Chapter 7

Geographical Simulation Analysis

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Introduction

The Economic Research Institute for ASEAN and East Asia (ERIA), in collaboration with the Institute of Developing Economies of the Japan External Trade Organization (IDE-JETRO), has conducted an economic impact analysis of infrastructure improvements and institutional reforms in the Association of Southeast Asian Nations (ASEAN) and neighbouring countries for the Comprehensive Asian Development Plan (CADP) (ERIA, 2010) and CADP 2.0 (ERIA, 2015). This chapter uses the latest IDE/ERIA-Geographical Simulation Model (IDE/ERIA-GSM) to provide economic impact analyses on infrastructure improvements and institutional reforms for the CADP 3.0.

The two major changes in the situation in ASEAN and East Asia are as follows. The first is the relative decline in importance of new physical interregional transportation infrastructure projects. In 2010 and 2015, a number of toll roads and other important infrastructure projects connecting major cities needed to be developed as soon as possible. As a result of the progress made in the construction of these motorways with regard to densely populated areas, infrastructure projects connecting cities have become less of a priority. At the same time, unlike when the CADP and CADP 2.0 were being developed, the number of remaining intercity toll road infrastructure projects with a significant impact on a country's economy is decreasing. The policy interest in transportation infrastructure projects has been shifting to urban transportation, rural infrastructure, and the expansion of existing infrastructure. In addition, many infrastructure projects that are not economically feasible remain in place, and some of them have been designated regional priority projects. New projects such as high-speed rail have been proposed, but progress has been slow due to the huge construction costs. A rapid expansion of the high-speed rail network, as seen in China, has not occurred in ASEAN or in other countries.

ASEAN Member States (AMS) are at varying levels of development, with some countries still urgently needing to improve their core transport infrastructure to link cities and towns. On the other hand, countries that are nearing completion of their core transport infrastructure need to tackle more difficult challenges to reap additional economic benefits, such as the effective deployment of information and communication technology (ICT) infrastructure and the introduction of new technologies to save energy.

The second is the coronavirus disease (COVID-19). How COVID-19 will change the shape of economic activity is not yet certain at the time of writing, but some trends can already be observed. There will be a decline in cross-country tourism and business travel opportunities, with some business travel being replaced by ICT-enabled teleconferences. As the airline industry has fallen on hard times, airfares have become more expensive, and the shift from relatively expensive air freight transport to cheaper land transport may become a long-term trend in the future.

This chapter is based on awareness of these issues. We build scenarios and run simulations. The scenarios include infrastructure in the CADP 3.0; the deployment of ICTs, especially 5G-enabled services; and progress in energy conservation. An overview of the IDE/ERIA-GSM and the differences between the latest IDE/ERIA-GSM and the versions used in the CADP/CADP 2.0 are presented in section 2. The scenarios and results are discussed in section 3. Conclusions are given in section 4.

What Is the 2020 Version of the IDE/ERIA-GSM?

The IDE/ERIA-GSM has been developed and extended since 2007 as a joint research project between ERIA and IDE-JETRO. The IDE/ERIA-GSM is an applied general equilibrium model based on spatial economics, which is similar to Puga and Venables (1996). The most significant feature is that the model is not based on country-level data, but on province- or district-level data. This allows us to calculate the economic impacts at the province or district level. The model also includes a logistics network of roads, railways, seaways, and airways.

The model can calculate not only the economic impact on the region or country where the transport infrastructure to be developed is located, but also the impact on the surrounding regions or countries. For example, if a road is developed to connect two cities, not only the people and companies in those two cities and in the cities and towns along the way, but also the people and companies in cities located beyond an end point city will benefit from occasional use of the road. This indirect impact is not confined to the country but extends to neighbouring countries and entire regions. Therefore, it is suitable for the analysis of international transportation infrastructure projects. The model also makes it possible to analyse the economic impacts of free trade agreements (FTAs), which are examined using country-level data. This means that the economic impact analysis of FTAs and province-to-province road projects can be calculated with the same tool, i.e. the IDE/ERIA-GSM. It is also possible to conduct an economic impact analysis of those combinations. The model includes agriculture; mining; five manufacturing industries (automotive, electronics and electrical appliances, textile and garments, food processing, and other manufacturing); and service industries. For more details on the model, see Kumagai et al. (2013).

How is the IDE/ERIA-GSM for the CADP 3.0 characterised? Table 7.1 shows a comparison of the 2010 and 2015 versions. In ERIA (2010), the economic impact of CADP infrastructure projects was presented as a cumulative effect for 2011–2020. In the 2010 version, the regional scope was the 10 AMS,[1] Bangladesh, and parts of China and India. In ERIA (2015), the economic impact of CADP 2.0 infrastructure projects, special economic zones (SEZs), and institutional reforms was presented in terms of the cumulative effect over 2021–2030.

[1] The 10 AMS are Brunei Darussalam, Cambodia, Indonesia, the Lao People's Democratic Republic (Lao PDR), Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Viet Nam.

The regional coverage includes the 10 AMS, all of China and India, Japan, the Republic of Korea, Bangladesh, Sri Lanka, Bhutan, and Nepal. In addition, 65 countries outside Asia are incorporated using country-specific data to represent the 'rest of the world'.

In 2010, time and costs for the trade across borders – for customs clearance, quarantine, tariffs, and non-tariff barriers, etc. – were all shown in a single integrated parameter. The analysis in 2010 showed that reducing this broadly defined border barrier could bring the greatest economic benefits to Myanmar. The 2015 version, as well as the current version, separated the costs at the border, transaction time at the border, tariffs, and non-tariff barriers in the data and analyses. This permits economic impact analysis of policy interventions on each item. In addition, the IDE/ERIA-GSM deals with productivity parameters. This is used to look at the impact analysis of SEZs and disasters on the economy.

Table 7.1 Comparison of the IDE/ERIA-GSM in the CADP (2010), CADP 2.0 (2015), and CADP 3.0

Item	CADP	CADP 2.0	CADP 3.0
	2010	2015	2021
Number of economies in East and South Asia	15	21	23
Number of regions	956	1,818	3,262
Number of nodes	1,676	5,833	11,076
Number of routes	2,691	10,906	20,067
Rest of the world (province-level data)	-	-	83 economies
Rest of the world (country-level data)	-	65 economies	63 economies
Number of transport modes	Road, sea, and air	Road, sea, air, and rail	Road, sea, air, rail, and HSR
Number of industries	7	7	8
Intermediate goods	Yes	Yes	Yes
Non-tariff barriers	No	Yes	Yes
Tariff data	No	Yes	Yes
SEZ/disaster analysis	No	Yes	Yes

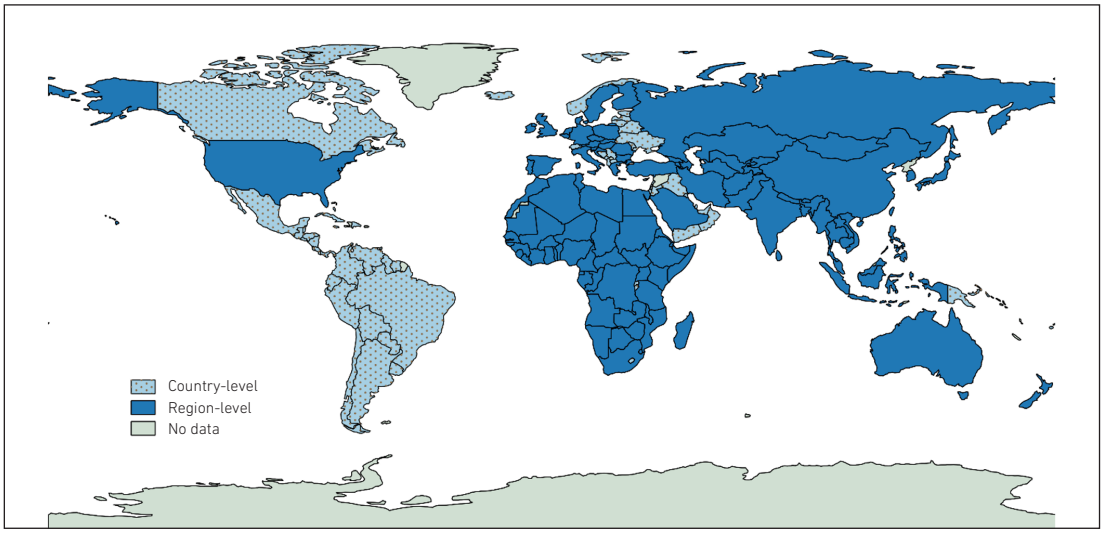
CADP = Comprehensive Asian Development Plan, ERIA = Economic Research Institute for ASEAN and East Asia, GSM = Geographical Simulation Model, HSR = high-speed rail, IDE = Institute of Developing Economies, SEZ = special economic zone.

Source: Authors.

The most important feature of the 2020 version is the extension of the geographic scope. In fact, the model has data at the subnational level for many countries and economies (Figure 7.1). Mining is also added to the industry category. The gross regional domestic product (GRDP) in 2010 for agriculture, mining, five manufacturing sectors, and the services sector is calculated mainly based on official statistics. In many cases, the GRDP is subdivided using data from industrial statistics and censuses.

In this study, following Keola and Kumagai (2016), we used night-time satellite imagery and land use data to construct a geo-economic data set for countries that do not have national level economic data. The number of mines by mineral resources and mineral export data for each country are used to further refine the interpolation method of GRDP for the mining sector.

Figure 7.1 Data Coverage in the IDE/ERIA-GSM
(as of 30 June 2020)



ERIA = Economic Research Institute for ASEAN and East Asia, GSM = Geographical Simulation Model, IDE = Institute of Developing Economies.

Source: Authors.

High-speed rail is a new mode of transport in the model. High-speed rail handles passengers only and will mainly contribute to the development of the services sector by stimulating the movement of people. The development of high-speed rail will help the labour and industry structure shift from agriculture and manufacturing to the services sector. In addition, countries will be divided into areas where the concentration of service industries is accelerating and areas where it is not.

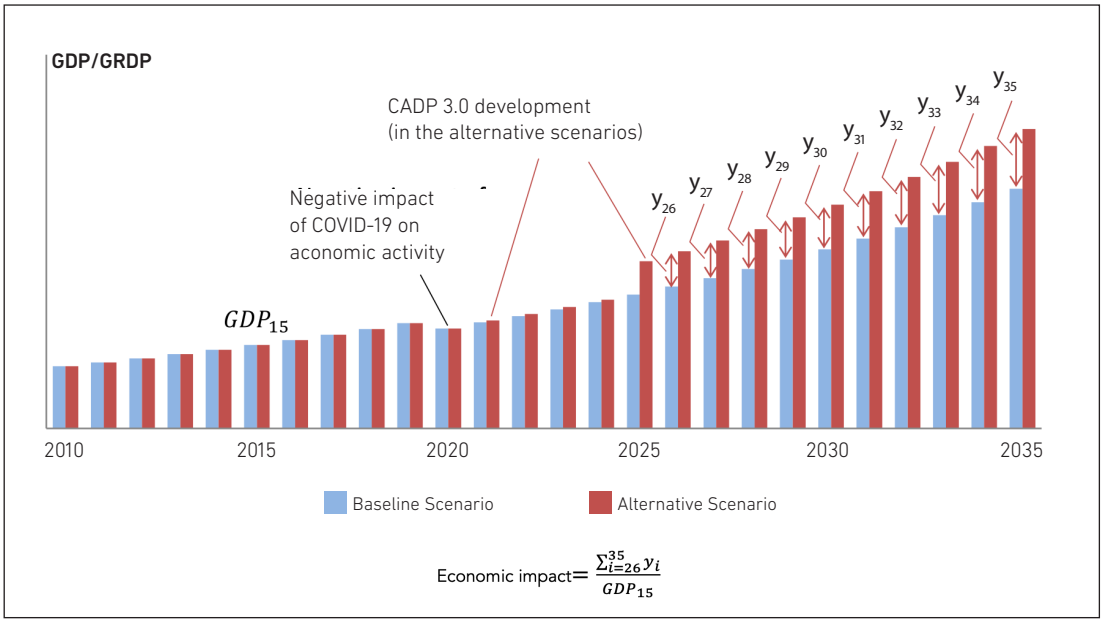
The simulation covers 20,067 routes: 12,859 land routes, 1,341 sea and inland waterways, 2,673 air routes, and 3,194 railroad routes (including high-speed railways). Route data consist of starting and ending cities, intercity distances, and speeds of vehicles travelling along the route. The land routes between the cities are constructed based on the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) Asian Highway Database (UNESCAP, n.d.) as a benchmark, and routes on various maps were added. Actual road distances between cities were used for intercity road distances, and where road distances were not available, straight-line distances were used. The data for air and sea routes are mainly from the Japan Maritime Research Institute (Nihon Kaiun Shukaijo, 1983) and a team from the Logistics Institute – Asia Pacific. The railway data were adopted from various sources, including maps and the official websites of the relevant railway companies.

Scenarios and Results

Economic impact

The impact assessment is done by comparing results from different scenarios. There are two major scenarios: one is the baseline scenario, which assumes no specific infrastructure development. It follows the same development pattern as before, according to International Monetary Fund (IMF) estimates, etc.; and includes the achievements of ASEAN so far, such as the implementation of the ASEAN Economic Community (AEC), ASEAN Single Window (ASW), ASEAN Trade in Services Agreement (ATISA), etc., and future developments from these achievements. The other is that additional infrastructure development or policy initiatives take place. This is called the development scenario. The difference between the baseline scenario and the development scenario is then defined as the economic impact. The economic impact is shown cumulatively over 2026–2035 in Figure 7.2.

Figure 7.2 Image of Economic Impact



CADP = Comprehensive Asian Development Plan, COVID-19 = coronavirus disease, GDP = gross domestic product, GRDP = gross regional domestic product.

Source: Authors.

The economic impacts of different scenarios in this analysis are summarised in Table 7.2.

Table 7.2 Cumulative 10-Year Economic Impacts, 2026–2035

Economy	Compared with the baseline scenario				Combined	All
	Physical infrastructure	IT	CT	Energy conservation		
Brunei Darussalam	0.5	0.3	30.3	21.7	53.3	54.1
Cambodia	6.7	23.9	6.0	48.6	85.9	138.5
Indonesia	19.5	11.3	1.2	40.4	73.2	129.9
Lao PDR	110.5	0.5	1.5	48.3	163.0	193.8
Malaysia	13.3	19.9	2.1	37.9	73.5	77.0
Myanmar	8.9	0.6	1.0	41.0	51.7	111.0
Philippines	36.8	32.1	1.3	40.3	112.9	130.8
Singapore	0.3	30.7	30.0	30.1	90.1	93.3
Thailand	0.8	14.5	4.6	29.0	49.3	68.9
Viet Nam	31.6	14.6	3.2	47.6	98.1	136.9
Japan	0.1	0.0	-0.1	0.1	0.1	0.2

Economy	Compared with the baseline scenario				Combined	All
	Physical infrastructure	IT	CT	Energy conservation		
Korea	0.1	0.1	-0.2	0.1	0.1	0.6
China	0.2	0.1	0.4	0.5	1.2	1.9
Australia	0.0	0.1	-0.1	0.2	0.2	1.1
New Zealand	0.0	0.0	-0.1	0.2	0.1	0.9
India	-0.1	0.5	0.5	0.7	1.6	3.7
United States	0.0	0.0	-0.1	-0.1	-0.2	0.0
Russia	0.0	0.0	-0.1	0.0	0.0	0.0
EU	0.0	0.0	-0.1	0.0	0.0	0.1
ASEAN10	16.2	17.4	5.6	37.6	77.4	109.0
EAS16	1.9	2.1	0.8	4.5	9.4	13.5
World	0.6	0.6	0.2	1.3	2.8	4.1

ASEAN = Association of Southeast Asian Nations, CT = communication technology, EAS = East Asia Summit, ERIA = Economic Research Institute for ASEAN and East Asia, EU = European Union, GSM = Geographical Simulation Model, IDE = Institute of Developing Economies, IT = information technology.

Source: IDE/ERIA-GSM simulation results.

Baseline scenario

COVID-19 was confirmed to have occurred in China at the end of December 2019, and since then, as of January 2022, a total of 300 million people have been infected and 5.5 million have died. Economic activities, the movement of people, and logistics are restricted in many countries, seriously damaging the global economy. A detailed estimate of the magnitude of the impact of COVID-19 is constantly changing.

In both the baseline scenario and the development scenario described below, we calibrate the growth rates of technical parameter A for each country to replicate the actual and projected gross domestic product (GDP) growth rates in the IMF's World Economic Outlook (IMF, 2021). As the actual and forecast GDP growth rates in the World Economic Outlook reflect the impact of COVID-19, this allows us to capture the wider impact of COVID-19 in the simulation. The following assumptions for the aviation industry, according to Kumagai et al. (2020), are included in the calibration:

- The frequency of flights in the model was reduced to reflect the less frequent international/domestic flights across the world from 2020 to 2021.

- The airfare per kilometre (km) was doubled to reflect the increased costs of air freight caused by limited capacity.
- Barriers to trade in the services sector between countries are assumed to be 20% more to reflect the impact of mutually imposed immigration/visiting restrictions.[2]

Even within the model, COVID-19 has negative economic effects on the economy. The negative impact on the services sector is significant, as it is assumed to be constrained by the aviation industry, but the manufacturing sector is also negatively affected, reflecting the reduced demand due to the overall economic downturn. The severity appears to be influenced by the degree of dependence on foreign trade. In other words, countries with large domestic economies have relatively small negative economic impacts. Indonesia, the Lao People's Democratic Republic (Lao PDR), and the Philippines have a relatively small impact, while Malaysia, Singapore, and Viet Nam have a relatively large impact.

Physical infrastructure scenario

We selected key projects from the CADP 3.0 project list (see Appendix of Chapter 6) to create this physical infrastructure scenario. Of the CADP 3.0 project list, it is assumed that the projects which are scheduled to be completed and start operating by 2025 are completed in 2025 in the model. The major projects in the scenario include the following:

Cambodia
- Phnom Penh–Sihanoukville expressway

Indonesia
- Serang–Panimbang toll road
- Yogyakarta–Bawen toll road
- Probolinggo–Banyuwangi toll road
- Patimban Port access
- Gedebage–Tasikmalaya–Cilacap road project
- Pekanbaru–Bangkinang–Payakumbuh–Bukittinggi road project
- Makassar–Parepare railway
- Kertajati Airport railway
- Patimban Port
- Depapre Port
- Development of Kediri Airport
- Construction of New Nabire Airport
- Construction of Bolaang Mongondow Airport
- Sukabumi Airport

[2] Barriers to trade in services between each country are tariff-equivalent data estimated by authors.

- Singkawang Airport
- Siboru Airport
- Banggai Laut Airport

Lao PDR
- Vientiane–Boten high-speed railway project
- 5th Lao–Thai Mekong Friendship Bridge (Bolikhamxay–Bueng Kan)
- Lao–Thai Mekong Bridge for high-speed train (Vientiane–Nong Khai)
- Vientiane–Hanoi expressway project (portion from Vientiane to Nam On)
- Vientiane–Boten expressway project

Malaysia
- Pan-Borneo highway (Sabah–Sarawak)
- Central spine road project
- Gemas–Johor Bahru electrified double track
- Johor Bahru–Singapore Rapid Transit System (RTS Link)
- East Coast Rail Link (ECRL)

Myanmar
- Muse–Kyaukphyu railway

Philippines
- North Luzon East Expressway (NLEX)
- Mindanao railway project: Tagum–Davao–Digos segment
- Subic–Clark Railway Project
- PNR South Long-Haul (Manila–Bicol) railway

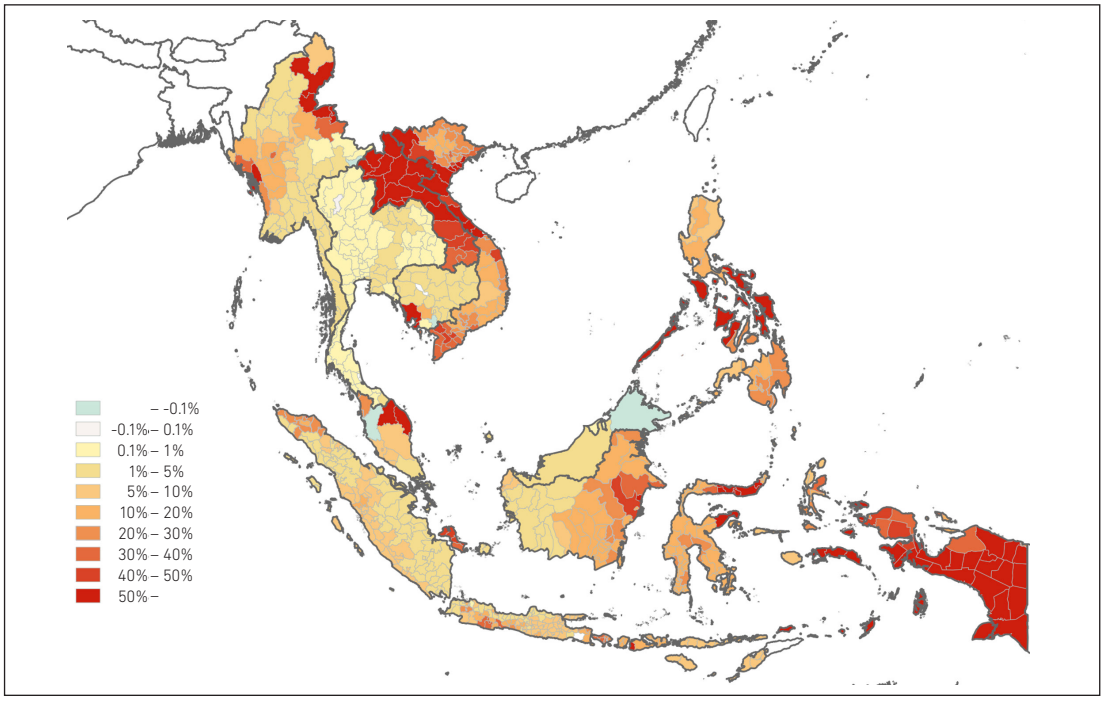
Thailand
- Bangkok–Nakhon Ratchasima high-speed railway
- Double track: Prachuab Khiri Khan–Chumphon
- Double track: Nakhon Pathom–Hua Hin
- Double track: Lopburi–Paknampho

Viet Nam
- Cam Lo–La Son highway
- Trung Luong–My Thuan highway
- My Thuan–Can Tho highway
- Van Don–Mong Cai highway
- Construction of passenger terminal T2 project – Cat Bi International Airport
- Construction of passenger terminal T2 – Vinh International Airport
- Building passenger terminal T2 – Phu Bai International Airport
- Dien Bien Phu Airport

CADP 3.0 infrastructure projects will give the Lao PDR the most significant cumulative economic impact (110.5%), with the Philippines gaining 36.8%, Viet Nam 31.6%, and Indonesia 19.5%. With a maximum speed of 160 km per hour (km/h) for passenger trains and 120 km/h for goods trains, the opening of the Lao High-Speed Railway will have a high economic impact on northern Lao PDR by significantly reducing the freight transport time. In the Philippines, Viet Nam, and Indonesia, much of the trunk interregional transportation infrastructure is composed of highways rather than expressways. Therefore, the economic impact of the new expressway project becomes large. On the other hand, in Viet Nam, it is not assumed that the expressway between Hanoi and Ho Chi Minh City will be fully completed by 2025. Further, in Indonesia, the highway connecting Sumatra to the north and south will only be partially completed. Even after this scenario is implemented, there is still a lot of ground left for the interregional transport infrastructure to yield larger economic impacts.

By region, the New Nabire Airport project in Indonesia will give Nabire the largest economic impact (Figure 7.3 and Table 7.3). Banggai and Fakfak will also gain significant economic impacts from the Banggai Laut Airport and Siboru Airport projects, respectively. In the Lao PDR, the northern part of the country (e.g. Bokeo, Luang Namtha, and Oudomxai provinces) receive a relatively high economic impact. There are also several regions with high economic benefits in northwest Viet Nam, central Philippines, and Papua Island. This confirms the statement in the introduction to this chapter that the policy interest of the AMS is shifting towards infrastructure in the peripheral regions.

Figure 7.3 Economic Impacts of the Physical Infrastructure Scenario on ASEAN
(%, cumulative impact during 2026–2035/GDP in 2015)



ASEAN = Association of Southeast Asian Nations, ERIA = Economic Research Institute for ASEAN and East Asia, GDP = gross domestic product, GSM = Geographical Simulation Model, IDE = Institute of Developing Economies.

Source: IDE/ERIA-GSM simulation results.

Table 7.3 Top 10 Gainers Under Physical Infrastructure Scenario
(%, cumulative impact during 2026–2035/GDP in 2015)

Region	Country	Impact
Nabire	Indonesia	6,432
Banggai	Indonesia	748
Fakfak	Indonesia	616
Maluku Tengah	Indonesia	424
Maluku Tenggara	Indonesia	402
Kaimana	Indonesia	369
Seram Bagian Timur	Indonesia	357
Seram Bagian Barat	Indonesia	334
Bokeo	Lao PDR	300
Oudomxai	Lao PDR	296

ASEAN = Association of Southeast Asian Nations, ERIA = Economic Research Institute for ASEAN and East Asia, GDP = gross domestic product, GSM = Geographical Simulation Model, IDE = Institute of Developing Economies.

Source: IDE/ERIA-GSM simulation results.

ICT development

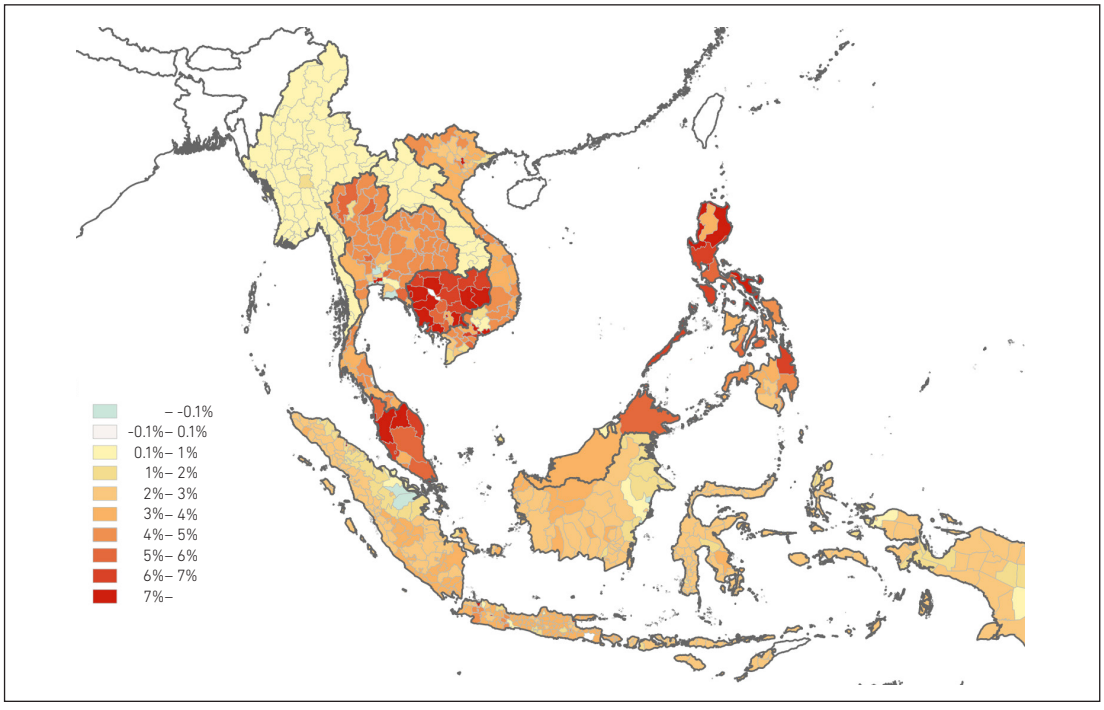
The development of ICT, in particular the diffusion of 5G technology and the emergence of new services triggered by it, is expected to lead to economic development through various channels. The future development of ICT, which has been ongoing since previous economic developments, is already included in the baseline scenario. In this chapter, we assume that additional information technology (IT) developments will lead to an intensive build-up of facilities in selected large cities. Although some attempts have been made to establish data centres and other facilities farther from cities to mitigate risks such as disasters, in practice the concentration of facilities in large cities continues due to their proximity to technicians, customers, and related services. Twelve ASEAN cities – Bandung, Bangkok, George Town, Hanoi, Ho Chi Minh City, Jakarta, Kuala Lumpur, Manila, Medan, Phnom Penh, Singapore, and Surabaya – will see a 1% increase in technical parameters in the services sector. This is called the IT effect.

The diffusion of 5G and related services in communication technology (CT) is assumed to be a reduction of transport costs and a reduction of trade barriers in the services sector, as CT can be seen as a technology that facilitates trade in goods and services and assumes the possibility of changing the way goods and services are traded. The barriers to trade in the services sector will be lowered at a fixed annual rate between 2021 and 2025 for all regions in the 10 AMS. The reductions in the services sector are as follows:

- Singapore, Brunei, Malaysia, and Thailand: 2% per year
- Indonesia, the Philippines, and Viet Nam: 4% per year
- Cambodia, Lao PDR, and Myanmar: 6% per year

The results are summarised in Figures 7.4 and 7.5 and Tables 7.4 and 7.5. In the IT scenario, countries with cities that experience large IT build-ups experience high economic impacts, while AMS that do not experience such build-ups experience little economic impact. The benefits of IT are not limited to the city where the IT buildout takes place, but extend to the entire country in which the city is located. Large-scale IT buildouts are strongly dependent on the size of the current market and the potential for future development, as the location must be chosen by the private sector, despite government incentives and environmental improvements.

Figure 7.4 Economic Impacts of IT Scenario on ASEAN
(%, cumulative impact during 2026–2035/GDP in 2015)



ASEAN = Association of Southeast Asian Nations, ERIA = Economic Research Institute for ASEAN and East Asia, GDP = gross domestic product, GSM = Geographical Simulation Model, IDE = Institute of Developing Economies, IT = information technology.

Source: IDE/ERIA-GSM simulation results.

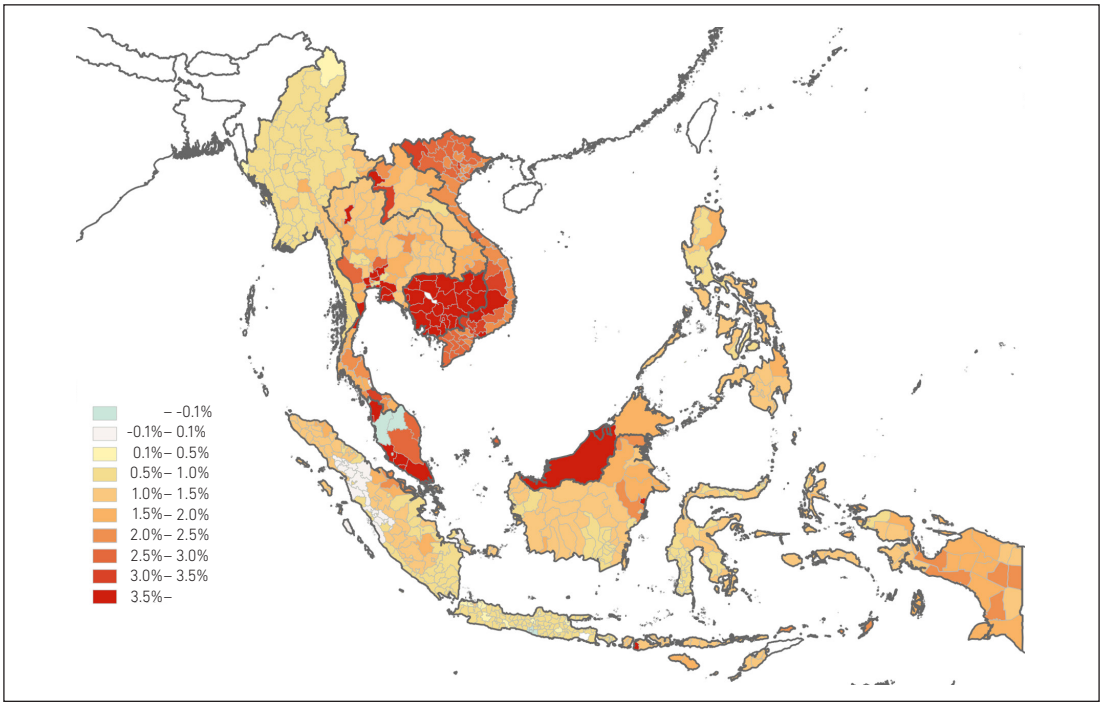
Table 7.4 Top 10 Gainers Under IT Scenario
(%, cumulative impact during 2026–2035/GDP in 2015)

Region	Country	Impact
Kuala Lumpur	Malaysia	78
Phnom Penh	Cambodia	64
National Capital Region	Philippines	57
Ho Chi Minh City	Viet Nam	56
Bangkok	Thailand	43
Ha Noi City	Viet Nam	42
Jakarta	Indonesia	31
Singapore	Singapore	31
Pulau Pinang	Malaysia	27
Kota Surabaya	Indonesia	26

ERIA = Economic Research Institute for ASEAN and East Asia, GDP = gross domestic product, GSM = Geographical Simulation Model, IDE = Institute of Developing Economies, IT = information technology.

Source: IDE/ERIA-GSM simulation results.

Figure 7.5 Economic Impacts of CT Scenario on ASEAN
(%, cumulative impact during 2026–2035/GDP in 2015)



ASEAN = Association of Southeast Asian Nations, CT = communication technology, ERIA = Economic Research Institute for ASEAN and East Asia, GDP = gross domestic product, GSM = Geographical Simulation Model, IDE = Institute of Developing Economies.

Source: IDE/ERIA-GSM simulation results.

Table 7.5 Top 10 Gainers Under CT Scenario
(%, cumulative impact during 2026–2035/GDP in 2015)

Region	Country	Impact
Brunei Darussalam	Brunei Darussalam	30
Singapore	Singapore	30
Samut Sakhon	Thailand	14
Pailin	Cambodia	14
Pulau Pinang	Malaysia	14
Rayong	Thailand	12
Samut Prakarn	Thailand	12
Phra Nakhon Si Ayudhya	Thailand	11
Mondulkiri	Cambodia	9
Negeri Sembilan	Malaysia	8

CT = communication technology, ERIA = Economic Research Institute for ASEAN and East Asia, GDP = gross domestic product, GSM = Geographical Simulation Model, IDE = Institute of Developing Economies.

Source: IDE/ERIA-GSM simulation results.

In the CT scenario, most regions in the AMS reap positive economic impacts. The city states of Singapore and Brunei reap particularly high economic impacts. Some large cities that have a high economic impact in the IT scenario have little economic impact in the CT scenario. The CT scenario tends to have higher economic impacts on the periphery of large cities and on major regional cities. For this reason, the CT scenario is complementary to the IT scenario.

Cambodia is next, with a relatively high economic impact of 6%. As Cambodia is also projected to have a high economic impact in the IT scenario, many regions show high figures in both Figures 7.4 and 7.5. This can be interpreted as the prosperity of the Cambodian service industry and the low level of external barriers to the service industry, which has also had a positive impact on the introduction of ICT.

In the roll-out of 5G, there is a trade-off between cost efficiency and cross-regional service deployment. Based on the GDP impact and cost efficiency alone, only these densely populated cities should deploy 5G and develop their service industries. This can be achieved at a much lower cost than deploying a nationwide 5G network and developing a new services industry that can be deployed in the same way throughout the country. This partial roll-out would be the preferred scenario for the private sector, including telecoms operators. On the other hand, deploying 5G only in the most populous cities and leaving the rest of the country without assistance would be contrary to balanced and equitable development. Rural areas would be even more gentrified. To achieve full-scale deployment of 5G across the country, regulations such as universal service obligations are needed to ensure equal service provision throughout the country.

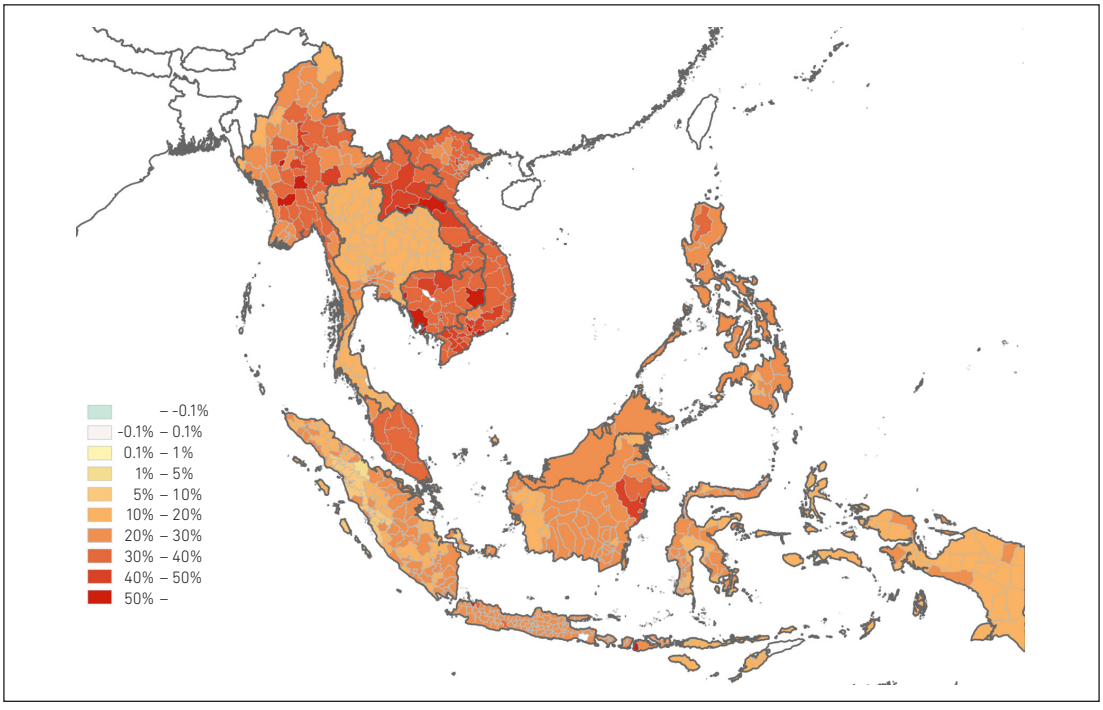
In addition, regulation should be imposed not only on telecoms operators but also on start-ups that provide new services combining internet and real services. Regulation of start-ups would be difficult to implement as it would have a direct negative impact on the profitability of private start-ups. A possible solution would be to mandate large companies with market dominance to roll out and operate their services in more than one city or region.

Energy conservation

In the energy conservation scenario, we assume the rise of energy saving technologies in ASEAN. Following Pollitt et al. (2017), we replicate the positive impact of active energy saving technology adoption on GDP in a macro pathway, with rising technology parameters on the IDE/ERIA-GSM (Figure 7.6 and Table 7.6). For the level of progress in energy efficiency and conservation, we use Kimura and Han (2021).[3]

[3] Whereas Kimura and Han (2021) assumed how ambitious energy efficiency and conservation could be achieved with a constant level of GDP, Pollitt et al. (2017) discussed the increase in GDP due to the introduction of energy saving technologies. The simulation in this chapter uses only the level of energy conservation in the alternative scenario of Kimura and Han (2021) and assumes that GDP could rise with the introduction of technology as in Pollitt et al. (2017).

Figure 7.6 Economic Impacts of Energy Conservation Scenario on ASEAN
(%, cumulative impact during 2026–2035/GDP in 2015)



ASEAN = Association of Southeast Asian Nations, ERIA = Economic Research Institute for ASEAN and East Asia, GDP = gross domestic product, GSM = Geographical Simulation Model, IDE = Institute of Developing Economies.

Source: IDE/ERIA-GSM simulation results.

Table 7.6 Top 10 Gainers Under Energy Conservation Scenario
(%, cumulative impact during 2026–2035/GDP in 2015)

Region	Country	Impact
Kota Bontang	Indonesia	161
Pailin	Cambodia	101
Nay Pyi Taw	Myanmar	98
Sumbawa Barat	Indonesia	76
Ba Ria–Vung Tau	Viet Nam	75
Nyaung-U	Myanmar	74
Phnom Penh	Cambodia	70
Vientiane Capital	Lao PDR	64
Mondulkiri	Cambodia	64
Kuala Lumpur	Malaysia	62

CT = communication technology, ERIA = Economic Research Institute for ASEAN and East Asia, GDP = gross domestic product, GSM = Geographical Simulation Model, IDE = Institute of Developing Economies.

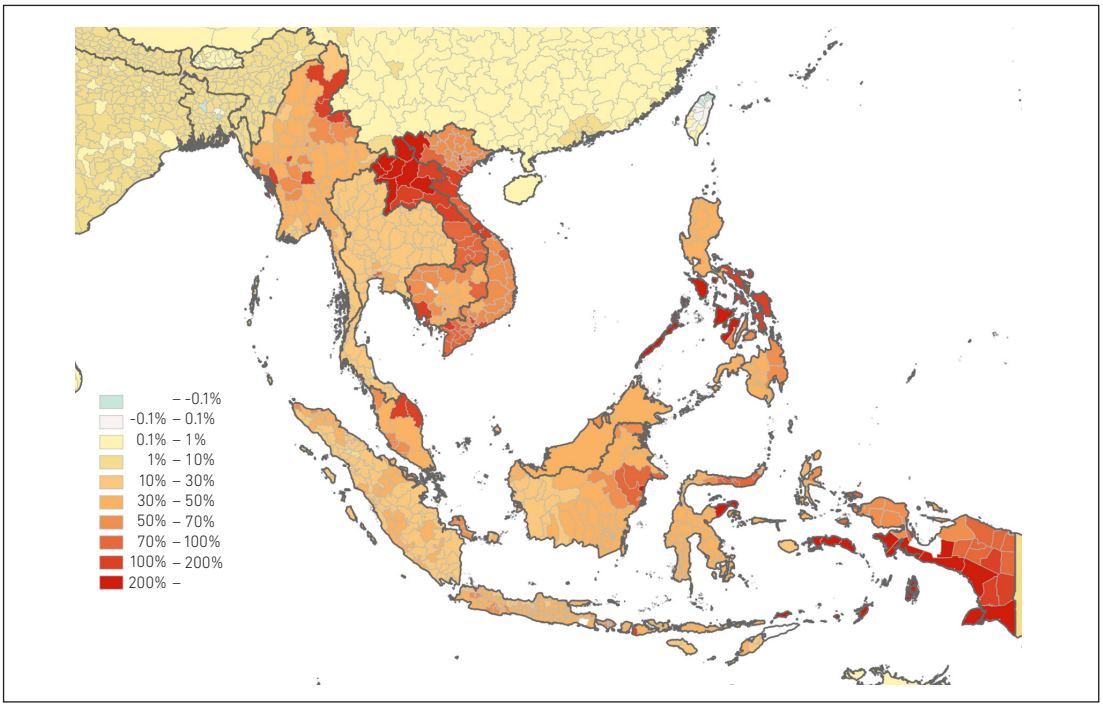
Source: IDE/ERIA-GSM simulation results.

The introduction of new technologies to achieve energy efficiency and conservation will have a significant economic impact on AMS. Regionally, Cambodia, the Lao PDR, Myanmar, and Viet Nam are the countries with the highest economic impact.

All' scenario

The results of the combined scenario of physical infrastructure, IT, CT, and the introduction of new technologies to achieve energy conservation are shown in Figure 7.7 and Table 7.7. For the nine AMS excluding Singapore, the economic impact of the combined scenario is higher than the sum of the economic impacts of the four scenarios. This indicates that there are synergies between the scenarios.

Figure 7.7 Economic Impacts of the Combined Scenario
(%, cumulative impact during 2026–2035/GDP in 2015)



ASEAN = Association of Southeast Asian Nations, ERIA = Economic Research Institute for ASEAN and East Asia, GDP = gross domestic product, GSM = Geographical Simulation Model, IDE = Institute of Developing Economies.

Source: IDE/ERIA-GSM simulation results.

Table 7.7 Top 10 Gainers Under Combined Scenario
(%, cumulative impact during 2026–2035/GDP in 2015)

Region	Country	Impact
Nabire	Indonesia	6,618
Banggai	Indonesia	790
Fak-fak	Indonesia	658
Maluku Tengah	Indonesia	458
Maluku Tenggara	Indonesia	435
Kaimana	Indonesia	399
Seram Bagian Timur	Indonesia	386
Seram Bagian Barat	Indonesia	362
Bokeo	Lao PDR	353
Oudomxai	Lao PDR	344

ERIA = Economic Research Institute for ASEAN and East Asia, GDP = gross domestic product, GSM = Geographical Simulation Model, IDE = Institute of Developing Economies.

Source: IDE/ERIA-GSM simulation results.

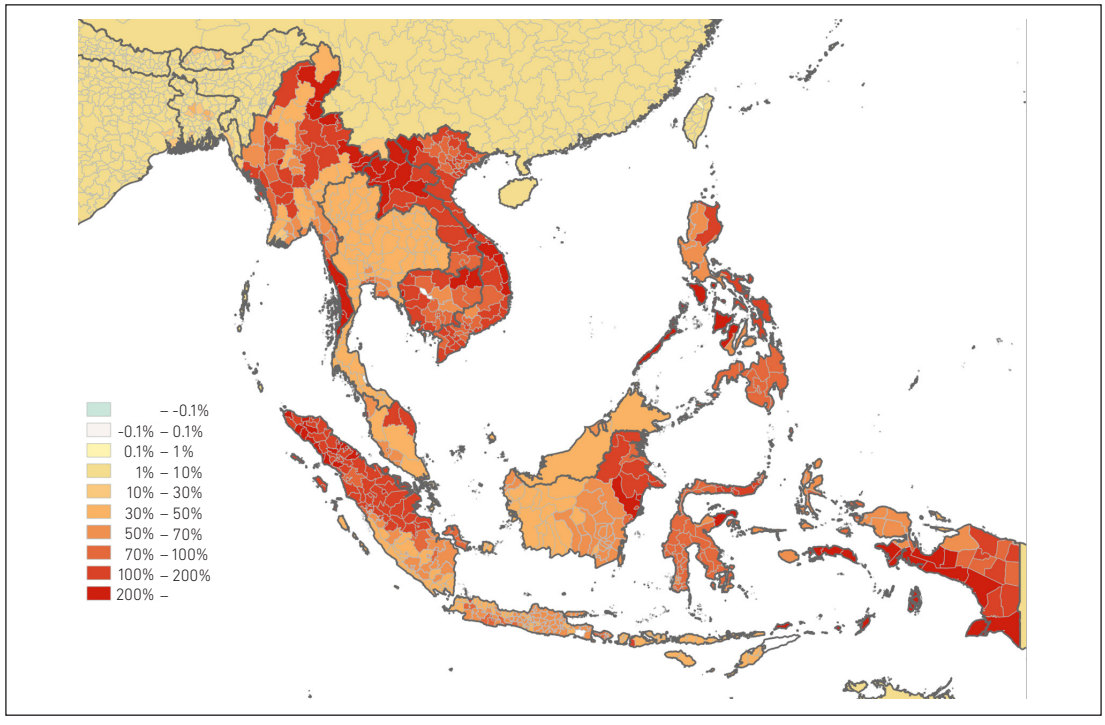
In addition to the combined scenario, the remaining key transport infrastructure projects that have a significant economic impact on the region are included in the 'all' scenario. These include:

- Completion of the Hanoi–Ho Chi Minh City expressway (AH1)
- Completion of the Manila–Davao expressway network (AH26)
- Completion of the Trans-Sumatran Highway
- Upgrading the backbone road network in Myanmar
- Upgrade of the Cambodian road section of the Mekong–India Economic Corridor
- Sea route improvement for specific sea corridor routes in ASEAN and surrounding countries
- Completion of deep sea port projects in Dawei and Kyaukphyu at the level of major feeder ports

Many of these are the projects that the 2015 CADP 2.0 analysis recommended to policymakers for early completion.

The economic impacts of the 'all' scenario are shown in Figure 7.8 and Table 7.8. Almost all the regions of ASEAN will gain positive economic impacts. Northern, northeastern, and southern Myanmar; northern Lao PDR; northern and northwestern Viet Nam; central Philippines; northeastern Cambodia; northern Sumatra; northern Sulawesi; and Papua are the regions with high economic impacts. For this to happen, it will need to be driven by policymakers. The remaining major projects must be completed, and 5G and new services must be rolled out across the country in an appropriate manner.

Figure 7.8 Economic Impacts of the 'All' Scenario
(%, cumulative impact during 2026–2035/GDP in 2015)



ASEAN = Association of Southeast Asian Nations, ERIA = Economic Research Institute for ASEAN and East Asia, GDP = gross domestic product, GSM = Geographical Simulation Model, IDE = Institute of Developing Economies.

Source: IDE/ERIA-GSM simulation results.

Table 7.8 Top 10 Gainers Under 'All' Scenario
(%, cumulative impact during 2026–2035/GDP in 2015)

Region	Country	Impact
Nabire	Indonesia	6,640
Kawthoung	Myanmar	1,939
Dawei	Myanmar	1,834
Myeik	Myanmar	1,478
Banggai	Indonesia	830
Fakfak	Indonesia	665
Tachileik	Myanmar	643
Bokeo	Lao PDR	625
Kota Bontang	Indonesia	543
Maluku Tengah	Indonesia	465

ERIA = Economic Research Institute for ASEAN and East Asia, GDP = gross domestic product, GSM = Geographical Simulation Model, IDE = Institute of Developing Economies.

Source: IDE/ERIA-GSM simulation results.

Table 7.9 shows the economic impacts by industry in each country for the combined and 'all' scenarios. In both scenarios, agriculture and mining have positive economic impacts, but manufacturing and services have much higher economic impacts than agriculture and mining. This is because the number of workers in agriculture falls compared with the baseline scenario, and more workers are employed in manufacturing and services. In fact, the food processing sector has grown significantly in many AMS. This indicates that more workers will be employed in food processing, which is expected to add more value to agricultural production.

Table 7.9 Economic Impacts of Combined and All Scenarios on ASEAN by Industry
(%, cumulative impact during 2026–2035/GDP in 2015)

Country	Agricul-ture		Automo-tive		E&E		Textile		Food Proc.		Oth. Mfg.		Services		Mining	
	CB	All	CB	All	CB	All	CB	All	CB	All	CB	All	CB	All	CB	All
Brunei Darussalam	15	19	219	217	133	134	118	122	113	126	164	165	57	58	10	10
Cambodia	13	21	202	250	107	140	42	70	33	64	76	96	125	202	17	18
Indonesia	35	66	64	103	29	34	30	54	22	54	25	52	113	199	8	11
Lao PDR	23	28	324	275	202	195	141	159	130	147	124	120	224	268	22	28
Malaysia	11	15	77	85	65	68	53	86	40	60	50	55	93	95	9	12
Myanmar	12	9	199	559	90	328	68	-74	43	1	69	194	78	210	21	-15
Philippines	23	35	84	129	40	32	46	197	49	119	43	49	167	178	6	8
Singapore	6	8	132	144	147	157	130	147	80	94	125	133	67	67	7	8
Thailand	10	25	41	84	30	32	31	103	23	63	27	47	72	84	7	9
Viet Nam	19	29	99	133	56	80	62	110	68	111	46	62	161	221	16	17

ASEAN = Association of Southeast Asian Nations, CB = combined, E&E = electronics and electric appliances, ERIA = Economic Research Institute for ASEAN and East Asia, Food Proc. = food processing, GDP = gross domestic product, GSM = Geographical Simulation Model, IDE = Institute of Developing Economies, Oth. Mfg. = other manufacturing.

Source: IDE/ERIA-GSM simulation results.

Furthermore, the services sector has a higher economic impact than the manufacturing sector, indicating that although developments such as IT and CT will have a positive impact on the manufacturing sector as well as the services sector, there is still room for ASEAN to grow further in the services sector, including healthcare and pharmaceuticals. Compared with the combined scenario, the 'all' scenario generates higher economic impacts in many industries in many countries. In the 'all' scenario, the services sector will grow further. This shows again that ASEAN has large potential in the services sector.

On the other hand, the 'all' scenario will bring about different changes in the Lao PDR and Myanmar than in the other countries. The Lao PDR will see strong growth in the automotive and electrical and electronics industries under the combined scenario, but this growth will be constrained under the 'all' scenario, and the services sector will grow strongly instead. In Myanmar, the textile industry will have a negative impact under the 'all' scenario, and the food processing industry will have a smaller impact than under the combined scenario. Instead, the automotive, electrical and electronics, and services industries will be much higher than in the combined scenario.

The negative economic impact of Myanmar's textile industry in the 'all' scenario is compared with the baseline scenario. This does not mean that the industry will be smaller than it is in 2022, but rather that it will not have to specialise in the textile industry, as other manufacturing and service sectors will grow significantly, whereas it would have had to in the baseline scenario.

Myanmar's greater share of the automotive and electrical and electronic industries within ASEAN will result in a lower share for the Lao PDR compared with the combined scenario, but this will be offset by further growth in the services sector, and the Lao PDR will reap higher economic benefits than in the combined scenario.

Conclusions

We have run a new simulation in response to the changing situation in ASEAN and East Asia. COVID-19 may impede the movement of people, especially with respect to international passenger traffic. In the simulation, a shift from air to land transport is evident.

Given this new normal situation with COVID-19, mitigation of the negative impacts by ICT becomes more important. The simulation results show that if infrastructure projects, ICT development, and the introduction of new technologies to achieve energy efficiency are successfully combined – as in the 'all' scenario – many regions located in peripheral areas of the AMS can develop to a greater extent.

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