

Chapter 7

Quantitative Assessment on Hard/Soft Infrastructure Development: The Geographical Simulation Analysis for CADP 2.0

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Chapter 7

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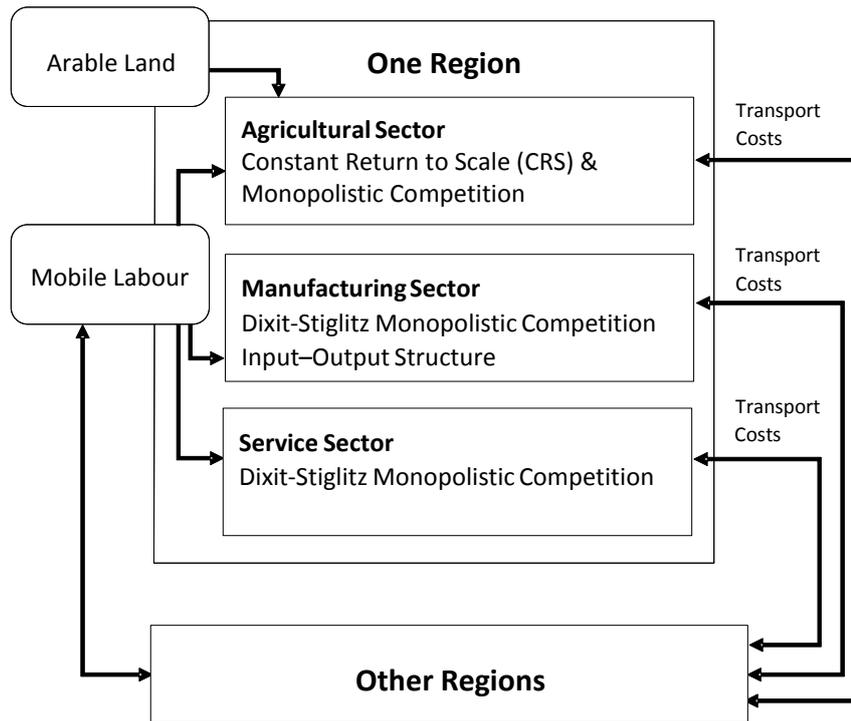
7.1. What is new in the IDE/ERIA–GSM 2015?

This chapter makes the quantitative assessment of further infrastructure development in the horizon of 2030 with the IDE/ERIA–GSM (Geographical Simulation Model) and tabulates our proposed infrastructure-related projects for connectivity and innovation. ERIA has been developing said model since 2007 in cooperation with the Institute of Developing Economies (IDE).

The IDE/ERIA–GSM illustrates the dynamics of the location of populations and industries in East Asia in the long term. Although many analyses forecast the macroeconomic indices in East Asia at the national level, an analysis using the macroeconomic models hardly forecast economic development in East Asia at the subnational level except for a scant amount of literature. The model also enables us to analyse the impact of specific infrastructure projects on regional economies at the subnational level. It further provides an objective evaluation tool to prioritise various infrastructure development projects.

The theoretical foundation of the IDE/ERIA–GSM follows New Economic Geography (NEG), in particular, Puga and Venables (1996), which captures the multi-sector and country general equilibrium. The IDE/ERIA–GSM features agriculture, five manufacturing sectors (automotive, electric and electronics, textile and garment, food processing, and other manufacturing), and the services sector. The model allows workers to move within countries and between sectors. A notable difference of the IDE/ERIA–GSM from that of Puga and Venables (1996) lies in the specification of the agricultural sector. The IDE/ERIA–GSM explicitly incorporates land size in its production and keeps its technology as constant returns to scale. For more details on the IDE/ERIA–GSM, see Chapter 4 of ERIA (2010), Kumagai and Isono (2011), and Kumagai et al. (2015).

Figure 7.1. Basic Structure of the Simulation Model in Simulation



Source: ERIA-IDE Team.

ERIA (2010) presented the simulation results based on the IDE/ERIA-GSM in terms of the cumulative gains in regional GDP for the 2011–2020 period from the set of CADP infrastructure projects. For CADP 2.0, we conduct an impact analysis of new sets of projects in terms of the cumulative gains in real GDP for the 2021–2030 period utilising the latest version of IDE/ERIA-GSM. The comparison of the 2010 CADP version and the current one is summarised in Table 7.1. In 2010, we covered ASEAN 10 countries, Bangladesh, and parts of China and India. Now the model includes whole regions of China and India, and other economies in East and South Asia such as Japan, Korea, Sri Lanka, Bhutan, and Nepal. The model also covers other areas of the world, referred as ‘Rest of the World’. We use country data for those 65 other countries. In 2010, border costs, tariffs, and non-tariff barriers (NTBs) were treated as one parameter representing a border barrier in a broader sense, while they are estimated separately and incorporated into the model in the latest version.¹² The current version of the IDE/ERIA-GSM also incorporates changes in productivity parameters, which describes SEZ (special economic zone) development or disasters, and

¹² As for the construction of the data on non-tariff barriers (NTBs), see Appendix 2. Note that the definition of NTBs is a broad one, a part of which can be removed by policies while others may not.

congestion at borders, ports, and airports that is endogenously calculated in the model.

Table 7.1. Comparison of IDE/ERIA-GSM for CADP (2010) and CADP 2.0 (2015)

	For CADP (2010)	For CADP 2.0 (2015)
Version of IDE/ERIA-GSM	4.0	9.0
Number of economies in East and South Asia	15	21
Number of regions	956	1,818
Number of nodes	1,676	5,833
Number of routes	2,691	10,906
Number of transport modes	Road, Sea, and Air	Road, Sea, Air, and Rail
Number of industries	7	7
Intermediate goods	Yes	Yes
Non-tariff barriers	No	Yes
Rest of the World	No	65 economies
Tariff data	No	Yes
SEZ/disaster analysis	No	Yes
Congestion	No	Yes

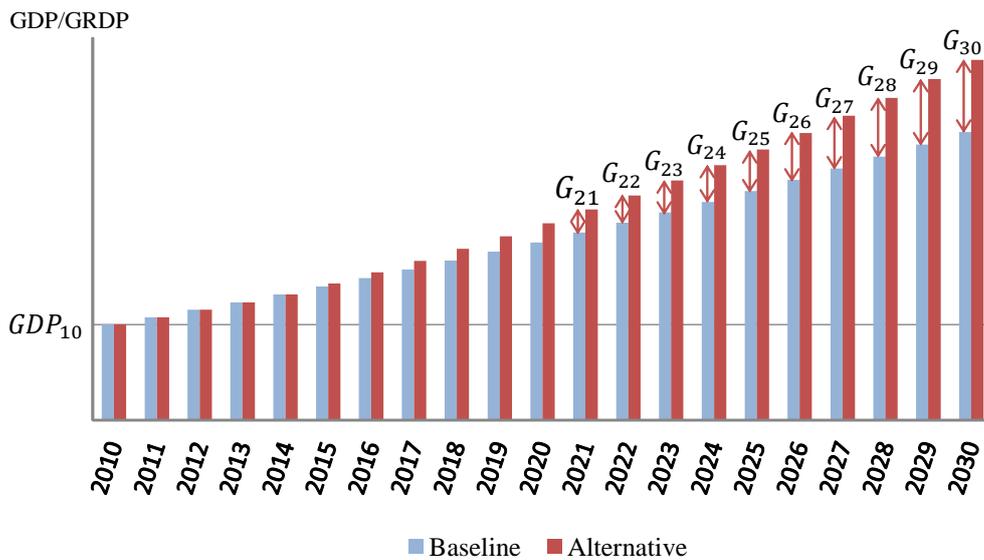
SEZ = special economic zone.

Source: ERIA-IDE Team.

7.2. Scenarios and Results

We conducted a baseline scenario and other alternative development scenarios. A 10-year (2021–2030) cumulative impact would be shown as *Impact density*, that is, the impact in US dollars divided by area, and percentage which is derived as Figure 7.2.

Figure 7.2. Economic Impact, in percentage



$$\text{Economic Impact} = \frac{\sum_{y=21}^{30} G_y}{GDP_{10}}$$

Source: ERIA-IDE Team.

Baseline scenario

We have the following assumptions across all scenarios:

- The national population of each country is assumed to increase by the rate forecasted by the United Nations Population Division until year 2030.
- International migration is prohibited.
- Tariffs and non-tariff barriers are changing based on FTA/EPAs (free trade agreements/economic partnership agreements) that are currently effective.
- We have calibrated different exogenous ‘technology progress’ parameters for each country to replicate the average GDP growth rate between 2010 and 2020 projected in the World Economic Outlook Database by the International Monetary Fund.

In the baseline and other development scenarios, we assume that some specific infrastructure projects are completed in 2015 in the model. Those projects include the Third and Fourth Mekong Bridge; expressways provision and extension in Myanmar, Indonesia, and the Philippines; road construction and improvement in Myanmar; and the Tsubasa Bridge in Cambodia.

Table 7.2. Grand Table: Economic Impact in 10 Years Cumulation (2021–2030, %)

Economy	MIEC	EWEC	NSEC	IMT	IMT+	BIMP-EAGA	BIMP-EAGA+	BIMSTEC	All Infra.	NTB	SEZ	All-All
Australia	0.52	0.00	0.02	0.08	0.15	0.22	0.33	0.65	1.28	0.84	-0.04	2.10
Bangladesh	0.48	0.00	-0.01	-0.04	-0.05	-0.05	-0.07	11.45	11.51	8.48	0.02	20.56
Bhutan	5.84	0.00	-0.03	0.06	0.07	0.02	0.07	3.91	104.90	4.75	-0.01	109.81
Brunei												
Darussalam	1.95	0.01	-0.29	0.39	0.61	1.00	1.41	1.93	5.32	82.07	-0.12	88.33
Cambodia	144.45	0.00	-0.58	-0.02	-0.02	-0.03	-0.06	-0.26	24.86	8.44	125.39	160.30
China	0.15	0.00	0.00	0.00	-0.01	-0.01	-0.02	0.06	0.10	7.74	0.02	7.99
India	0.56	0.00	0.00	0.02	0.03	0.02	0.03	6.61	6.59	12.21	-0.01	19.28
Indonesia	0.07	0.00	0.00	2.20	35.01	27.30	57.88	0.07	91.87	25.86	0.03	118.50
Japan	0.52	0.00	0.02	0.10	0.12	0.18	0.22	0.57	1.39	1.29	-0.03	2.67
Korea	0.71	0.03	0.03	0.11	0.15	0.33	0.36	0.55	1.74	2.44	-0.03	4.17
Lao PDR	-1.58	25.55	2.69	-0.03	-0.04	-0.03	-0.04	-0.09	61.85	12.85	79.06	156.58
Malaysia	1.64	0.04	0.02	0.54	0.75	0.25	0.69	1.47	3.46	54.36	-0.01	58.55
Myanmar	9.80	44.27	5.54	-0.05	-0.06	-0.07	-0.09	76.70	89.19	25.35	70.54	193.82
Nepal	0.13	0.00	0.00	0.00	0.00	0.00	0.00	1.25	6.10	8.33	0.00	14.69
New Zealand	0.56	-0.01	0.03	0.09	0.13	0.17	0.24	0.71	1.29	0.28	-0.06	1.52
Philippines	0.19	0.00	-0.01	-0.04	0.46	0.97	13.08	0.07	13.76	25.10	0.03	39.82
Singapore	3.74	0.15	0.04	1.25	1.50	0.67	1.36	4.86	7.86	6.06	-0.11	13.92
Sri Lanka	6.43	0.00	0.01	0.00	0.01	-0.01	0.03	6.15	8.20	29.30	0.02	40.82
Taiwan	0.75	0.04	0.06	0.12	0.16	0.34	0.40	0.64	1.80	1.79	-0.04	3.57
Thailand	4.64	0.02	0.51	0.11	0.22	0.05	0.18	0.44	7.86	41.68	0.02	51.58
Viet Nam	57.57	1.05	-0.20	-0.01	-0.02	-0.03	-0.03	0.20	17.14	47.47	56.86	124.81
United States	0.27	0.00	0.00	0.02	0.04	0.04	0.04	0.19	0.52	0.88	-0.01	1.39
Russia	-0.05	0.00	0.00	0.00	0.00	0.00	0.01	-0.03	-0.03	0.56	0.00	0.54
European Union	-0.15	0.00	0.01	0.07	0.09	0.09	0.15	0.01	0.86	0.88	-0.03	1.72
ASEAN10	6.11	1.34	0.23	1.06	13.37	10.37	23.16	2.92	42.08	31.19	6.33	80.87
EAS16	1.02	0.15	0.04	0.16	1.52	1.23	2.65	1.25	5.93	7.87	0.68	14.73
World	0.34	0.04	0.01	0.08	0.49	0.40	0.84	0.46	2.20	2.94	0.19	5.41

BIMP-EAGA = Brunei Darussalam–Indonesia–Malaysia–The Philippines East ASEAN Growth Area, BIMP-EAGA+ = BIMP-EAGA and surrounding regions, BIMSTEC = Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation, EWEC = East–West Economic Corridor, IMT = Indonesia–Malaysia–Thailand Growth Triangle, IMT+ = IMT and surrounding regions, MIEC = Mekong–India Economic Corridor, NSEC = North–South Economic Corridor, NTB = non-tariff barrier, SEZ = special economic zone. Source: IDE/ERIA-GSM simulation result.

Development scenario

We have eight economic corridor development and subregional development scenarios: (1) Mekong–India Economic Corridor (MIEC), (2) Greater Mekong Subregion (GMS) East–West Economic Corridor (EWEC), (3) GMS North–South Economic Corridor (NSEC), (4) Indonesia–Malaysia–Thailand Growth Triangle (IMT), (5) IMT and surrounding regions (IMT+), (6) Brunei Darussalam–Indonesia–Malaysia–Philippines East ASEAN Growth Area (BIMP-EAGA), (7) BIMP-EAGA and surrounding regions (BIMP+), and (8) Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC). We have four sectoral development scenarios—all infrastructure development (All Infra.); NTB reduction (NTB); SEZ development in Cambodia, Lao PDR, Myanmar, and Viet Nam (SEZ); and combination of those three sectoral development scenarios (All-All). The impact of all scenarios is summarised in Table 7.2.

In each scenario is a combination of different types of trade and transport facilitation measures:

- Road development and improvement which provide a new road section or reduce time at the specific road section in the model
- Railway development and improvement which provide a new rail section or reduce time at the specific rail section in the model
- Sea route establishment and enhancement which provide a new sea section or reduce time at the specific sea section in the model
- Port construction and upgrade which reduce time and costs at loading, unloading, and trans-shipping goods at the port and prevent congestion
- Airport upgrade which reduces time and costs at loading, unloading, and trans-shipping goods at the airport and prevents congestion
- Border post upgrade and border facilitation which reduce time and costs for passing the border and prevent congestion
- SEZ development which raises the productivity parameter of the specific region in the model
- NTB reduction where NTB in manufacturing and services sector in the specific economy is lowered

(1) Mekong–India Economic Corridor (MIEC)

Figure 7.3 illustrates the economic effect of the MIEC. The simulation is based on the scenario that SEZ development in the GMS in 2015 is associated with one-shot productivity improvement. The scenario also assumes connectivity improvements, the development of Dawei, and associated one-shot productive improvement at Dawei in 2020. The following lists the scenario with more details.

2015

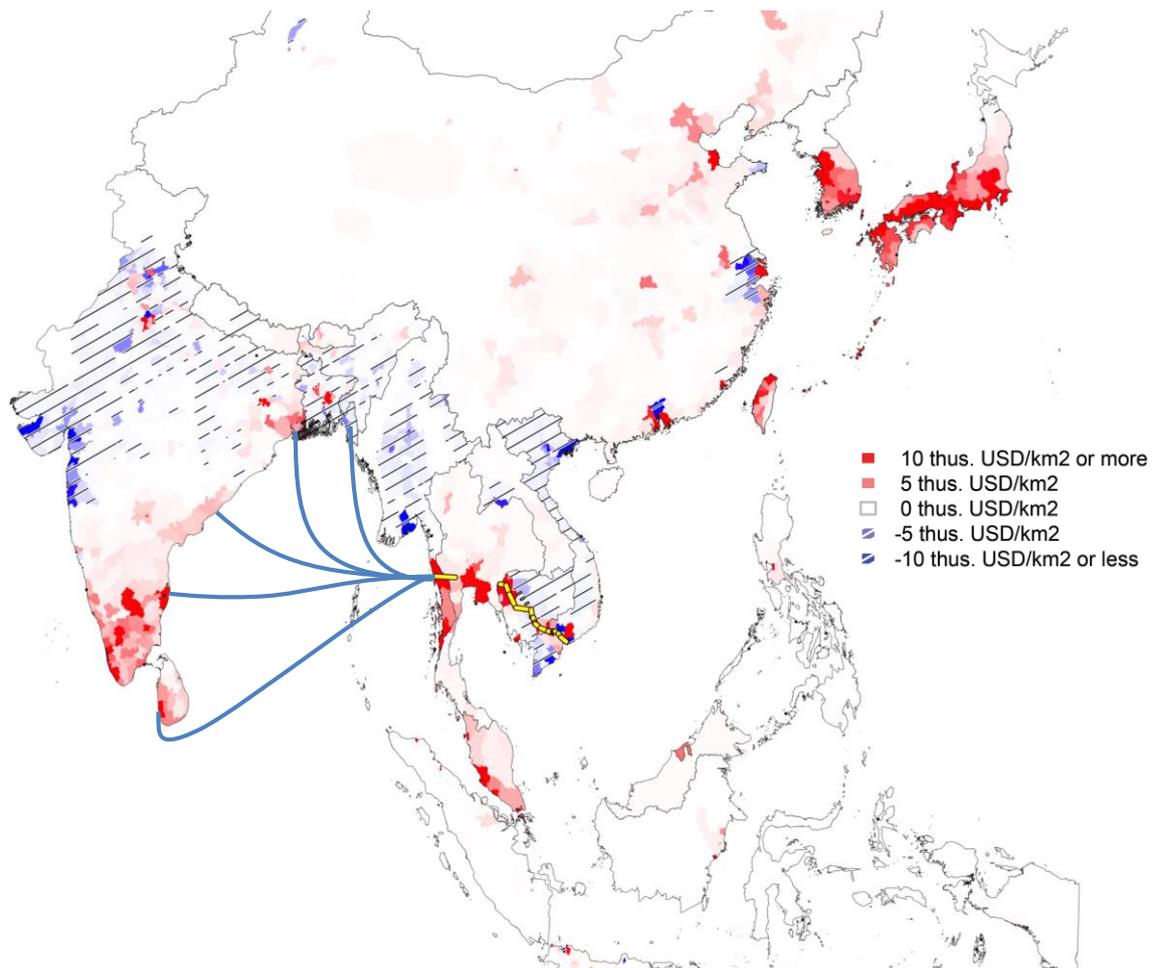
(a) Productivity improvement by five percent at Ho Chi Minh City, Bien Hoa, Svay Rieng, Phnom Penh, Kandal, Batdambang, Sisophon, and Krong Preah Sihanouk

2020

- (a) Road improvement along National Roads No. 1 and 5 in Cambodia
- (b) Road improvement between Moc Bai and Cai Mep Port in Viet Nam
- (c) Road improvement between Kanchanaburi and Dawei Port
- (d) Connection of Dawei with Chittagong, Kolkata, Visakhapatnam, Chennai, and Colombo by sea routes equivalent to internationally important routes
- (e) Border facilitation at borders between Poipet and Aranyaprathet, Bavet and Moc Bai, and Phu Nam Ron and Thiki
- (f) Productivity improvement by 50 percent at Dawei
- (g) Port and airport expansion to prevent congestion:
 - Port Dawei
 - Port Bangkok
 - Port Laem Chabang
 - Port Map Ta Phut
 - Port Sihanoukville
 - Port Saigon
 - Port Cai Mep
 - Port of Colombo
 - Port Visakhapatnam
 - Port Madras
 - Port Chittagong
 - Port Calcutta
 - Port Haldia
 - Airport Don Muang International
 - Airport Suvarnabhumi International

- Airport U Taphao International
- Airport Phnom Penh International
- Airport Tansonnhat International
- Airport Netaji Subhash Chandra Bose International
- Airport Chennai International

Figure 7.3. Economic Impact of Mekong–India Economic Corridor (2030, Impact Density)



Note: Data not available for North Korea and Timor-Leste. Data not available for Jammu and Kashmir.
Source: IDE/ERIA-GSM simulation result.

The top gainers in percentage of 10 years' cumulation will be Dawei, Myanmar (939.65 percent); Phnom Penh, Cambodia (389.17 percent); and Dong Nai, Viet Nam (388.05 percent). It is noteworthy that other countries such as Japan, South Korea, Malaysia, and Singapore will have a high positive impact even though we did not include any improvements or development for those countries. Myanmar will have a relatively smaller positive impact (9.80 percent) than Cambodia (144.45 percent) and Viet Nam (57.57

percent) due to the lack of link between Dawei and other regions in the country in this scenario. As discussed in previous studies, Myanmar should combine MIEC development with domestic corridor development and regulatory reform to fully benefit from the Dawei and MIEC projects.

Table 7.3. Top 10 Gainers of Mekong–India Economic Corridor (Cumulative Impact during 2021–2030/ GDP in 2010)

	Region	Country	%
1	Dawei	Myanmar	939.7
2	Phnom Penh	Cambodia	389.2
3	Dong Nai	Viet Nam	388.1
4	Kawthoung	Myanmar	254.5
5	Ho Chi Minh City	Viet Nam	244.2
6	Kandal	Cambodia	183.5
7	Sihanoukville	Cambodia	145.8
8	Banteay Meanchey	Cambodia	136.7
9	Svay Rieng	Cambodia	123.5
10	Battambang	Cambodia	123.5

Source: IDE/ERIA-GSM simulation result.

(2) GMS East–West Economic Corridor (EWEC)

The EWEC scenario assumes a one-shot productivity improvement by five percent in 2015 at Thakhek, Savannakhet and Pakse, Lao PDR, and in 2020 at Hpa An, Myawaddy, and Yangon, Myanmar on the EWEC. The scenario also assumes improvements in hard infrastructure in Lao PDR, Myanmar, and Viet Nam and soft infrastructure at Myanmar–Thailand, Thailand–Lao PDR, and Lao PDR–Viet Nam borders in 2020. The following lists the scenario with more details.

2015

(a) Productivity improvement by five percent at Thakhek, Savannakhet, and Pakse

2020

(a) Road improvement between Da Nang to Lao Bao in Viet Nam

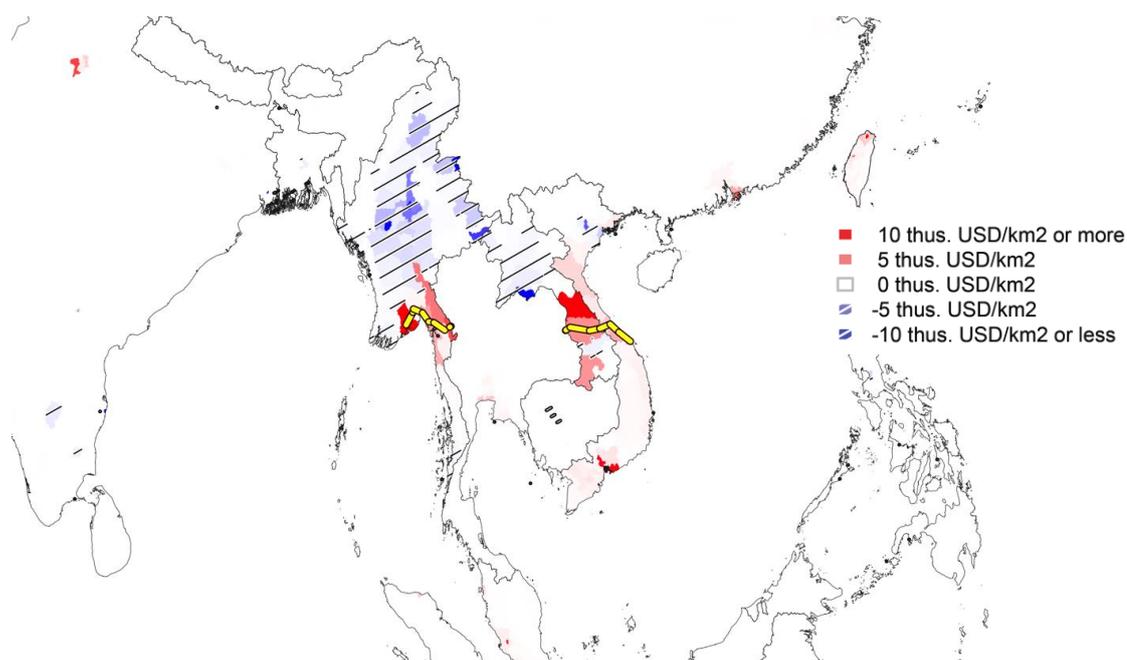
(b) Road improvement between Densavanh to Kaysone Phomvihane in Lao PDR

(c) Road improvement between Kawkareik to Yangon in Myanmar

(d) Border facilitation at borders between Myawaddy and Mae Sot, Mukdahan and Kaysone Phomvihane (Savannakhet), and Densavanh and Lao Bao

- (e) Productivity improvement by five percent at Hpa An, Myawaddy, and Yangon
- (f) Port and airport expansion to prevent congestion:
 - Port Da Nang
 - Port Yangon
 - Airport Yangon International
 - Airport Danang International

**Figure 7.4. Economic Impact of East–West Economic Corridor
(2030, Impact Density)**



Source: IDE/ERIA-GSM simulation result.

**Table 7.4. Top 10 Gainers of East–West Economic Corridor
(Cumulative Impact during 2021–2030/ GDP in 2010)**

	Region	Country	%
1	Yangon	Myanmar	226.3
2	Khammouan	Lao PDR	216.4
3	Myawaddy	Myanmar	207.6
4	Hpa-An	Myanmar	76.0
5	Savannakhet	Lao PDR	74.7
6	Champasak	Lao PDR	66.2
7	Thaton	Myanmar	19.4
8	Quang Tri	Viet Nam	17.3
9	Thua Thien-Hue	Viet Nam	16.3
10	Mawlamyine	Myanmar	14.3

Source: IDE/ERIA-GSM simulation result.

EWEC in this scenario is extended to Yangon from Hpa An, where road improvements are not assumed in the MIEC scenario. We assume road improvement in Viet Nam, Lao PDR, and Myanmar and no improvement in Thailand. The top gainers from this scenario will be Yangon, Myanmar (226.26 percent); Khammouan, Lao PDR (216.44 percent); and Myawaddy, Myanmar (207.63 percent). Hpa-An, Myanmar (75.97 percent) and Savannakhet, Lao PDR (74.72 percent) will follow after the three top regions.

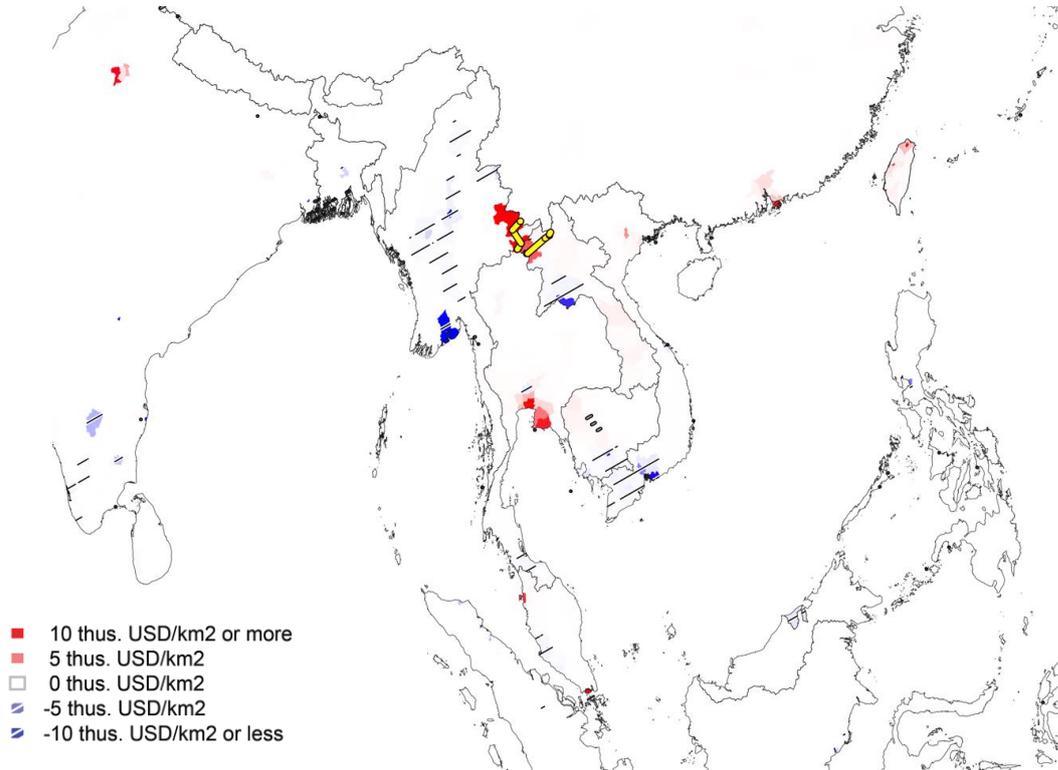
(3) GMS North–South Economic Corridor (NSEC)

The NSEC scenario assumes a five percent productivity improvement in Myanmar; road improvement at the Lao PDR and Myanmar sections; and cross-border facilitation at China–Lao PDR, China–Myanmar, Lao PDR–Thailand, and Myanmar–Thailand borders in 2020. The scenario also assumes expansion of ports in Thailand and airports in China and Thailand. The following lists the scenario with more details.

2020

- (a) Road improvement between Tachileik to Daluo in Myanmar
- (b) Road improvement between Houayxay and Boten in Lao PDR
- (c) Border facilitation at borders between Mae Sai and Tachileik, Daluo and Mong La, Chiang Khong and Houayxay, and Boten and Mohan
- (d) Productivity improvement by five percent at Tachileik and Kengtung
- (e) Port and airport expansion to prevent congestion:
 - Port Bangkok
 - Port Laem Chabang
 - Port Map Ta Phut
 - Airport Don Muang International
 - Airport Suvarnabhumi International
 - Airport U Taphao International
 - Airport Chiang Rai International
 - Airport Wujiaba

**Figure 7.5. Economic Impact of North–South Economic Corridor
(2030, Impact Density)**



Source: IDE/ERIA-GSM simulation result.

**Table 7.5. Top 10 Gainers of North–South Economic Corridor
(Cumulative Impact during 2021–2030/ GDP in 2010)**

	Region	Country	%
1	Tachileik	Myanmar	433.6
2	Kengtung	Myanmar	187.4
3	Bokeo	Lao PDR	118.9
4	Louang-Namtha	Lao PDR	10.9
5	Khammouan	Lao PDR	7.1
6	Oudomxai	Lao PDR	6.4
7	Pailin	Cambodia	5.3
8	Phongsali	Lao PDR	5.2
9	Monghpyak	Myanmar	5.2
10	Louang Prabang	Lao PDR	5.0

Source: IDE/ERIA-GSM simulation result.

Because better connectivity has already been achieved between Ha Noi and Kunming, including Noi Bai–Lao Cai Expressway, the NSEC in this scenario, which includes only unfinished projects, excludes the Kunming–Ha Noi section. The three top beneficiaries

of NSEC will be Tachileik, Myanmar (433.62 percent); Kengtung, Myanmar (187.40 percent); and Bokeo, Lao PDR (118.94 percent). The NSEC will have the smallest impact on ASEAN (0.23 percent) as a whole compared with the MIEC (6.11 percent), EWEC (1.34 percent), and other subregional integration scenarios.

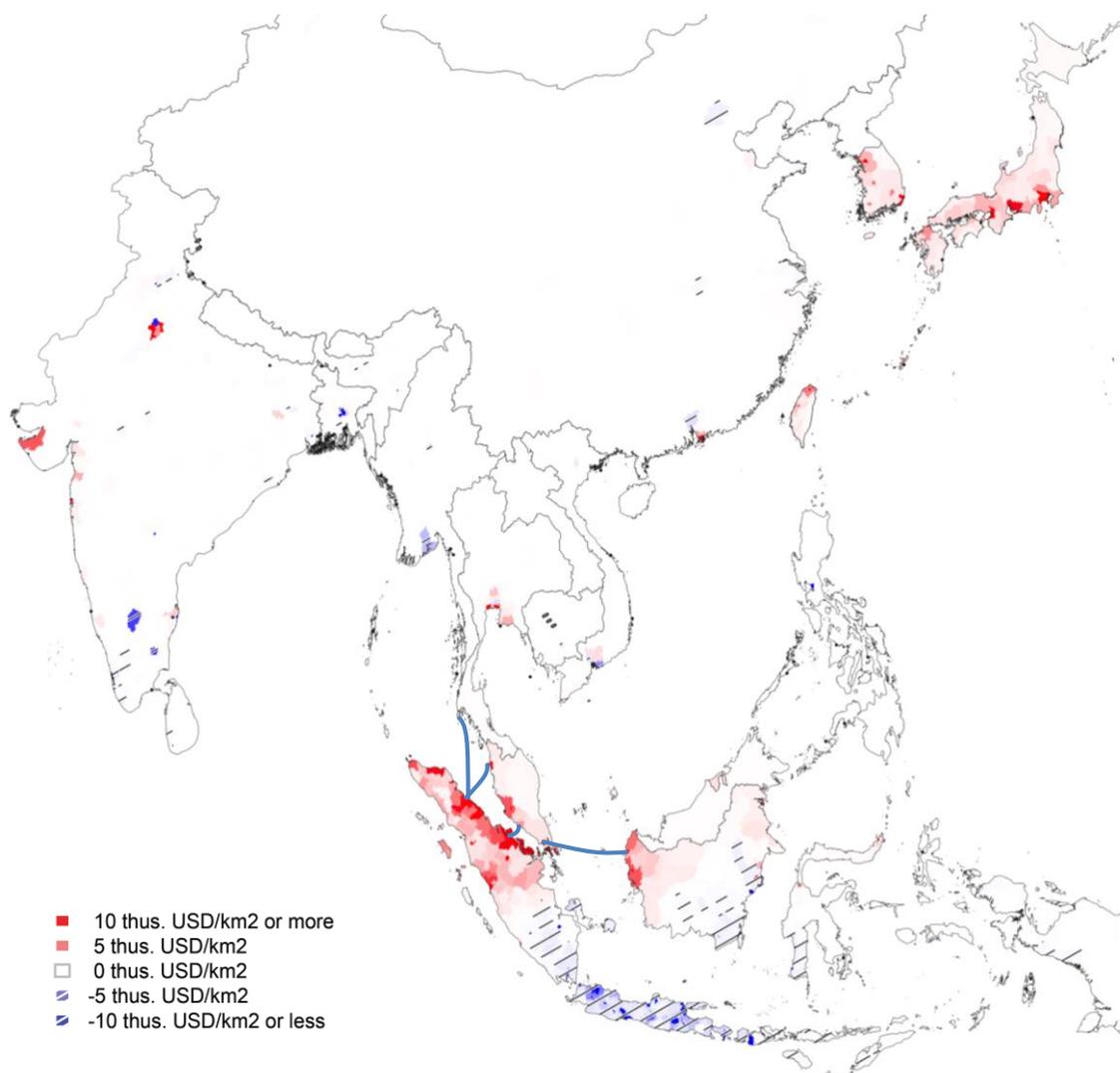
(4-1) Indonesia–Malaysia–Thailand Growth Triangle (IMT)

2020

- (a) New RoRo route between Tanjung Pelepas and Sambas
- (b) New RoRo route between Malacca and Dumai
- (c) New RoRo route between Penang and Belawan and Phuket and Belawan
- (d) Port and airport expansion to prevent congestion:
 - Port Dumai
 - Port Malacca
 - Port Belawan
 - Port Penang
 - Port Phuket
 - Airport Penang International
 - Airport Phuket International

This scenario includes proposed RoRo routes in the Master Plan on ASEAN Connectivity (MPAC) and some additional routes. Top gainers will be Kota Pontianak, Indonesia (78.12 percent); Kota Singkawang, Indonesia (62.00 percent); and Kota Medan, Indonesia (59.54 percent). The top gainer country from the scenario is Indonesia (2.20 percent), followed by Singapore (1.25 percent).

Figure 7.6. Economic Impact of Indonesia–Malaysia–Thailand Growth Triangle (2030, Impact Density)



Note: Data not available for North Korea and Timor-Leste. Data not available for Jammu and Kashmir.
Source: IDE/ERIA-GSM simulation result.

Table 7.6. Top 10 Gainers of Indonesia–Malaysia–Thailand Growth Triangle (Cumulative Impact during 2021–2030/GDP in 2010)

	Region	Country	%
1	Kota Pontianak	Indonesia	78.1
2	Kota Singkawang	Indonesia	62.0
3	Kota Medan	Indonesia	59.5
4	Kota Banda Aceh	Indonesia	50.2
5	Bengkayang	Indonesia	40.4
6	Kota Pekanbaru	Indonesia	40.0
7	Kota Tarakan	Indonesia	39.9
8	Kota Sabang	Indonesia	39.7
9	Kota Tebingtinggi	Indonesia	39.7
10	Pontianak	Indonesia	39.4

Source: IDE/ERIA-GSM simulation result.

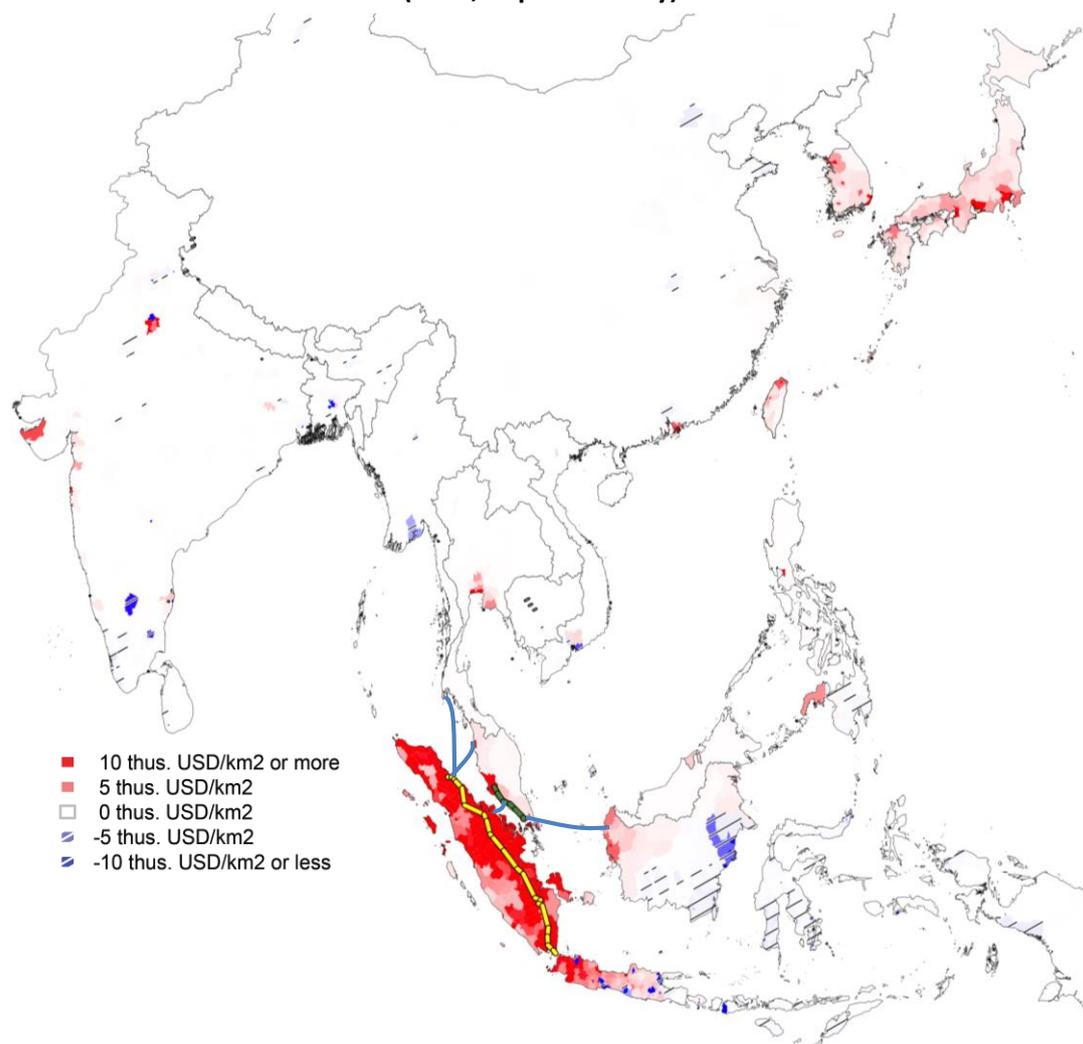
(4-2) Indonesia–Malaysia–Thailand Growth Triangle Plus (IMT+)

2020

- (a) Road improvement along Trans-Sumatran Highway between Medan and Bakaheuni
- (b) Kuala Lumpur–Singapore High-Speed Rail Link
- (c) New RoRo route between Tanjung Pelepas and Sambas
- (d) New RoRo route between Malacca and Dumai
- (e) New RoRo route between Penang and Belawan and Phuket and Belawan
- (f) Port and airport expansion to prevent congestion:
 - Port Dumai
 - Port Malacca
 - Port Belawan
 - Port Penang
 - Port Phuket
 - Port Kelang
 - Port Jakarta
 - Airport Penang International
 - Airport Phuket International
 - Airport Kuala Lumpur International
 - Airport Soekarno Hatta International

In this IMT+ scenario, we added the Trans-Sumatran Highway between Medan and Bakaheuni, a high-speed rail link between Kuala Lumpur and Singapore, and port and airport expansions in Kuala Lumpur and Jakarta. The economic impact of the IMT+ scenario on ASEAN would be more than 10 times bigger than the original IMT scenario. The top gainers will be Kota Medan (394.28 percent), Kota Pekanbaru (327.17 percent), and Kota Lhokseumawe (296.86 percent) of the island of Sumatra in Indonesia. Top gainer country from the scenario is Indonesia (35.01 percent), followed by Singapore (1.50 percent). IMT+ will have a considerably bigger impact on ASEAN (13.37 percent) compared with the IMT (1.06 percent).

Figure 7.7. Economic Impact of IMT+ (2030, Impact Density)



IMT+ = Indonesia–Malaysia–Thailand Growth Triangle and surrounding regions.

Note: Data not available for North Korea and Timor-Leste. Data not available for Jammu and Kashmir.

Source: IDE/ERIA-GSM simulation result.

Table 7.7 Top 10 Gainers of IMT+ (Cumulative Impact during 2021–2030/GDP in 2010)

	Region	Country	%
1	Kota Medan	Indonesia	394.3
2	Kota Pekanbaru	Indonesia	327.2
3	Kota Lhokseumawe	Indonesia	296.9
4	Kota Tebingtinggi	Indonesia	294.1
5	Kota Banda Aceh	Indonesia	278.5
6	Kota Pematang Siantar	Indonesia	275.9
7	Kota Jambi	Indonesia	267.2
8	Kota Binjai	Indonesia	240.7
9	Kota Tanjungbalai	Indonesia	222.0
10	Kota Langsa	Indonesia	216.1

IMT+ = Indonesia–Malaysia–Thailand Growth Triangle and surrounding regions.

Source: IDE/ERIA-GSM simulation result.

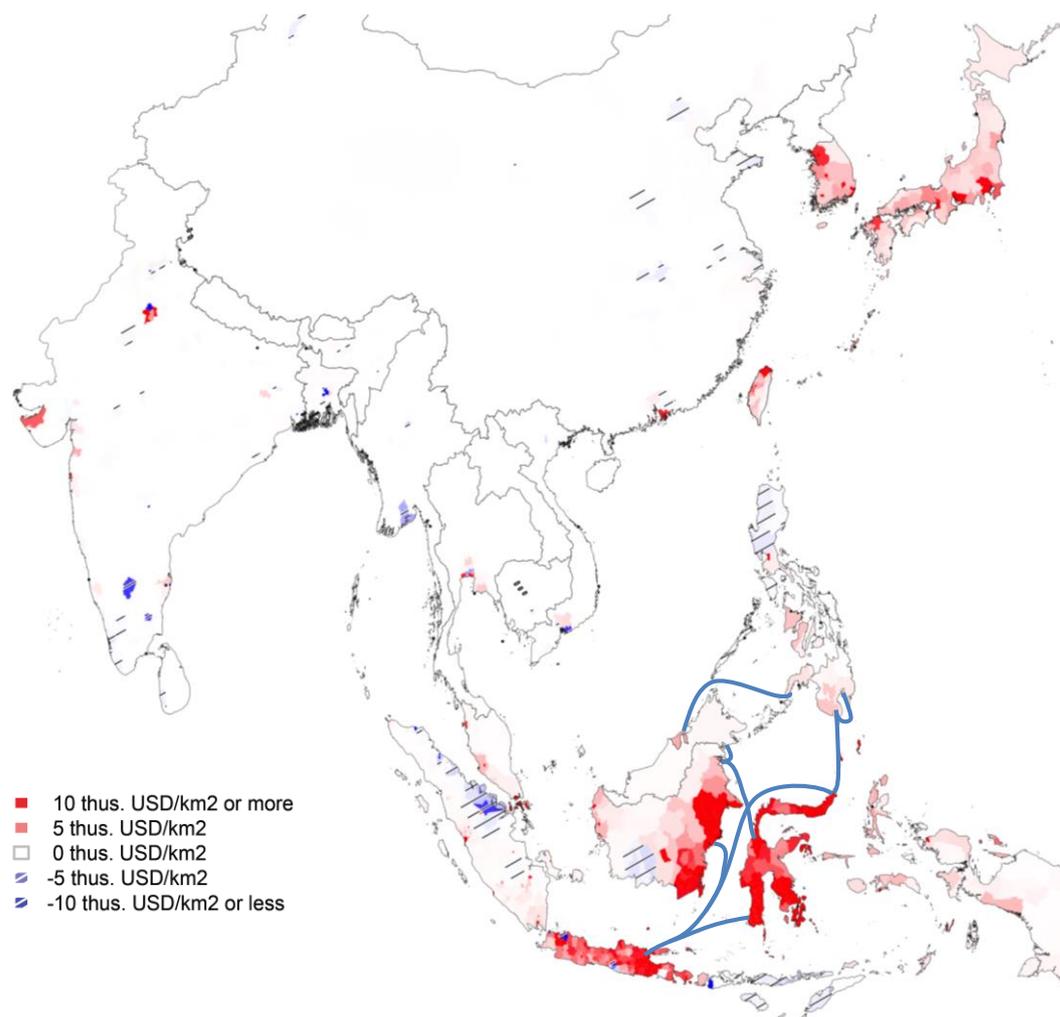
(5-1) Brunei Darussalam–Indonesia–Malaysia–The Philippines East ASEAN Growth Area (BIMP-EAGA)

2020

- (a) New RoRo route along Davao–General Santos–Bitung
- (b) New RoRo route between Zamboanga and Muara
- (c) New RoRo route along Tawau–Tarakan–Palu
- (d) Sea route improvement between Surabaya and Makassar
- (e) Sea route improvement between Surabaya and Balikpapan
- (f) Sea route improvement between Surabaya and Bitung
- (g) Port expansion to prevent congestion:
 - Port Makassar
 - Port Balikpapan
 - Port Bitung
 - Port General Santos

As in the IMT scenario, the BIMP scenario includes proposed RoRo routes in MPAC and some additional routes. Top beneficiary regions will be Kota Makassar (513.76 percent), Kota Pare-pare (468.24 percent), and Kota Manado (455.73 percent) of the island of Sulawesi in Indonesia. Top gainer country is Indonesia (27.30 percent), followed by Brunei Darussalam (1.00 percent). BIMP will bring 10.37 percent of the economic impact to ASEAN.

**Figure 7.8. Economic Impact of BIMP-EAGA
(2030, Impact Density)**



BIMP-EAGA = Brunei Darussalam–Indonesia–Malaysia–The Philippines East ASEAN Growth Area.
 Note: Data not available for North Korea and Timor-Leste. Data not available for Jammu and Kashmir.
 Source: IDE/ERIA-GSM simulation result.

**Table 7.8. Top 10 Gainers of BIMP-EAGA
(Cumulative Impact during 2021–2030/ GDP in 2010)**

	Region	Country	%
1	Kota Makasar	Indonesia	513.8
2	Kota Pare-pare	Indonesia	468.2
3	Kota Manado	Indonesia	455.7
4	Kota Balikpapan	Indonesia	402.3
5	Kendari	Indonesia	364.2
6	Kota Samarinda	Indonesia	351.1
7	Kota Bitung	Indonesia	339.1
8	Kota Tomohon	Indonesia	326.5
9	Kota Palu	Indonesia	317.2
10	Kota Kendari	Indonesia	317.0

BIMP-EAGA = Brunei Darussalam–Indonesia–Malaysia–The Philippines East ASEAN Growth Area.
 Source: IDE/ERIA-GSM simulation result.

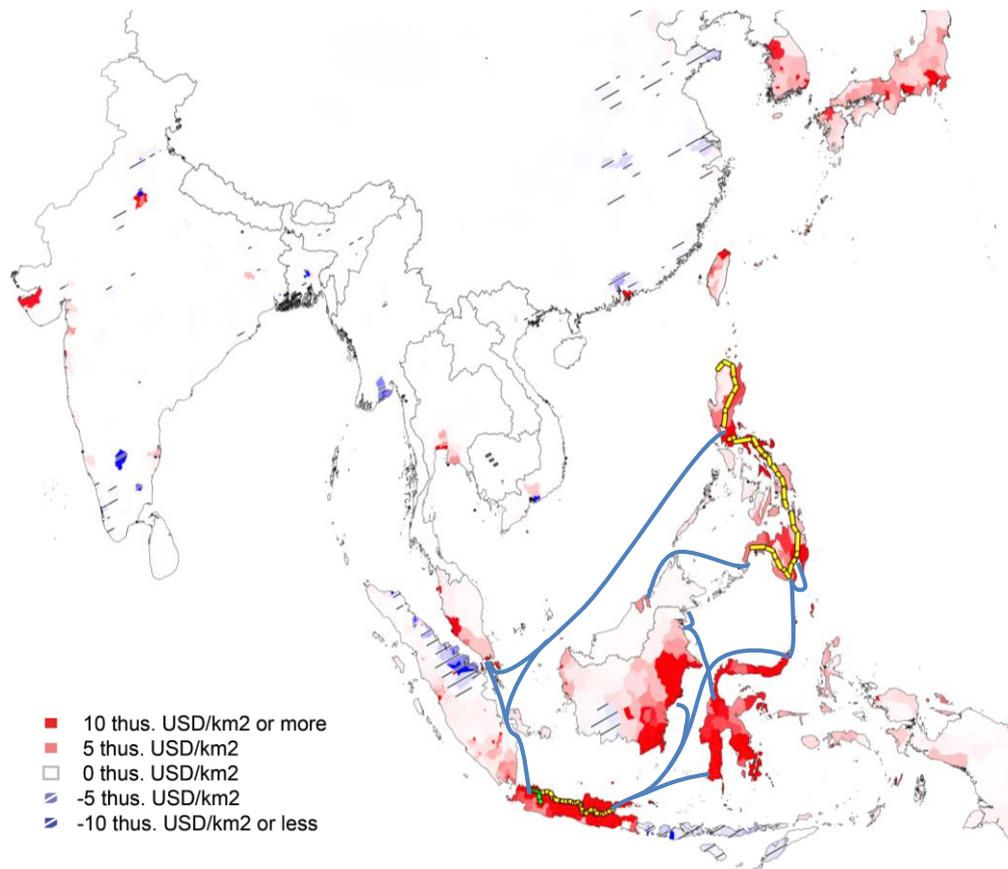
(5-b) Brunei Darussalam–Indonesia–Malaysia–The Philippines East ASEAN Growth Area Plus (BIMP-EAGA+)

2020

- (a) Road improvement along Trans-Java Highway between Cirebon and Surabaya
- (b) Road improvement along Pan-Philippine Highway between Laoag and Guiguinto, Santo Tomas and Matnog, Allen to Liloan, and Lipata and Ipil
- (c) New RoRo route along Davao–General Santos–Bitung
- (d) New RoRo route between Zamboanga and Muara
- (e) New RoRo route along Tawau–Tarakan–Palu
- (f) Sea route improvement between Manila and Singapore, Singapore and Jakarta, and Jakarta and Manila
- (g) Sea route improvement between Surabaya and Makassar
- (h) Sea route improvement between Surabaya and Balikpapan
- (i) Sea route improvement between Surabaya and Bitung
- (j) Jakarta–Bandung High-Speed Railway
- (k) Port and airport expansion to prevent congestion:
 - Port Makassar
 - Port Balikpapan
 - Port Bitung
 - Port General Santos
 - Port Jakarta
 - Port Semarang
 - Port Surabaya
 - Port Manila
 - Airport Ninoy Aquino International
 - Airport Soekarno Hatta International

We added expressway construction between Cirebon and Surabaya in Indonesia and along the Pan-Philippine Highway in the Philippines, and sea route improvement among Singapore, Manila, and Jakarta. Kota Makassar (544.93 percent), Kota Pare-pare (496.66 percent), and Kota Manado (469.94 percent) will gain the most. It must be noted that those top three regions are the same as those in the BIMP scenario and they gain more than the previous scenario. BIMP-EAGA+ will also have a considerably bigger economic impact on ASEAN (23.16 percent), particularly Indonesia (57.88 percent) and the Philippines (13.08 percent), compared with BIMP-EAGA (10.37 percent on ASEAN, 27.30 percent on Indonesia, and 0.97 percent on the Philippines).

Figure 7.9. Economic Impact of BIMP-EAGA+ (2030, Impact Density)



BIMP-EAGA+ = Brunei Darussalam–Indonesia–Malaysia–The Philippines East ASEAN Growth Area and surrounding regions.

Note: Data not available for North Korea and Timor-Leste. Data not available for Jammu and Kashmir.

Source: IDE/ERIA-GSM simulation result.

Table 7.9. Top 10 Gainers of BIMP-EAGA+ (Cumulative Impact during 2021–2030/GDP in 2010)

	Region	Country	%
1	Kota Makasar	Indonesia	544.9
2	Kota Pare-pare	Indonesia	496.7
3	Kota Manado	Indonesia	469.9
4	Kota Balikpapan	Indonesia	420.7
5	Kendari	Indonesia	382.4
6	Kota Samarinda	Indonesia	376.2
7	Kota Bitung	Indonesia	349.5
8	Kota Tomohon	Indonesia	337.2
9	Kota Kendari	Indonesia	332.6
10	Kota Palu	Indonesia	331.5

BIMP-EAGA+ = Brunei Darussalam–Indonesia–Malaysia–The Philippines East ASEAN Growth Area and surrounding regions.

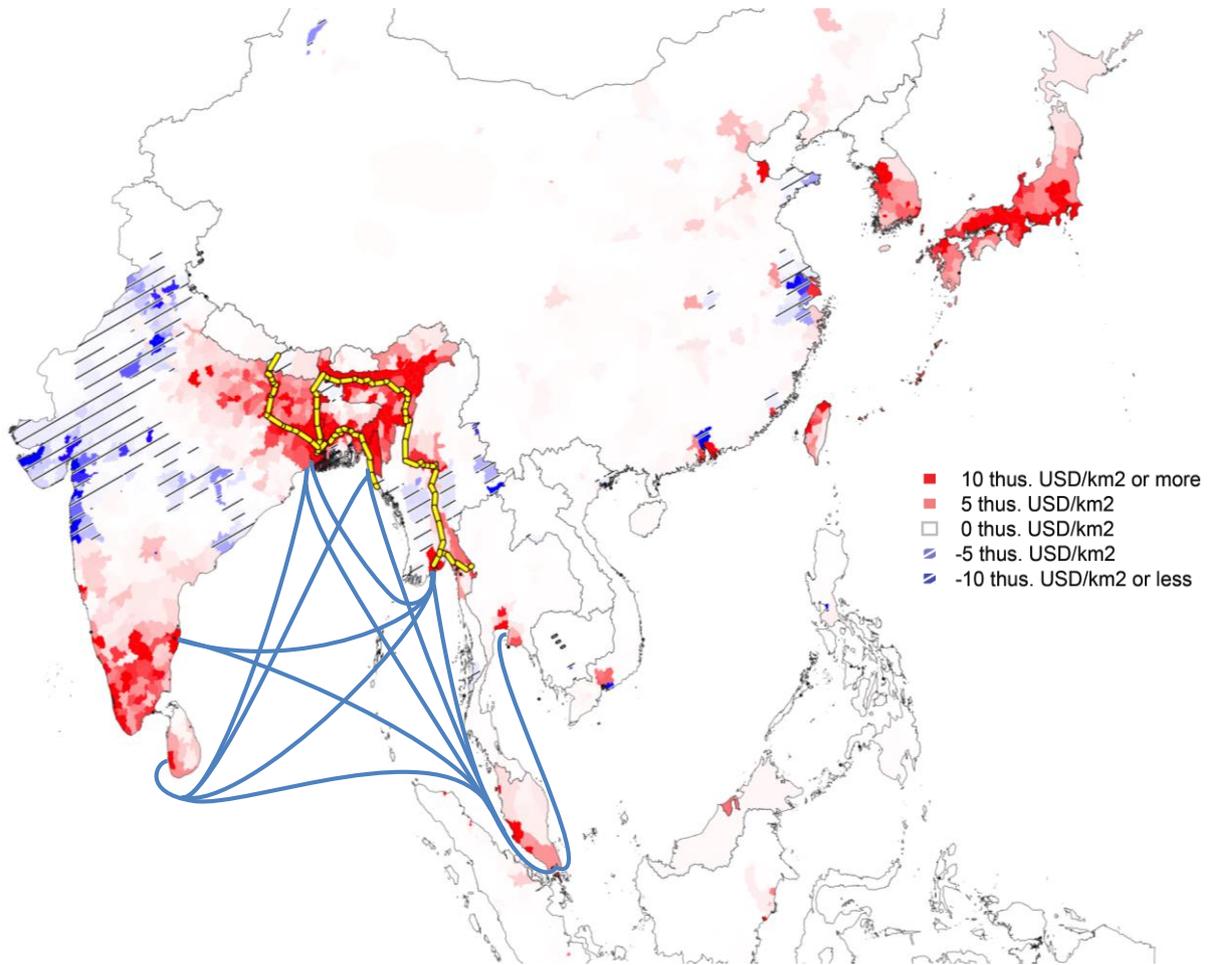
Source: IDE/ERIA-GSM simulation result.

(6) Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC)

2020

- (a) Road improvement between Kawkareik and Yangon, and Payagyi and Tamu in Myanmar
- (b) Road improvement between Moreh and Kolkata, Raxaul and Kolkata, and Petrapole and Kolkata in India
- (c) Road improvement between Benapole and Teknaf in Bangladesh
- (d) Road improvement between Birgunj and Kathmandu in Nepal
- (e) Border facilitation at borders between Mae Sot and Myawaddy, Tamu and Moreh, Petrapole and Benapole, and Raxaul and Birgunj
- (f) Productivity improvement by five percent at Hpa-An, Myawaddy, Mandalay, Yangon, and Kyaukpyu
- (g) Sea route improvement at selected routes:
 - Port Laem Chabang–Port Singapore
 - Port Singapore–Port Yangon
 - Port Chittagong–Port Singapore
 - Port Haldia–Port Singapore
 - Port Madras–Port Singapore
 - Port of Colombo–Port Singapore
 - Port Calcutta–Port Yangon
 - Port Yangon–Port Madras
 - Port Yangon–Port of Colombo
 - Port of Colombo–Port Haldia
 - Port of Colombo–Port Chittagong
- (h) Port and airport expansion to prevent congestion:
 - Port Chittagong
 - Port Haldia
 - Port Madras
 - Port of Colombo
 - Port Yangon
 - Airport Yangon International
 - Airport Netaji Subhash Chandra Bose International
 - Airport Zia International
 - Airport Chennai International

**Figure 7.10. Economic Impact of BIMSTEC
(2030, Impact Density)**



BIMSTEC = Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation.

Note: Data not available for North Korea. Data not available for Jammu and Kashmir.

Source: IDE/ERIA-GSM simulation result.

**Table 7.10. Top 10 Gainers of BIMSTEC
(Cumulative Impact during 2021–2030/GDP in 2010)**

	Region	Country	%
1	Kohima	India	593.0
2	West Imphal	India	437.6
3	Dimapur	India	411.1
4	Mandalay	Myanmar	355.6
5	Senapati	India	299.2
6	Churachandpur	India	293.2
7	Phek	India	284.4
8	Wokha	India	277.6
9	East Imphal	India	265.1
10	Zunheboto	India	263.5

BIMSTEC = Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation.

Source: IDE/ERIA-GSM simulation result.

The scenario consists of road improvement among Thailand, Myanmar, India, Bangladesh, and Nepal; sea route improvement among Singapore, Bangkok, Yangon, Chittagong, Kolkata, Chennai, and Colombo; and related expansion of ports and airports. Kohima, India (593.02 percent); West Imphal, India (437.56 percent); and Dimapur, India (411.08 percent) will have the largest impact from the scenario. At the country level, Myanmar is the top gainer (76.70 percent), followed by India (6.61 percent). The economic impact on ASEAN is 2.92 percent.

(7) All Infrastructure Development

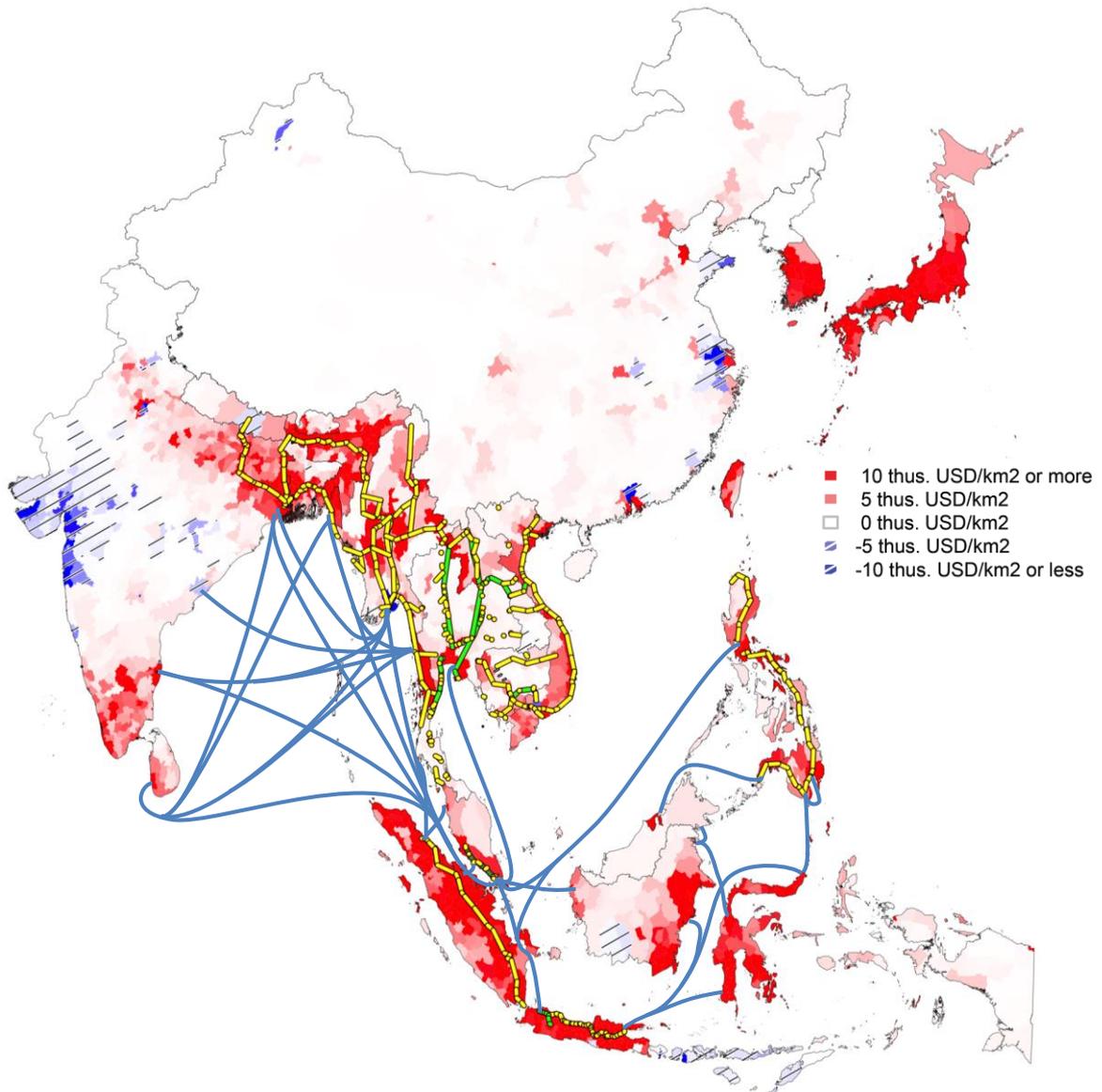
This scenario considers all infrastructure projects for subregional developments, including the following:

- (a) Road improvement as shown in Figure 7.11. It includes domestic road improvement in Cambodia, Myanmar, and Lao PDR; expressway construction between Ha Noi and Ho Chi Minh City, and other developments stated in the previous scenarios.
- (b) New railway in Thailand, Malaysia, Singapore, and Indonesia
- (c) Border facilitation in ASEAN countries—between ASEAN countries and between an ASEAN Member State and a surrounding country.
- (d) Sea route improvement for specific sea corridor routes in the MIEC, IMT+, BIMP-EAGA+, and BIMSTEC scenarios
- (e) Port and airport expansion to prevent congestion in whole East Asia

Gainers from this scenario are Kawthoung, Myanmar (2,020.06 percent); Tachileik, Myanmar (979.91 percent); and Dawei, Myanmar (869.97 percent). Those regions will benefit from being connected to other parts of Myanmar and to other countries through improvements of domestic and international corridors. This scenario will bring significantly large economic gains to ASEAN (42.08 percent), particularly Indonesia (91.87 percent), the Philippines (13.76 percent), and CLMV countries (Cambodia, 24.86 percent; Lao PDR, 61.85

percent; Myanmar, 89.19 percent; and Viet Nam, 17.14 percent) than other subregional integration scenarios.

**Figure 7.11. Economic Impact of All Infrastructure Development
(2030, Impact Density)**



Note: Data not available for North Korea and Timor-Leste. Data not available for Jammu and Kashmir.
Source: IDE/ERIA-GSM simulation result.

**Table 7.11. Top 10 Gainers of All Infrastructure Development
(Cumulative Impact during 2021–2030/GDP in 2010)**

	Region	Country	%
1	Kawthoung	Myanmar	2020.1
2	Tachileik	Myanmar	979.9
3	Dawei	Myanmar	870.0
4	Myeik	Myanmar	769.0
5	Kohima	India	593.4
6	Samdrup-Jonkha	Bhutan	571.3
7	Kengtung	Myanmar	562.5
8	Kota Makasar	Indonesia	544.9
9	Samtse	Bhutan	512.5
10	Kota Pare-pare	Indonesia	497.3

Source: IDE/ERIA-GSM simulation result.

(8) Non-tariff Barriers

(a) Additional NTB reduction from 2016 to 2025 every year for selected countries:

Country	%	Country	%
Bangladesh	1.46	Malaysia	1.44
Bhutan	2.12	Myanmar	3.48
Brunei Darussalam	2.18	Nepal	2.45
Cambodia	1.31	Philippines	1.05
China	1.69	Sri Lanka	1.42
India	1.80	Thailand	1.30
Indonesia	1.97	Viet Nam	1.23
Lao PDR	1.81		

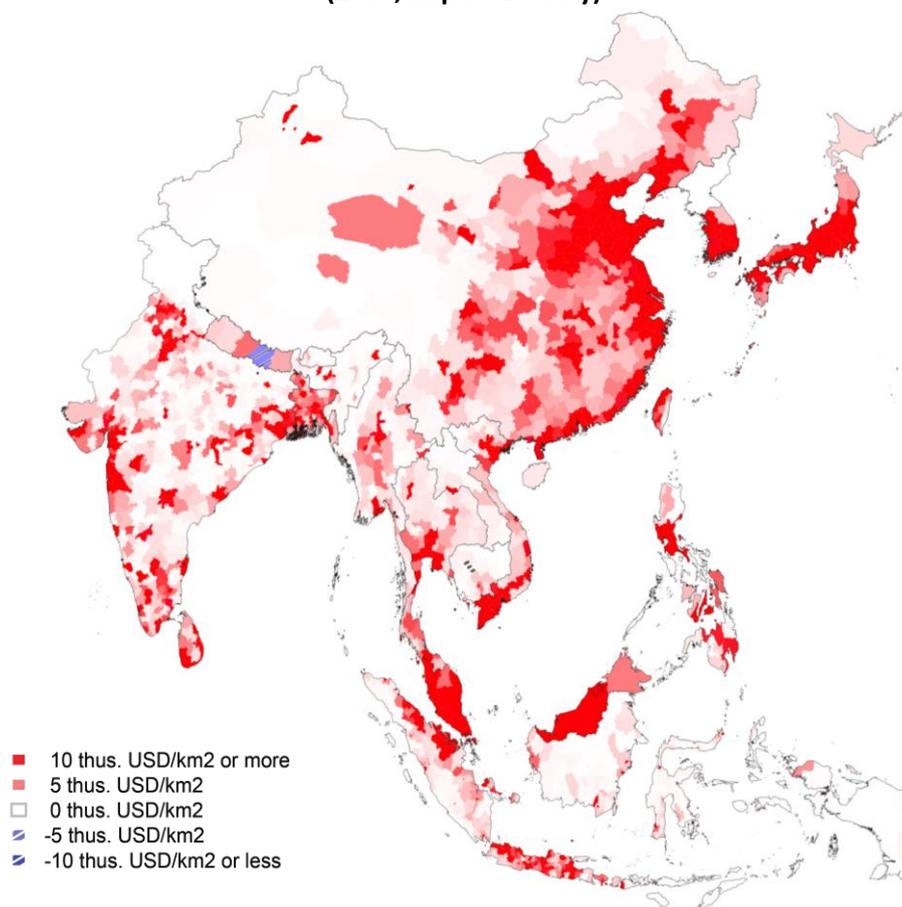
Source: Authors' assumption.

We assume an aggressive regulatory reform where country A, for example, gradually reduces NTBs from 2016 to 2025 up to the level of country B, which is 10 ranks higher than country A in terms of the estimated NTB value among 185 economies. This assumption requires country A to drastically raise its competitiveness in the world to 10 ranks higher. It can only be achieved through a combination of regional cooperation and each economy's own effort.

Most regions will be positively impacted by overall regulatory reforms. Top gainers will be Kota Lhokseumawe, Indonesia (283.77 percent); Dong Nai, Viet Nam (135.98 percent); and Cilacap, Indonesia (135.78 percent). Like the All Infra. scenario, the NTB scenario will generate a significant economic impact on ASEAN (31.19 percent) and each

member state, particularly Brunei Darussalam (82.07 percent), Malaysia (54.36 percent), Viet Nam (47.47 percent), and Thailand (41.68 percent).

Figure 7.12. Economic Impact of NTB Reduction (2030, Impact Density)



NTB = non-tariff barrier.

Note: Data not available for North Korea and Timor-Leste. Data not available for Jammu and Kashmir.

Source: IDE/ERIA-GSM simulation result.

Table 7.12. Top 10 Gainers of NTB Reduction (Cumulative Impact during 2021–2030/GDP in 2010)

	Region	Country	%
1	Kota Lhokseumawe	Indonesia	283.8
2	Dong Nai	Viet Nam	136.0
3	Cilacap	Indonesia	135.8
4	Kota Cilegon	Indonesia	134.7
5	Binh Duong	Viet Nam	131.8
6	Kota Balikpapan	Indonesia	122.9
7	Samut Sakhon	Thailand	114.5
8	Rayong	Thailand	111.1
9	Jamnagar	India	104.4
10	Samut Prakarn	Thailand	96.1%

NTB = non-tariff barrier.

Source: IDE/ERIA-GSM simulation result.

(9) Special Economic Zone

(a) One-shot productivity improvement for specific SEZ sites in CLMV countries

This scenario assumes a one-shot increase in productivity by five percent in SEZ sites in Cambodia, Lao PDR, and Viet Nam in 2015, and Myanmar in 2020. An exceptional productivity improvement is assumed in Dawei where a new SEZ development project will improve productivity by 50 percent:

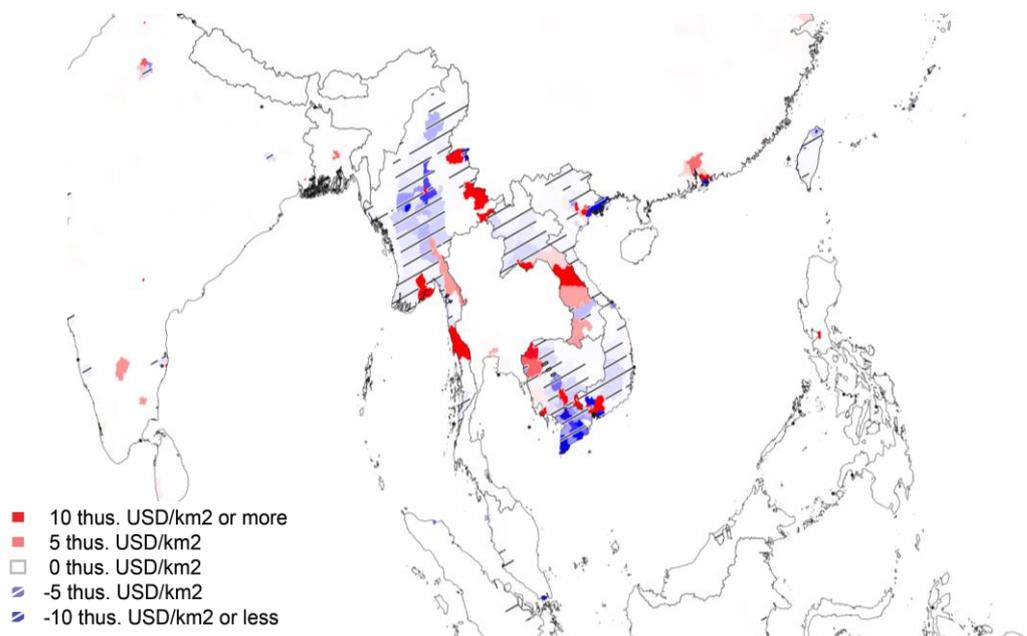
By 5 percent in 2015	By 5 percent in 2020	By 50 percent in 2020
<ul style="list-style-type: none"> ● Ha Noi ● Ho Chi Minh ● Bien Hoa ● Hai Duong ● Sisophon ● Batdambang ● Phnom Penh ● Krong Preah Sihanouk ● Svay Rieng ● Ta Khmau ● Kaoh Kong ● Vientiane Capital ● Pakxanh ● Thakhek ● Khanthabuly ● Pakse 	<ul style="list-style-type: none"> ● Hpa-An ● Myawaddy ● Mandalay ● Muse ● Yangon ● Tachileik ● Kengtung ● Kyaukpyu 	<ul style="list-style-type: none"> ● Dawei

Source: Authors' assumption.

As shown in Figure 7.13, this scenario mainly benefits only the regions that have SEZs. Those that will experience the largest impact are Dawei, Myanmar (722.79 percent); Dong Nai, Viet Nam (380.51 percent); and Phnom Penh, Cambodia (361.62 percent). Most regions in CLMV countries will be negatively impacted compared with the baseline scenario in 2030. At the country level, the top beneficiary countries are CLMV—Cambodia (125.39 percent), Lao PDR (79.06 percent), Myanmar (70.54 percent), and Viet Nam (56.86 percent). The assumption that only CLMV countries will improve productivity can negatively impact the rest of East Asian countries. However, the estimated negative economic impact is not

significant (-0.12 percent on Brunei Darussalam, -0.11 percent on Singapore); ASEAN as a whole will have 6.33 percent higher growth.

Figure 7.13. Economic Impact of SEZ in CLMV (2030, Impact Density)



CLMV = Cambodia, Lao PDR, Myanmar, Viet Nam; SEZ = special economic zone.

Source: IDE/ERIA-GSM simulation result.

Table 7.13. Top 10 Gainers of SEZ in CLMV (Cumulative Impact during 2021–2030/GDP in 2010)

	Region	Country	%
1	Dawei	Myanmar	722.8
2	Dong Nai	Viet Nam	380.5
3	Phnom Penh	Cambodia	361.6
4	Mandalay	Myanmar	277.9
5	Ho Chi Minh City	Viet Nam	234.8
6	Tachileik	Myanmar	229.6
7	Yangon	Myanmar	206.1
8	Khammouan	Lao PDR	193.6
9	Vientiane capital	Lao PDR	193.0
10	Kandal	Cambodia	172.1

CLMV = Cambodia, Lao PDR, Myanmar, Viet Nam;

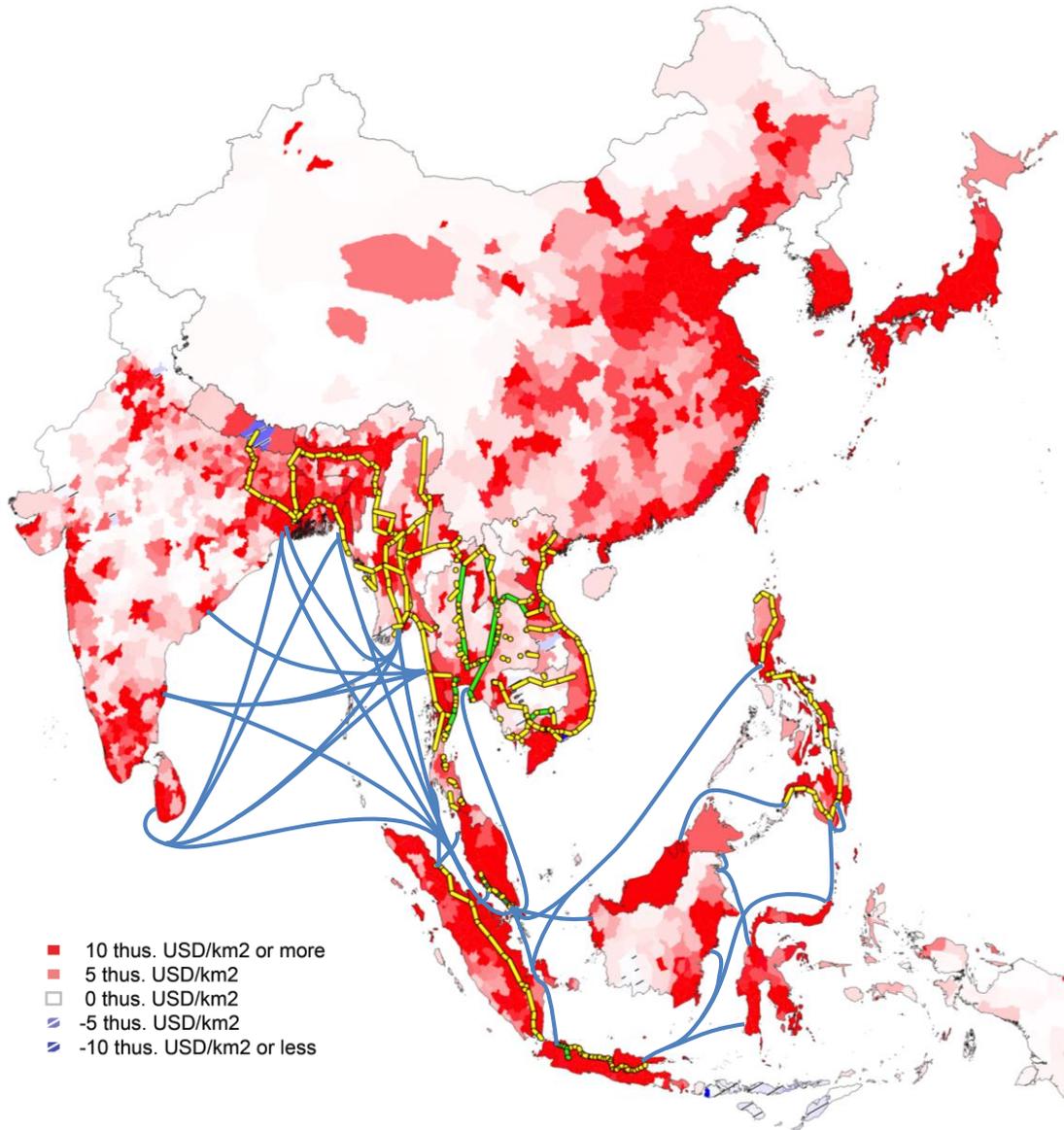
SEZ = special economic zone.

Source: IDE/ERIA-GSM simulation result.

(10) All-All

(a) All improvements of infrastructure, NTB reduction, and SEZ

**Figure 7.14. Economic Impact of All-All Improvement
(2030, Impact Density)**



Note: Data not available for North Korea and Timor-Leste. Data not available for Jammu and Kashmir.

Source: IDE/ERIA-GSM simulation result.

**Table 7.14. Top 10 Gainers of NTB Reduction
(Cumulative Impact during 2021–2030/GDP in 2010)**

	Region	Country	%
1	Dawei	Myanmar	2163.7
2	Kawthoung	Myanmar	2026.4
3	Tachileik	Myanmar	1336.5
4	Kengtung	Myanmar	797.8
5	Myeik	Myanmar	780.9
6	Kohima	India	594.0
7	Samdrup-Jonkha	Bhutan	575.0
8	Kota Lhokseumawe	Indonesia	570.9
9	Kota Makasar	Indonesia	558.0
10	Kota Balikpapan	Indonesia	539.5

NTB = non-tariff barrier.

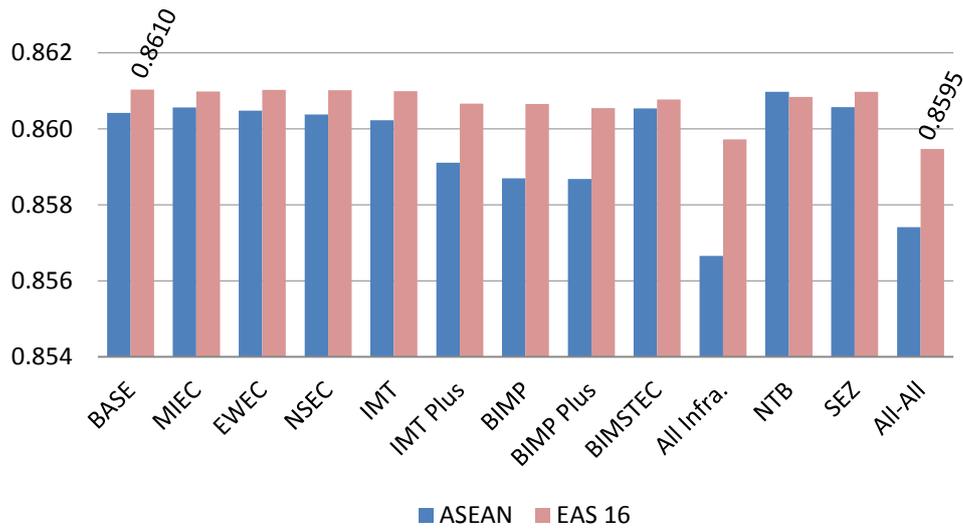
Source: IDE/ERIA-GSM simulation result.

This scenario assumes all infrastructure development, reduction in NTB, and SEZ development, which are assumed in other scenarios. The combination of all improvements will largely impact most of the regions. The top three gainers will be Dawei, Myanmar (2,163.71 percent); Kawthoung, Myanmar (2,026.38 percent); and Tachileik, Myanmar (1,336.46 percent). ASEAN as a whole gains 80.87 percent additional growth. Top gainers are CLMV countries—Cambodia (160.30 percent), Lao PDR (156.58 percent), Myanmar (193.82 percent), and Viet Nam (124.81 percent)—as well as Indonesia (118.50 percent) and Brunei Darussalam (88.33 percent).

7.3. Impact on Gini and Traffic

Figure 7.15 shows the impact of each scenario on the spatial Gini of ASEAN and EAS 16 countries.

Figure 7.15. Economic Impact on Gini (2030)



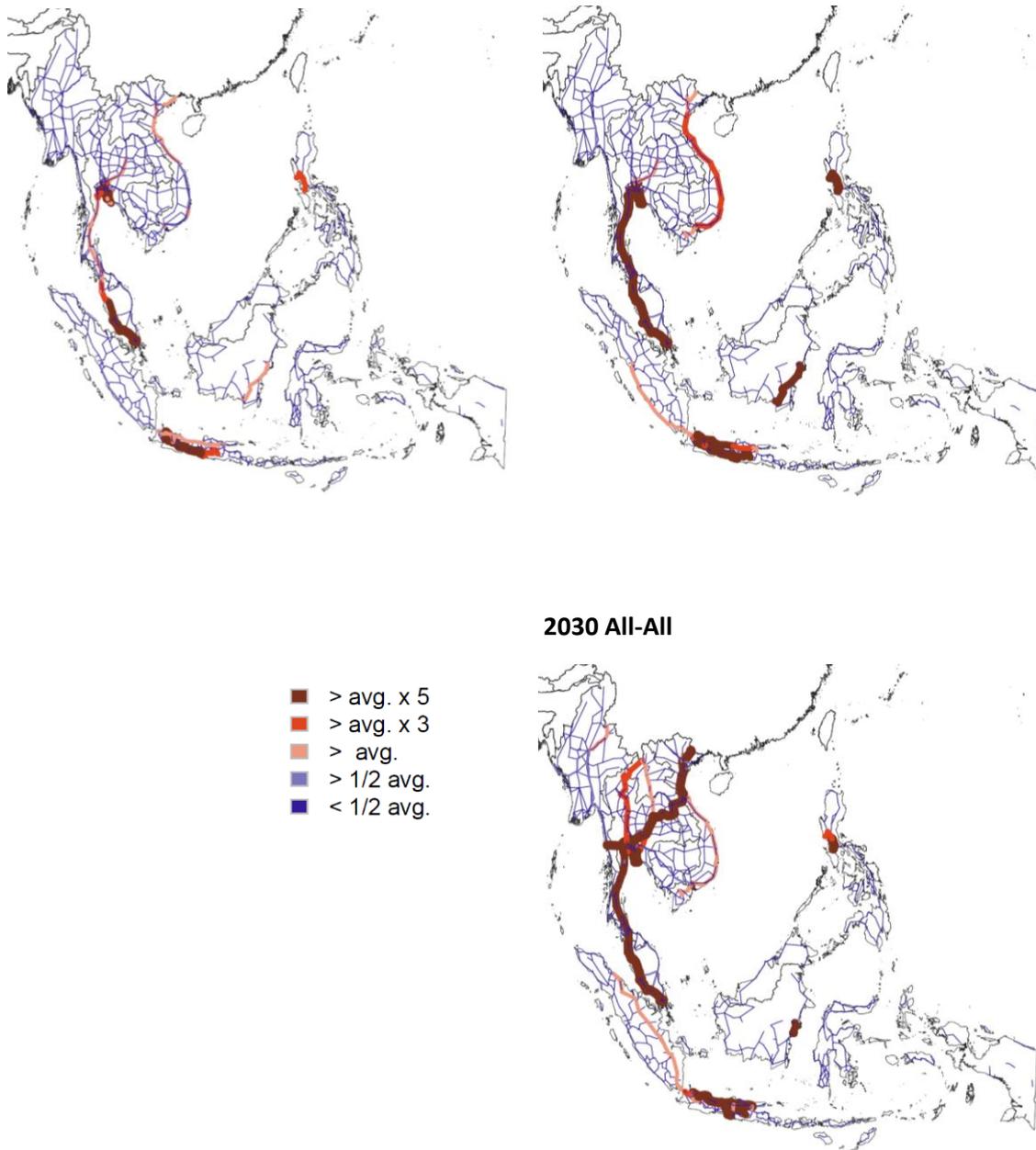
Source: IDE/ERIA-GSM simulation result.

Compared with the baseline scenario, all scenarios will reduce spatial Gini of EAS 16 countries, while MIEC, EWEC, BIMSTEC, NTB, and SEZ scenarios will increase the Gini of ASEAN. 'All-All' scenario will reduce Gini coefficients for both ASEAN and EAS 16. We find that BIMP-EAGA, BIMP-EAGA+, and All Infra. scenarios have a larger impact on reducing Gini coefficients.

Reduced NTBs have a relatively small impact on the Gini of the EAS but worsen that of ASEAN. It is probably because regulatory reform will benefit large cities or existing clusters more than smaller cities or rural areas, although most of the regions will be positively impacted. This comparison of Gini coefficient informs that strategic infrastructure development can disperse and distribute the benefit towards smaller cities and rural areas. It should be noted that the reduction in NTBs will cause a large economic impact as illustrated above.

Figures 16 and 17 see the traffic change for the intermediate goods of the automotive industry and the electronics and electric appliances industry. If we do not have any infrastructure and other facilitation measures as in the baseline scenario, traffic volume will be enlarged from 2010.

Figure 7.16. Traffic of Automotive Intermediate Goods in ASEAN
2010 Baseline **2030 Baseline**

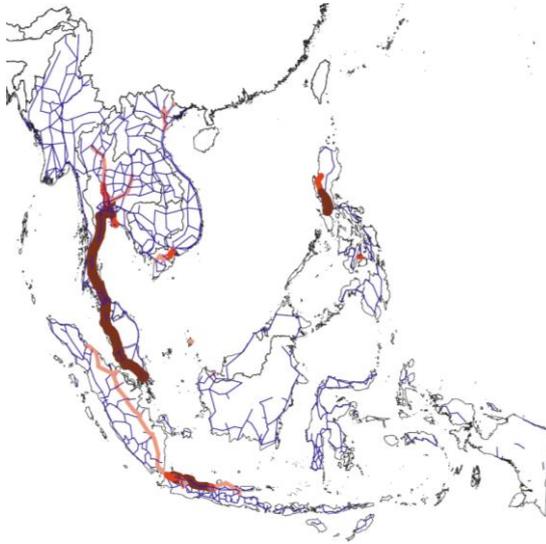


Note: For all three figures, *avg.* is average traffic volume of ASEAN in 2030 in the baseline scenario.
 Source: IDE/ERIA-GSM simulation result.

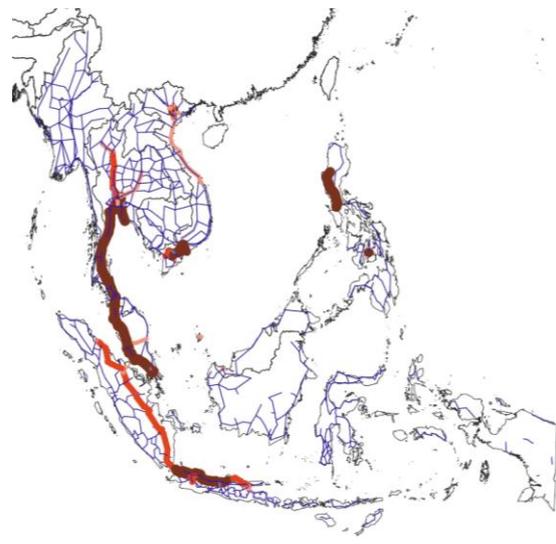
However, if we have overall development as in the All-All scenario, we will see new transport corridors such as Ha Noi–Bangkok–Dawei, NSEC, and Trans-Sumatran Highway. It implies that there are underlying demands for those corridors and we must provide sufficient capacity to meet the demand. At the same time, regions along the corridors can attract more firms and industries utilising increasing transport demand.

Figure 7.17. Traffic of E&E Intermediate Goods in ASEAN

2010 Baseline

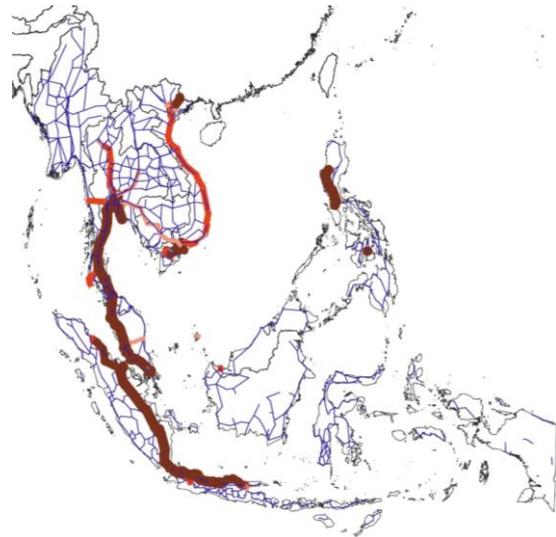


2030 Baseline



2030 All-All

- > avg. x 5
- > avg. x 3
- > avg.
- > 1/2 avg.
- < 1/2 avg.



E&E = electronics and electrical appliances.

Source: IDE/ERIA-GSM simulation result.

