

Chapter 2

The High-speed Railway (HSR) Service, The Eastern Economic Corridor's Development, and Thailand: A Geographical Simulation Analysis

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Abstract: The economic impact of Thailand's HSR project, and development of the Eastern Economic Corridor (EEC), has been estimated using the Geographical Simulation Model (IDE-GSM). The HSR service will generate a positive economic impact in the areas along the routes and in the areas extending from the stations, but will generate a negative economic impact in other areas. Adding the EEC's development to the Eastern Line project will generate a highly positive economic impact along the Eastern Line route, but other areas will suffer a negative economic impact in comparison with the baseline scenario. In order to spread the economic impact of development in one area across the whole country, additional measures are necessary, and in this paper, we propose the Mekong-India Economic Corridor (MIEC) as an example.

Keywords: Simulation, Thailand, High-speed railway, Economic Corridor
JEL Classification: O53; R12; R13

1. Introduction

As the initiative of Thailand's high-speed railway and the development of the Eastern Economic Corridor (EEC) is being embodied, the economic impact of these projects has been estimated using the Geographical Simulation Model (IDE-GSM, Kumagai *et al.* 2013). Currently, four HSR projects, the Northeastern, Northern, Southern and Eastern Lines are planned, and construction of the Northeastern Line started in January 2018, and the EEC will cover from Bangkok to Rayong.

IDE-GSM is a simulation model based on spatial economics. As of January 2018, the economic data is divided by 30 Asian countries/economies and 59 other countries of the world, into about 2,000 regions, and over 12,000 routes. In this study, we divide the data for Chachoengsao, Chonburi, and Rayong provinces into the district level to measure if the impact emerges evenly or unevenly within these provinces.

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In the simulation, and subject to various assumptions and calibrations, the changes in industrial agglomeration in the medium- to longer-term, as well as the economic impact of the construction, improvement, and expansion of the roads, railways, ports, and airports have been simulated. In addition to the physical transport infrastructure, the economic impact analyses of the economic measures, such as the industrial parks, special economic zones, institutional reforms, free trade agreements, and the combination of soft infrastructure development and physical infrastructure development can be estimated. The results of the simulation analyses have been cited in the comprehensive Asia Development Plan and the ASEAN Connectivity Master Plan (ERIA 2010, 2015, ASEAN 2010, Isono and Kumagai 2016).

The discussion in this paper covers five points. Firstly, how will the HSR service affect the Thai economy? Secondly, to what extent will the economic impact of the four HSR projects differ? Thirdly, what will bottlenecks of the HSR project have only a small economic impact? Fourthly, how will development of the EEC affect the Thai economy? Finally, what kind of measures are necessary to spread the economic benefit of a development in one region across the whole country?

In particular, we discuss how the HSR projects and the EEC's development will contribute to the industrial shift from manufacturing to the services sector, including the R&D and headquarters functions in the manufacturing sector. The HSR service will contribute to the easier movement of people that will benefit the services sector through encouraging tourism, R&D, and the headquarters functions.

The conclusions are as follows. The HSR service will generate a positive economic impact in the areas through which the routes pass, and in the areas extending from the various stations, but could cause a negative economic impact in other areas. Compared to the three HSR routes, the Northeastern, Northern and Southern Lines, the economic impact of the Eastern Line passing through the EEC area will be small. This is because the Eastern Line is not used much due to the distance from the center of Bangkok to Lat Krabang station, which is set as the terminal station in Scenario 4, and the dominant intercity movement is by road transport. For the Eastern Line, connecting the Don Mueang and U-Tapao airports, raising the frequency of the HSR service will increase the economic impact significantly. In the scenario assuming the EEC's development including the Eastern Line, a positive economic impact will emerge only in the areas along the HSR route, but other regions will experience either a negative impact or only a small positive impact. This implies that it is difficult to expect the ripple effect across the whole country from one region's development. For this reason, it is necessary to combine measures covering a much broader region, such as the Mekong-India Economic Corridor, in order to spread the positive economic impact generated in the EEC region throughout the country.

The IDE-GSM project conducted four studies covering HSRs in Thailand, ASEAN, and the Mekong region. From 2012 to 2015, we conducted a joint study with the Thai Research Fund and Thammasat University concerning the impact analysis of the HSR and the double-track railway projects in Thailand. The Comprehensive Asia Development Plan 2.0 (ERIA 2015) provided a simulation analysis with the IDE/ERIA-GSM, which included HSR projects in Thailand, Malaysia, Singapore, and Indonesia. Another studied the estimated economic impact of the HSR and medium-speed rail projects in ASEAN, for which China was reported to be interested in developing. The

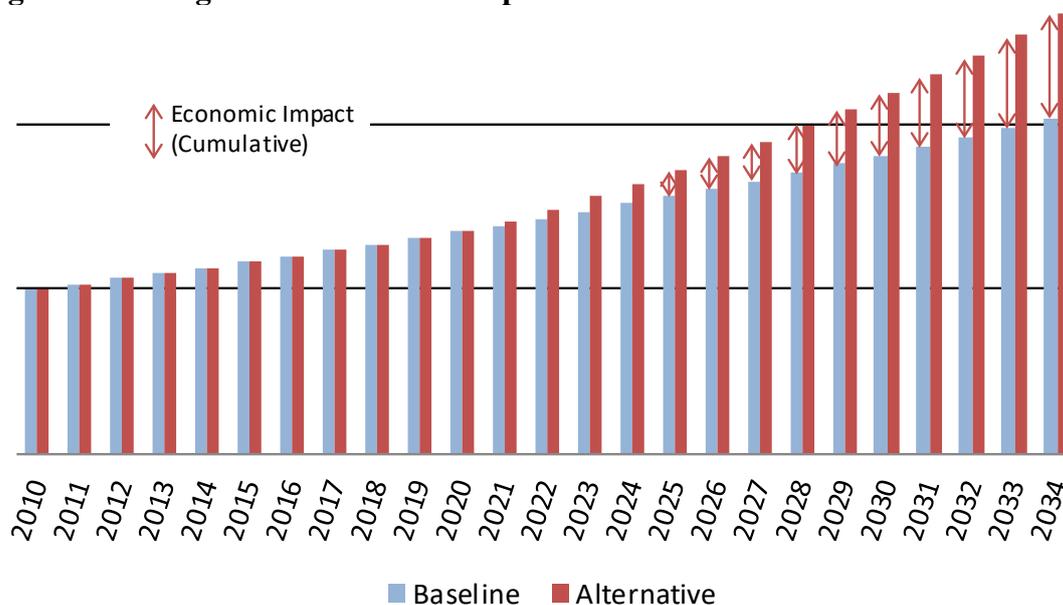
fourth study covered a detailed estimation of the economic impact under multiple conditions for the HSR connecting Kuala Lumpur and Singapore.

The structure of this paper is as follows. Section 2 summarizes the important assumptions arising from the settings of the IDE-GSM; Section 3 sets the scenarios; Section 4 discusses the results and interpretation; and Section 5 is the conclusion.

2. Important Assumptions

The image of the economic impact is shown in Figure 2-1. The impact is indicated by cumulative value for the period 2025-2034 in value, and depicted as a figure for the 2030 estimated data. Depending on the scenario, a negative economic impact can emerge depending on the region, which means that it could show a lower GRDP (Regional GDP) compared with the 2025-2034 GRDP in the baseline scenario. Note that it does not mean it will necessarily be a lower GRDP compared to the current GRDP for 2017.

Figure 2-1: Image of the Economic Impact



Source: Author

In addition, the baseline scenario assumes congestion at Laem Chabang Port and Suvarnabhumi Airport. Scenario 6 and later scenarios, assume easing of such congestion attributable to the expansion of Laem Chabang Port and Suvarnabhumi Airport; thus, the economic impact of these scenarios will generally be greater than that whereby the congestion at Laem Chabang Port and Suvarnabhumi Airport is not assumed in the baseline scenario.

How do improvements in the transportation infrastructure in the model lead to changes in the GDP and GRDP in the model? Firstly, infrastructure development will broadly reduce transport costs, including time and money costs, which leads to cost reduction by firms. Firms in the area will achieve increased sales and profits. This may lead to an increase in the wages of the workers, and because workers are also consumers, their utility improves through the increased consumption. Firms and households will

move to regions that can deliver higher profits and better amenities. Also, reducing the transport cost means that consumers can purchase a greater variety of goods and services from many regions, and thus real wages will rise. Movement of firms and households to the regions means that more sales and profits are expected by the firms located in these regions, so a kind of ripple effect occurs. Through changes in such behavior patterns, the GDP and GRDP performance will change across the country and in the regions.

The important assumptions of the model that influence the interpretation of the results in this analysis are summarized by the following four points.

Firstly, which firms engage in infrastructure development in the country does not affect the outcome. In the model, it is assumed that the time for a certain section is reduced by the improved or newly developed infrastructure. Even if the infrastructure is built with domestic capital, or a Chinese firm constructs the infrastructure, or even if another country finances the infrastructure, the assumptions do not change, so the result does not change.

Secondly, a city's center does not move. In the model, representative location (latitude and longitude) in the region are set for each region, and it is considered that households and firms are located at such representative location, that is, the center of a city. When developing a railroad in the model, it is assumed that a station's location is selected where it is reported as the planned location. We assume that goods and services will be shipped by land transport from the representative location in the region to the nearest station. In the real world, it can be considered that in the long-term a city's center moves according to railway construction and urban development moves to the area surrounding the station, but in this analysis we have assumed that the representative location does not move.

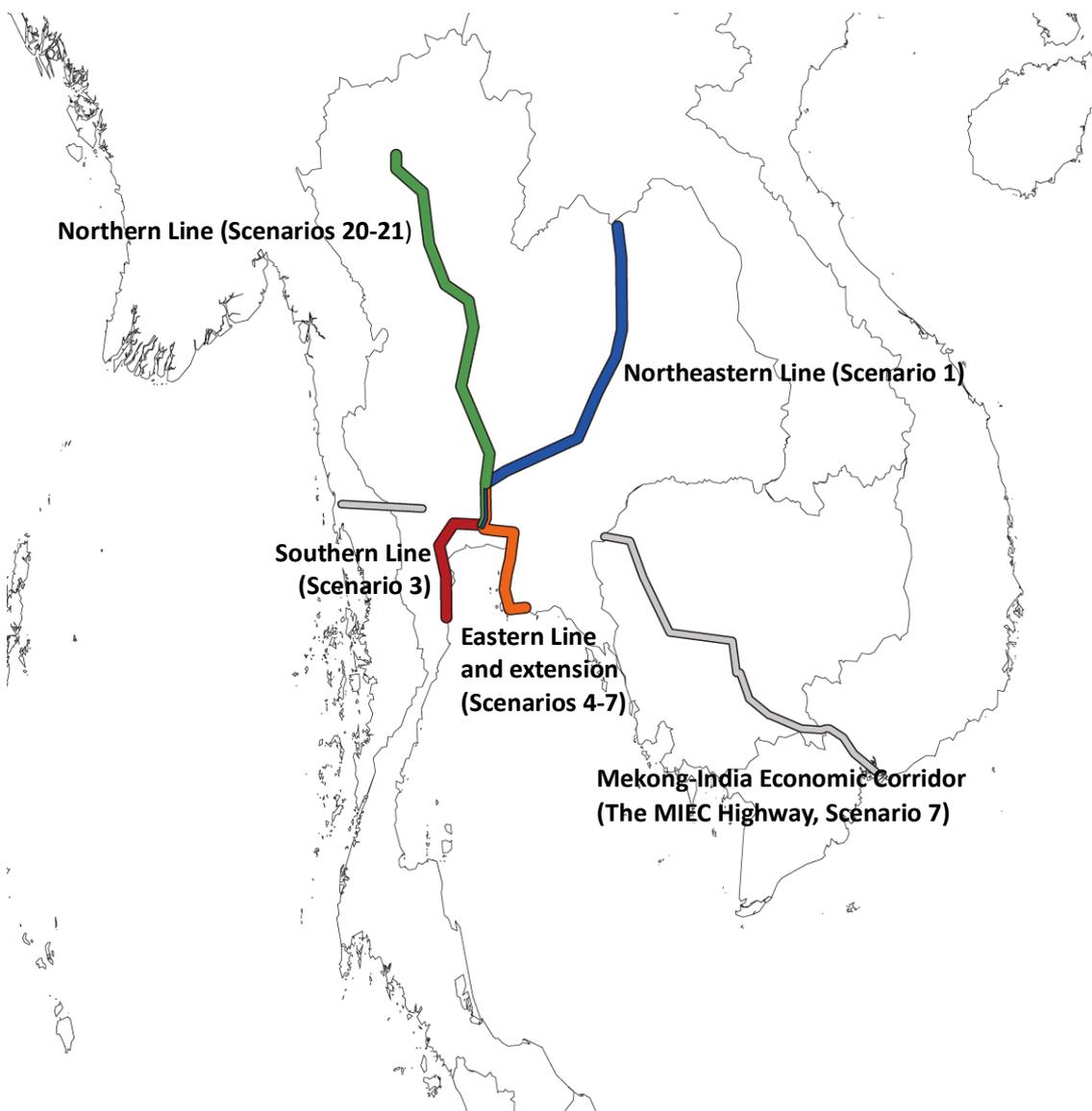
Thirdly, the HSR service does not transport goods. More precisely, it does not ship manufactured and agricultural goods. In the model, it is assumed that the services sector goods are shipped by the services sector with a transport cost, and the HSR service is the mode to ship such services sector goods. As a result, the HSR service will directly affect the activities of the services sector.

Finally, we have not assumed any reduction of additional non-tariff barriers (NTB) unless explicitly stated. Also, unless explicitly stated, we have not assumed that the HSR service will increase productivity at a firm's office level. In the model, in addition to the direct monetary costs and the time costs converted in terms of time for transporting goods and services, other expenses, called NTB, differences in language and religion, called cultural barriers, are estimated and added to the monetary and time costs. The NTB in this analysis means the monetary and time expenses already incurred before the goods and services depart, such as the cost to find trading partners, to prepare documents, and to learn about the applicable trading procedures. In particular, the NTBs in the model include policy-based barriers, such as the complexity of the official procedures, and the skill of the users, such as accuracy in completing application forms. In this paper, there has been no change in the ability of the users (firms and households), even when the HSR service opens and the number of people using the service increases. That is, the NTBs will not fall further than that assumed in the baseline model. At the same time, it has been assumed that firm-level productivity in the production of the services sector goods will not rise by the opening date of the HSR service.

3. Scenarios

The assumptions in the scenarios were set through interviews with experts and through various news sources by October 2017. The various scenarios' map is shown in Figure 2-2. Unless otherwise stated, it has been assumed that the transfer time at a station is 30 minutes for an hourly service frequency, to allow for ticketing and security checks, and the representative speed is 192kms/h. The cost per distance by the HSR service is assumed to be eight times that of the standard railway, twice that by road, and half that by air.

Figure 2-2: The Scenarios' Map



Source: Author

Firstly, the scenarios have been set separately for each of the four HSR routes

(Scenarios 1 to 4). The Northern Line runs to Phitsanulok in Scenario 20, and extends to Chiang Mai in Scenario 21. The Eastern Line runs from Lat Krabang to Rayong in Scenario 4, extends to Don Mueang, and adds the U-Tapao airport's HSR service underground station in Scenario 50. In Scenario 51 we raise the service frequency and reduce the transfer time at the station to 15 minutes (30-minute frequency of service operation), and in Scenario 52, we extend the line to Ayutthaya. In addition to the Eastern Line in Scenario 52, Scenario 6 covers the EEC's development. Scenario 7 includes the EEC's and MIEC's development with Scenario 52, and Scenario 7 *minus* removes the Eastern Line from Scenario 7.

Scenario 1: Northeastern Line

- Bangkok (Bang Sue) - Nong Khai
 - Bang Sue, Don Mueang, Ayutthaya, Saraburi, Nakhon Ratchasima, Bua Yai, Ban Phai, Khon Kaen, Udon Thani, and Nong Khai stations are open
 - Operation starts in 2025

Scenario 20: Northern Line (1)

- Bangkok (Bang Sue) - Phitsanulok
 - Bang Sue, Don Mueang, Ayutthaya, Lopburi, Nakhon Sawan, Phichit, and Phitsanulok stations are open
 - Operation starts in 2027

Scenario 21: Northern Line (1)

- Bangkok (Bang Sue) - Phitsanulok
 - Bang Sue, Don Mueang, Ayutthaya, Lopburi, Nakhon Sawan, Phichit, and Phitsanulok stations are open
 - Operation starts in 2027
- Phitsanulok - Chiang Mai
 - Sukhothai, Satchanalai, Lampang, Lamphun, and Chiang Mai stations are open
 - Operation starts in 2029

Scenario 3: Southern Line

- Bangkok (Bang Sue) - Hua Hin
 - Bang Sue, Nakhon Pathom, Ratchaburi, Phetchaburi, and Hua Hin stations are open
 - Operation starts in 2025

Scenario 4: Eastern Line (1)

- Bangkok (Lat Krabang) - Rayong
 - Lat Krabang, Chachoengsao, Chonburi, Si Racha, Pattaya, and Rayong stations are open
 - Average speed is 163kms/h
 - Operation starts in 2023

Scenario 50: Eastern Line (2)

- Don Mueang - Rayong
 - *Don Mueang, Bang Sue, Makkasan*, Lat Krabang, Chachoengsao, Chonburi, Si

- Racha, Pattaya, *U-Tapao Airport*, and Rayong stations are open
- Average speed is 163kms/h
- Operation starts in 2023

Scenario 51: Eastern Line (3)

- Don Mueang - Rayong
 - Don Mueang, Bang Sue, Makkasan, Lat Krabang, Chachoengsao, Chonburi, Si Racha, Pattaya, *U-Tapao Airport*, and Rayong stations are open
 - Average speed is 163 kms/h
 - The transfer time at the station is 15 minutes
 - Operation starts in 2023

Scenario 52: Eastern Line (4)

- Don Mueang - Rayong
 - Don Mueang, Bang Sue, Makkasan, Lat Krabang, Chachoengsao, Chonburi, Si Racha, Pattaya, *U-Tapao Airport*, and Rayong stations are opened
 - Average speed is 163 kms/h
 - The transfer time of the station is 15 minutes
 - Operation starts in 2023
- Ayutthaya - Don Mueang
 - Ayutthaya station is open
 - Average speed is 163kms/h
 - The transfer time at the station is 15 minutes
 - Operation starts in 2025

Scenario 6: Eastern Line and the EEC

- Settings for the Eastern Line in Scenario 52 are used
- We expand Laem Chabang Port in 2020, so that the additional congestion at the port assumed in the baseline scenario is completely overcome
- We expand the terminal building of Suvarnabhumi Airport in 2020, so that the additional congestion at the airport assumed in the baseline scenario is reduced by half
- We expand the passenger terminal of *U-Tapao* airport in 2025, and establish the same international flight routes as used by Suvarnabhumi airport
- We increase the productivity parameter of the service sector by 10% in 2025 in Bangkok, Mueang Chachoengsao, Mueang Chonburi, Si Racha-Chonburi, Bang Lamung, Ban Chang, Mueang Rayong. The productivity parameters are increased in these province/districts for automotive by (1.3%), electricity (1.72%), textiles (1.13%), food processing (0.85%), and other manufacturing sectors (1.62%)

Scenario 7: Eastern Line, EEC and MIEC Development

- Settings for the Eastern Line in Scenario 52 are used
- Roads are widened in the Mekong-India Economic Corridor (MIEC) section of Cambodia-Vietnam in 2025, so that the speed of trucks will increase from 38.5 kms/h to 60 kms/h, and Customs clearance time and costs at the border crossings along the Corridor are halved
- In 2025, Dawei Deep-sea Port opens and the expressway from Dawei to Thailand

- opens
- We expand Laem Chabang Port in 2020, so that the additional congestion at the port assumed in the baseline scenario is completely overcome
- We expand the terminal building of Suvarnabhumi Airport in 2020, so that the additional congestion at the airport assumed in the baseline scenario is reduced by half
- We expand the passenger terminal of U-Tapao airport in 2025, and establish the same international flight routes as used by Suvarnabhumi airport
- We increase the productivity parameter of the service sector by 10% in 2025 in Bangkok, Mueang Chachoengsao, Mueang Chonburi, Si Racha-Chonburi, Bang Lamung, Ban Chang, Mueang Rayong. The productivity parameters are increased in these province/districts for automotive by (1.3%), electricity (1.72%), textiles (1.13%), food processing (0.85%), and other manufacturing sectors (1.62%)
- We reduce the NTBs for Thailand each year from 2021 to 2030 for automotive by (0.65%), electricity (0.86%), textiles (0.565%), food processing (0.425%), other manufacturing sectors (0.82%) and the service industry (5%)
- We reduce the NTBs for Myanmar, Cambodia, and Vietnam by 2% for the manufacturing and service sectors each year from 2021 to 2030

Scenario 7minus: EEC and MIEC Development

- We adopt Scenario 7's settings excluding the Eastern Line, that is, only the assumptions of the EEC and MIEC are set

4. Results

4.1 The Economic Impact of the HSR Services

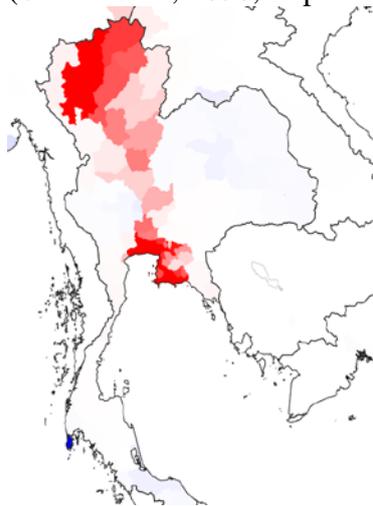
The economic impact of the four HSR projects in Thailand is summarized in Table 2-1. The economic impact of the Northern Line and Eastern Line are shown as Figures 2-3 and 2-4. The economic impact is relatively high in Scenario 1 due to the longer distance, and the economic impact decreases in the sequence of Scenarios 21, 20, 3, and 4. These projects show a positive economic impact in the areas along the HSR routes and extending from the HSR stations, but cause a negative economic impact in the other areas, which cancels some of the positive impact in the national GDP performance.

Table 2-1: Economic Impact of the HSR Projects in Thailand
(Million USD, cumulative for 2025-2034, based on 2010 prices)

| | | SC1 | SC20 | SC21 | SC3 | SC4 |
|--------------|---------------|--------|-------|--------|-------|-----|
| Thailand | GDP | 11,539 | 5,875 | 10,990 | 2,604 | 9 |
| | Manufacturing | 1,622 | 421 | 648 | 12 | -2 |
| | Services | 9,905 | 5,453 | 10,341 | 2,598 | 11 |
| Bangkok | GRDP | 6,756 | 2,567 | 3,726 | 1,001 | -3 |
| | Manufacturing | 213 | 58 | 90 | 6 | 0 |
| | Services | 6,544 | 2,510 | 3,637 | 995 | -3 |
| Chachoengsao | GRDP | -329 | 168 | 316 | 19 | -1 |
| | Manufacturing | 75 | 20 | 31 | 1 | 0 |
| | Services | -404 | 148 | 285 | 18 | 0 |
| Chonburi | GRDP | -171 | 140 | 240 | 2 | 10 |
| | Manufacturing | 101 | 27 | 42 | 4 | 0 |
| | Services | -272 | 113 | 198 | -2 | 10 |
| Rayong | GRDP | -871 | 397 | 685 | -60 | -2 |
| | Manufacturing | 380 | 98 | 152 | -3 | -1 |
| | Services | -1,251 | 299 | 532 | -58 | -1 |

Source: IDE-GSM simulation result

Figure 2-3: Economic Impact of the Northern Line
(Scenario 21, 2030, Impact Density)



Source: IDE-GSM simulation result

Figure 2-4: Economic Impact of the Eastern Line
(Scenario 4, 2030, Impact Density)



Source: IDE-GSM simulation result

In Scenarios 1, 20 and 21, the impact on Bangkok's services sector is fairly positive, while the Eastern Line shows a small but negative impact on Bangkok's services sector. The Northeastern Line and the Northern Line have a shorter HSR service distance than the road distance, and have a greater time saving effect. On the other hand, the color in Figure 2-4 is barely seen due to the almost negligible impact in Scenario 4. The Eastern Line will run at a slower average speed due to the many stations and relatively shorter distance, and the railway distance between Bangkok and Rayong is longer than the road distance between those cities, because the HSR's route detours to Chachoengsao station. Moreover, Lat Krabang station is far from the city centre of Bangkok. Therefore, the benefit of reducing the time by the HSR service is small, and many travelers will continue to use road transport in the model.

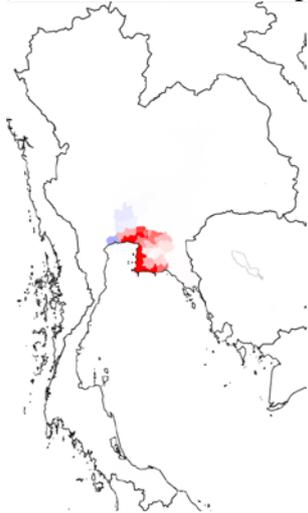
We found that the waiting time at the stations, and the time to travel from Bangkok's city center to the HSR's terminal station at Lat Krabang has an adverse effect on the competition with road travel. As shown in Table 2-2 and Figure 2-5, it is important to locate another station closer to the Bangkok's city center (Scenario 50 and later), and increase the HSR service frequency (Scenario 51 and later).

Table 2-2: Economic Impact of the Eastern Line
(Million USD, cumulative for 2025-2034, at 2010 prices)

| | | SC4 | SC50 | SC51 | SC52 |
|--------------|---------------|-----|------|-------|-------|
| Thailand | GDP | 9 | 115 | 1,393 | 1,401 |
| | Manufacturing | -2 | -23 | -189 | -190 |
| | Services | 11 | 137 | 1,583 | 1,593 |
| Bangkok | GRDP | -3 | -29 | 54 | 47 |
| | Manufacturing | 0 | -2 | -21 | -21 |
| | Services | -3 | -27 | 75 | 68 |
| Chachoengsao | GRDP | -1 | 40 | 270 | 269 |
| | Manufacturing | 0 | -1 | -8 | -8 |
| | Services | 0 | 41 | 278 | 277 |
| Chonburi | GRDP | 10 | 54 | 437 | 448 |
| | Manufacturing | 0 | -3 | -23 | -24 |
| | Services | 10 | 57 | 460 | 472 |
| Rayong | GRDP | -2 | 8 | 363 | 364 |
| | Manufacturing | -1 | -5 | -34 | -34 |
| | Services | -1 | 14 | 396 | 398 |

Source: IDE-GSM simulation result

Figure 2-5: Economic Impact of the Eastern Line Connecting the Three Airport Stations and Increasing the Frequency
(Scenario 52, 2030, Impact Density)



Source: IDE-GSM simulation result

The Eastern Line passes the eastern coastal area, which has an agglomeration of manufacturing industries, so the HSR service will encourage the economy to shift from manufacturing to the services sector, and the economic impact of the Eastern Line on the manufacturing sector will be negative. Compared with the fact that Scenarios 1, 21 and 3 do not interfere with the manufacturing sector at all, or even promote agglomeration of the manufacturing activities in the eastern coastal area, the Eastern Line results in inhibiting the growth of the manufacturing sector in the eastern coastal

area compared with the baseline scenario.

4.2 Economic Impact of the Eastern Line, and the EEC's and MIEC's Development

The economic impact in Scenario 6 and later, is much greater than that due to the HSR service alone, because the economic impact in Scenario 6 includes the EEC's development, and Scenario 7 shows the EEC and MIEC after institutional reform, i.e. reduction of NTBs (Table 2-3). Through development of the services industry, led by the Special Economic Zones, and the expansion of the ports and airports, regulatory reform, and the Eastern Line, it is possible to achieve a greater economic impact.

Table 2-3: Economic Impact of the Eastern Line and the EEC's Development (Scenario 6), and the Eastern Line with the EEC's and MIEC's Development (Scenario 7)
(Million USD, cumulative for 2025-2034, at 2010 prices)

| | | SC6 | SC7 |
|--------------|---------------|---------|---------|
| Thailand | GDP | 300,129 | 920,402 |
| | Manufacturing | 19,704 | 599,181 |
| | Services | 280,726 | 320,546 |
| Bangkok | GRDP | 243,911 | 317,480 |
| | Manufacturing | 19,884 | 85,819 |
| | Services | 224,004 | 231,402 |
| Chachoengsao | GRDP | 7,678 | 40,271 |
| | Manufacturing | 346 | 29,368 |
| | Services | 7,340 | 10,864 |
| Chonburi | GRDP | 17,051 | 53,049 |
| | Manufacturing | 4,394 | 38,819 |
| | Services | 12,661 | 14,193 |
| Rayong | GRDP | 46,159 | 179,920 |
| | Manufacturing | 13,276 | 141,455 |
| | Services | 32,891 | 38,416 |

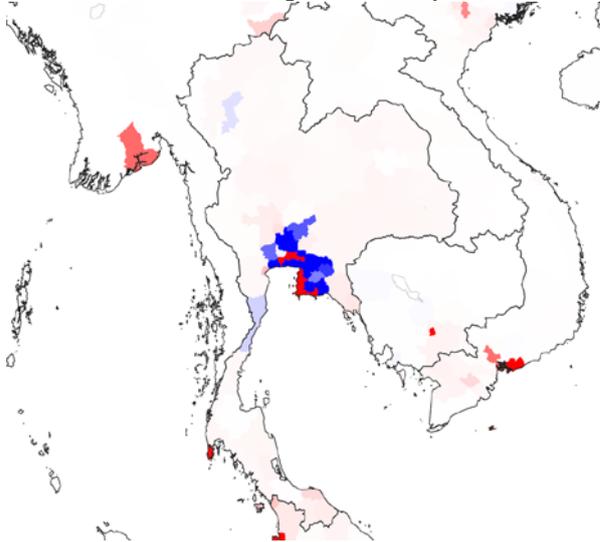
Source: IDE-GSM simulation result

Furthermore, although the simulation assumes institutional reform and additional productivity parameter increases, it can be considered that opening of the Eastern Line will increase the efficiency of the services sector as well as reduce the barriers to the trade in the services sector due to the improved face-to-face communications. In other words, it can be assumed that some of the assumptions about the productivity increment in the EEC can be achieved using the Eastern Line as the trigger. In particular, the Eastern Line connects the country's three major airports, so we should expect this effect.

One of the most distinct differences between Scenarios 6 and 7 is the distribution of the economic impact among the regions. Scenario 6 shows a highly positive economic impact only along the Eastern Line's route, but the other areas suffer a negative economic impact in comparison with the baseline scenario. This is because there will be an inflow of firms and households to the districts with HSR service stations, and the surrounding districts will have a relatively lower attraction for firms and households

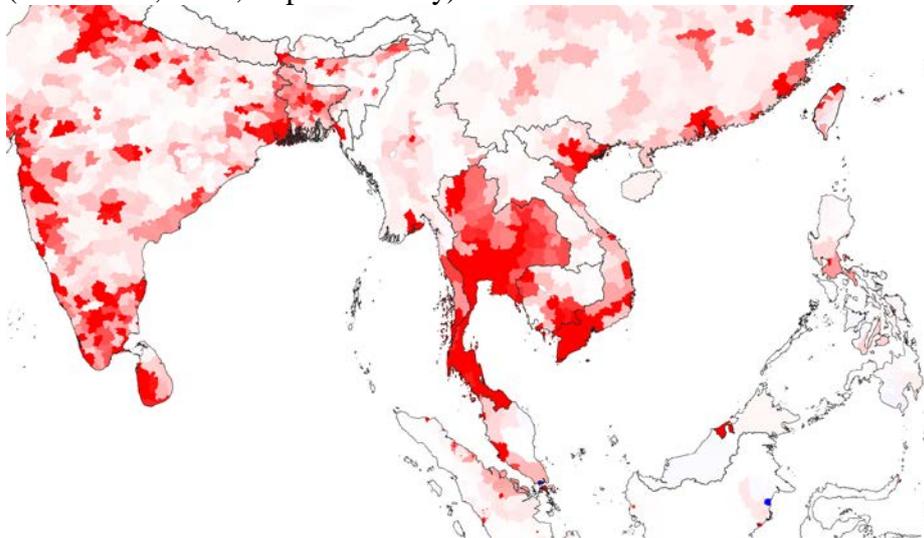
compared with the baseline scenario; thus, they will attract fewer human resources. This clearly implies that development in a specific region may not be enough to develop the whole country, even though it may increase the country's GDP significantly. However, if we combine with the MIEC, and achieve NTB reductions in Thailand and the surrounding countries, the positive economic impact could spread to the whole country (Figures 2-6 and 2-7).

Figure 2-6: Economic Impact of the Eastern Line and the EEC's Development
(Scenario 6, 2030, Impact Density)



Source: IDE-GSM simulation result

Figure 2-7: Economic Impact of the Eastern Line and the EEC's and MIEC's Development
(Scenario 7, 2030, Impact Density)



Source: IDE-GSM simulation result

4.3 Economic effect of the Eastern Line given the EEC's and MIEC's development

If considering the scenario of implementing the Eastern Line by adopting policies that encourage the shift to the services sector and relocation of the manufacturing sector in the EEC and MIEC, the economic impact on Thailand will be about 1.3 times that shown in Scenario 52 (Table 2-4). Also, consider that the Eastern Line could help the region increase firms' productivity level and lower NTBs in reality. Therefore, the Eastern Line should be considered as a part of the EEC's development, which requires adopting a set of policies promoting the shift to the services sector. Only constructing the HSR infrastructure would hinder the growth of the manufacturing sector in the eastern coastal area, and is unlikely to impact the services sector. On the other hand, the HSR service combined with promoting the EEC's and MIEC's development will accelerate the shift of the manufacturing sector to the services sector (Table 2-5).

Table 2-4: Economic Impact of Implementing the Eastern Line without the EEC's and MIEC's Development (Scenario 52), and with Such Development (Scenario 7 – Scenario 7 minus)

(Million USD, cumulative for 2025-2034, at 2010 prices)

| | | SC52 | 7-7minus |
|----------|---------------|-------|----------|
| Thailand | GDP | 1,401 | 1,827 |
| | Manufacturing | -190 | -112 |
| | Services | 1,593 | 1,939 |

Source: IDE-GSM simulation result

Table 2-5: Provinces Showing a Larger Impact in the Services Sector (Scenario 7)

(Million USD, cumulative for 2025-2034, 2010 price)

| | Province | Services |
|----|------------------------|----------|
| 1 | Bangkok | 231,402 |
| 2 | Rayong | 38,416 |
| 3 | Chonburi | 14,193 |
| 4 | Chachoengsao | 10,864 |
| 5 | Samut Prakarn | 2,446 |
| 6 | Songkhla | 984 |
| 7 | Chiang Mai | 934 |
| 8 | Samut Sakhon | 925 |
| 9 | Phuket | 895 |
| 10 | Nakhon Ratchasima | 812 |
| 11 | Phra Nakhon Si Ayudhya | 809 |
| 12 | Nakhon Si Thammarat | 701 |
| 13 | Surat Thani | 698 |
| 14 | Pathum Thani | 692 |
| 15 | Nonthaburi | 674 |
| 16 | Ratchaburi | 673 |
| 17 | Khon Kaen | 515 |
| 18 | Nakhon Pathom | 452 |
| 19 | Ubon Ratchathani | 447 |
| 20 | Saraburi | 445 |

Source: IDE-GSM simulation result

At the same time, it is also important that the services sector functions as an input resource for the manufacturing sector. In fact, the manufacturing sector is also growing in Scenario 7 compared with the baseline scenario. In other words, we are not claiming that Thailand should give up the manufacturing sector, but that the manufacturing sector should be promoted with support from higher quality services.

In Scenario 7, we assume adoption of the policy that will induce the shift from manufacturing to the services sectors throughout Thailand, while there are provinces which will show a larger economic impact on the manufacturing sector than the services sector. Scenario 7 suggests that we expect dispersion of the agglomeration of manufacturing activities from the EEC provinces to other provinces. Table 2-6 tells us that even though the economic impact may be higher in the provinces with existing industrial clusters, such as Rayong, Samut Prakarn, and Chonburi, it is expected that the manufacturing sectors would spread to Khon Kaen, Ratchaburi, Kanchanaburi in the future. It should be noted that this kind of dispersion does not occur in Scenario 6, wherein we do not assume the MIEC's development.

Table 2-6: Provinces With a Greater Impact on the Manufacturing Sector than the Services Sector (Scenario 7)

(Million USD, cumulative for 2025-2034, 2010 price)

| Row Labels | Manufacturing | Services |
|--------------------------|---------------|----------|
| 1 Rayong | 141,455 | 38,416 |
| 2 Samut Prakarn | 109,686 | 2,446 |
| 3 Samut Sakhon | 74,247 | 925 |
| 4 Phra Nakhon Si Ayudhya | 44,156 | 809 |
| 5 Chonburi | 38,819 | 14,193 |
| 6 Chachoengsao | 29,368 | 10,864 |
| 7 Pathum Thani | 13,812 | 692 |
| 8 Nakhon Pathom | 7,664 | 452 |
| 9 Saraburi | 7,502 | 445 |
| 10 Songkhla | 5,086 | 984 |
| 11 Prachuap Khilikhan | 4,026 | 340 |
| 12 Nonthaburi | 3,646 | 674 |
| 13 Lamphun | 3,253 | 127 |
| 14 Khon Kaen | 2,742 | 515 |
| 15 Ratchaburi | 2,619 | 673 |
| 16 Surat Thani | 2,308 | 698 |
| 17 Nakhon Ratchasima | 2,278 | 812 |
| 18 Lopburi | 1,902 | 363 |
| 19 Kanchanaburi | 1,582 | 194 |
| 20 Nakhon Si Thammarat | 1,336 | 701 |

Source: IDE-GSM simulation result

5. Conclusion

The analysis shows that the impact of the Northeastern and Northern Lines will be greater due to the fact that they will connect the agglomeration of the services sector in Bangkok over longer distances to many districts.

It should be noted that different assumptions will yield different results. For example, if we lower the fees for air transport in the assumptions, considering the proliferation of low-cost carriers, the economic impact of the Northeastern and Northern Lines could be less than that stated in this analysis. Different HSR service opening years than we have assumed may also change the simulation results. Interest in HSR services is increasing in the ASEAN countries, while delays in projects are reported with Thailand's and Indonesia's HSR projects. In such cases, several factors should be considered, such as the time-consuming negotiations with the partner countries, land acquisition, the procedure for preparing construction documents that comply with the domestic laws and regulations by foreign construction companies, and the change of policies by the government. Such matters are very common regarding international infrastructure

projects, and delays to these railway projects are very likely to occur.

The economic impact of the Eastern Line will be relatively small due to multiple factors when compared with road transport, such as the HSR service's detour to Chachoengsao, the travel time from Bangkok's city center to the HSR's terminal station, waiting time at the stations, and the cost per distance. Each of these factors will reduce the benefit of the Eastern Line. Moreover, with the settings up to Scenario 52, which do not assume any change in the productivity parameters and NTBs, the effect on industrial relocation will be relatively small.

By contrast, the EEC's and MIEC's development will positively encourage the shift from the manufacturing to the services sectors in Scenario 6, and from manufacturing alone to the manufacturing and services sectors combined in Scenario 7. This trend indicates that increasing the firms' productivity parameters and the reducing NTBs will be essential. The economic impact of the Eastern Line on the premise of the EEC's and MIEC's development will be higher than if they there was no development planned.

Based on the discussions throughout this paper, the policy recommendations for the Eastern Line can be stated as;

- It is important to increase the HSR service frequency (Scenarios 50 → 51). In the assumption, we have allowed some time for ticketing and security checks. Therefore, an e-ticketing system for easy booking and changing the train service booking data anytime through mobile/smartphones would be a good solution.
- The Eastern Line should be developed integrally with the EEC's and MIEC's development (Scenarios 51 → 6 → 7).
- It is important to increase the productivity of firms and make trading in the services sector more vigorous by opening the Eastern Line. It is essential that the Eastern Line connects the country's three main airports to encourage face-to-face communications. Within the EEC, R&D driven industrial parks should be built near the Eastern Line stations (based on the assumptions in Scenarios 6 and 7).

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