from the Global Innovation Index (GII) scores which is the average of the input and output sub-indices. The sub-index score is the average from the score of pillars. Pillar score is calculated as the weighted average of sub-pillars scores. The sub-pillar score is calculated as the weighted average of individual indicators. There are data from 129 economies in GII 2019.

### **III. Methodology**

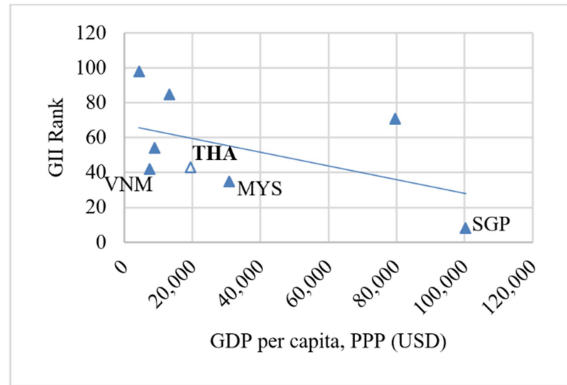
It is the aim of this paper to investigate the innovation performance and trend of Thailand. To reflect the innovation performance and innovation trend of Thailand, GII 2019 rank of Thailand is explored. Firstly, Thailand's rank is benchmarked with other closely-related countries to reflect the real performance of Thailand. Secondly, the innovation trend is observed by exploring the ranks on the GII, input, and output sub-indexes, using ranking data dated back to 2011. Finally, to examine the innovation trend, deeper investigations are conducted based on 5 input and 2 output innovation pillars, based on GII 2011-2019 reports.

### **IV. Result Presentation**

#### **Innovation Performance of Thailand**

To investigate Thailand's innovation performance, Southeast Asian countries are selected as the benchmark. These countries are closely linked together under the declaration of the Association of Southeast Asian Nations (ASEAN). This intergovernmental organization aims at integrating socio-economic of 10 member states, i.e., Indonesia, Malaysia, Philippines, Singapore, Thailand, Brunei, Lao PDR, Myanmar, Cambodia, and Viet Nam. ASEAN initiatives are, for example, the free

flow of goods, service, skill labor, and investment. Whilst most of the member states are low-income or upper-middle income, the World Economic Forum projects ASEAN to be the world’s fourth-largest economy by 2050.



**Fig. 1:** Thailand and ASEAN Innovation Performance [XIII]

Fig.1 maps GII 2019 rank with GDP per capita of 8 ASEAN members. (Myanmar and Lao PDR are not included in GII). The linear line represents the average GII rank of ASEAN members against GDP per capita. The position under the trend line is preferable as it refers to the performance above the average.

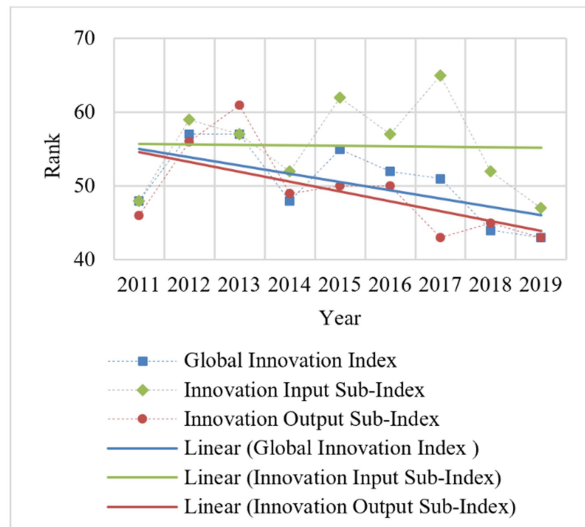
The best performer of ASEAN is Singapore, ranked at the world’s 8th. However, its GDP per capita is also superior to other ASEAN. The runner up is Malaysia, ranked at the world’s 35th. Then Viet Nam is ranked at the world’s 42nd.

Thailand is ranked at the world’s 43rd and ASEAN’s 4th. Considering the ASEAN average trend line, it is suggestive that the innovation performance of Thailand, along with Singapore, Viet Nam, and Malaysia, are very satisfactory.

**Innovation Trend of Thailand**

Focusing on the innovation input and innovation output perspectives, Thailand is ranked the world’s 47th and 43rd, respectively in 2019. Interestingly, among 34 upper-middle-income economies, Thailand is ranked 5th and 4th. Fig. 2 illustrates the ranks of Thailand as of the Global Innovation Index, innovation output sub-index, and innovation input sub-index from 2011 to 2019. Here, the overall trend is of interest, instead of focusing on the year-on-year improvement since the indicators have been changed in several indices. The lines are linearly fitted to those ranks, representing the developing or declining progression.

From Fig.2, it can be seen that in general Thailand has improved its innovation potential as the Global Innovation ranks have been improved since 2011. Thailand was ranked the world’s 48th in 2011 and is now ranked the world’s 43rd. The blue line represents a general improvement from this perspective. The innovation output of Thailand has also improved, considering the red line. Thailand is currently ranked as the world’s 43rd in 2019.



**Fig. 2:** Thailand Innovation Performance and Trend

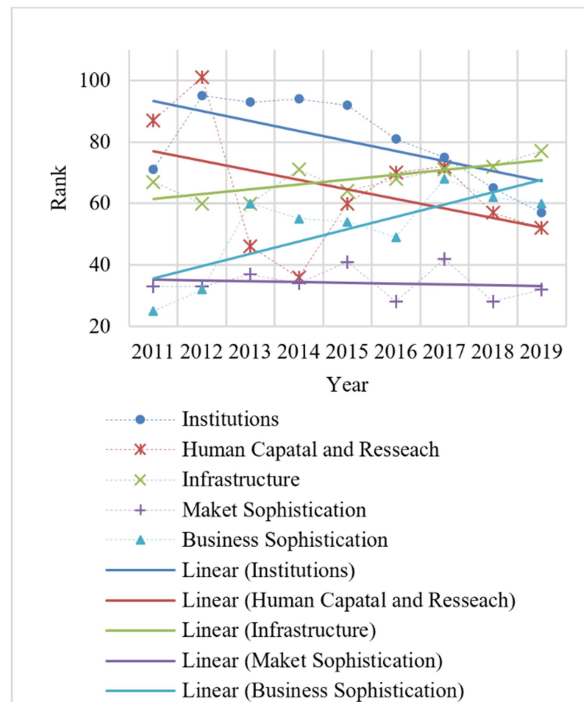
On the other hand, Thailand's innovation input is questionable. Ranks of Thailand may have swung up and down since 2011. The green line does not show any improvement since 2011. Despite the current rank at the world's 47th in 2019, the general tendency is suggested as “no improvement”.

**Innovation Input Trend of Thailand**

Innovation input consists of 5 pillars. Fig.3 illustrates Thailand's innovation input performance based on these 5 pillars. Again, the trend line is of interest. Here, it can be seen that pillars of institutions and human capital and research are the only 2 pillars that show improvement. In the institution pillar, Thailand is reportedly strong in the business environment, i.e., ease of starting a business and ease of resolving insolvency. Yet, the cost of redundancy dismissal can still be a restraint. Human capital and research are also a strong point of the Thai innovation ecosystem, i.e., graduates in sciences and engineering, global R&D companies, QS university ranking. Yet, the Thai education system, e.g., pupil-teacher ratio, PISA scale in reading, maths, and sciences, is somewhat weak. Currently, Thailand is positioned as the world's 81st in education. The ranks on the education of Thailand are averaged at 83rd between 2011-2019. Tertiary inbound mobility is also deficient.

The outlook of infrastructure and business sophistication pillar show declining performance. The trend of infrastructure declining is evident since 2015. Thailand is weak in ICT access, the government's online service, e-participation, GDP/unit of energy use, and environmental performance. The only strong point of Thailand in this pillar is logistics performance. Timeliness is the potency of the Thai logistics system [I], [XLIV]. The trend of business sophistication is also declining, yet questionable [XXIV]. Whilst the indicators had been updated during 2011-2017, the ranks had swung. From 2017 to 2019, the trend is otherwise. Thai business

sophistication performance has improved from 68th in 2017, 62nd in 2018 to 60th in 2019. Thailand is reportedly secure in gross domestic expenditure on R&D financed by business at 75.2% (ranked world's 4th), intellectual property payments ratio to total trade, high-tech import ratio to total trade, and percentage of research talents in business enterprise. University/industry research collaboration is acceptable [XLVII]. Yet, knowledge-intensive employment, the gross domestic expenditure on R&D financed by abroad and ICT service import ratio to total trade are among the challenging constraints.



**Fig. 3:** Thailand Innovation Input Performance and Trend

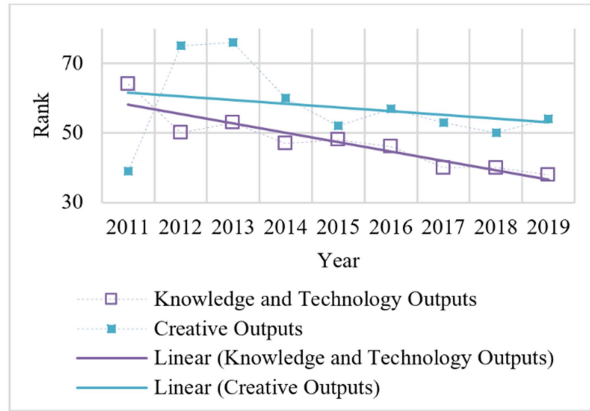
The linear trend line of market sophistication does not show any improvement during the period of interest. The indicators in this pillar have also been updated regularly until 2016. Despite no improvement, this pillar is a strong point of Thailand, averagely positioned at the world's 34th since 2011. Thailand is strong in domestic credit to private sector, ease of protecting minority investors, market capitalization at 104.2% of GDP (ranked world's 10th), and domestic market scale.

**Innovation Output Trend of Thailand**

Innovation output comprises of 2 pillars. The trend line of knowledge and technology outputs in Fig.4 shows strong improvement. Knowledge diffusion in Thailand is reportedly solid. High-tech net export ratio per total trade at 15% launches Thailand as the world's 8th in this indicator. Utility model by origin, the growth rate of GDP per worker, and high- and medium-high-tech manufacturers are

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Sakgasem Ramingwong et al*

among the capable points of Thai innovation output. Again, ICT service export is feeble.

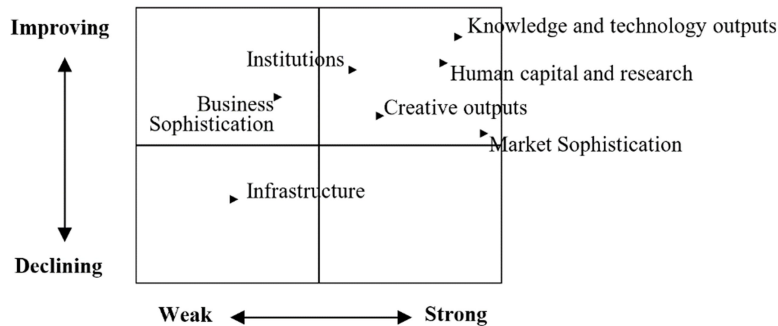


**Fig. 4:** Thailand Innovation Output Performance and Trend

In the creative outputs pillar, the trend line shows minorly improvement. Outstandingly, the export of the creative goods of Thailand is at 8.7% of total trade which directs Thailand to the world's 1st pinnacle. The other criteria on this pillar show no significant strengths or weakness, except for the very low ratio of cultural and creative service export per total trade.

**V. Discussion**

Fig.5 illustrates Thailand's innovation performance in the view of a matrix. The X-axis represents weaknesses-strengths. Y-axis represents an improving-declining trend. Here, it can be seen that knowledge and technology outputs, human capital and research, institutions, and creative inputs of Thailand are effectual. Market sophistication is strong yet questionably no improvement. Business sophistication has been developing in the right direction. Oppositely, the infrastructure of Thailand is concerning.



**Fig. 5:** Innovation Performance Matrix of Thailand

## **VI. Conclusion**

Reported in Global Innovation Report 2011-2019, Thailand's innovation performance and the trend can be identified. It is indicative that Thailand is considerably strong in the innovation ecosystem. Among 7 pillars of innovation, knowledge and technology outputs, human capital and research, institutions, and creative inputs are considered Thai strengths with a positive sign of improvement. Creative goods export ratio per total trade and high-tech net export ratio per total trade of Thailand are recognizably superior in the global league. Market sophistication is also Thai strength but still challenging as there has been no significant improvement for the past 9 years. Business sophistication is despite a weak point of the Thai innovation ecosystem yet there is a promising improvement. Gross domestic expenditure on R&D financed by business is considered assuring. The only concern is the infrastructure to support innovation.

## **VII. Acknowledgment**

This research is part of the project "Industry 4.0 for SMEs" from the European Union's Horizon 2020 research and innovation program under the Marie Skłodowska-Curie grant agreement No 734713.

This research work was partially supported by Chiang Mai University – Thailand.

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