Ikumo Isono ed., *The Need to Upgrade the Geographical Simulation Model (IDE-GSM)*,
ERIA Collaborative/Support Research Report, IDE-JETRO, 2021

Chapter 1
The need to upgrade the IDE-GSM: Advantages of the model, economic situation in East Asia, and changing policy agenda

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Abstract

Since 2007, the Geographical Simulation Model (IDE-GSM) has been used as a policy recommendation tool for infrastructure development, economic corridor development, and economic integration in ASEAN and East Asia. With a setting that allows for changing economic dependencies between countries and regions, and for infrastructure development to further change economic dependencies, the IDE-GSM has provided an appropriate response to the prioritization of infrastructure development that balances economic growth by narrowing the development gaps. On the other hand, policy issues outside the transport sector, such as information and communications technology, environments, and energy, have become increasingly important in economic integration. Policy attention in the transport sector has also shifted from infrastructure linking major cities to urban transport, rural infrastructure, and maintenance of existing infrastructure. To meet these changing policy agendas, it is necessary to upgrade the IDE-GSM.

Keywords: Simulation, East Asia, Infrastructure, Policy agenda.

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Introduction

The Institute of Developing Economies-Geographical Simulation Model (IDE-GSM) is a simulation model based on spatial economics, also known as the new economic geography (Kumagai et al. 2013). Its development started in 2007 and has been extended in collaboration with the Economic Research Institute for ASEAN and East Asia (ERIA). The main objective of the model is to identify how economic activities are concentrated in specific regions and how the development of infrastructure connecting the region affects economic activities. We have prefecture-level data for 21 East Asian economies and 77 other countries worldwide. The other 71 countries have country-level data. Only country-level data are used for West Asia, the Middle East, and the Americas. In Asia, which is the focus of the analysis, prefecture-level data can be used in many countries.

Although the IDE-GSM calls itself a model, it has several components. The project has built its own economic model, with the simulation program created from scratch in Java. The dataset contains socio-economic, logistics, and geo-mapping data. To create these data, support programs and scripts were created. Many of the parameters were estimated independently to fit the model settings.

The results of the simulations are provided in the form of policy recommendations to the ERIA,[1] the World Bank, the Asian Development Bank (ADB), the Economic and Social Commission for Asia and the Pacific (UNESCAP), and national and local governments. ERIA's work includes the comprehensive Asia development plan (CADP, ERIA 2010) submitted to the East Asia Summit, the Master Plan on ASEAN Connectivity (MPAC, ASEAN 2011) adopted at the ASEAN Summit, and the ASEAN Strategic Transport Plan (ERIA 2011).

The IDE-GSM has been used as a policy recommendation tool in line with the East Asian trend of developing infrastructure, reducing non-tariff barriers, restructuring production networks by enterprises, and institutional economic integration. On the other hand, the current economic situation, changing policy agendas, and the progress of research in related fields make the upgrading of the IDE-GSM an urgent task.

This report aims to identify the advantages of the IDE-GSM, what kind of upgrading is required, and why. In the introductory chapter, we justify the research questions in this report. Section 2 of this chapter discusses the changes in the economic environment and

[1] The versions in collaboration with the ERIA are known as the IDE/ERIA-GSM.

policy issues in East Asia that have provided the basis for the effective use of the IDE-GSM. Section 3 discusses the advantages of the IDE-GSM. Section 4 provides analytical examples. Section 5 concludes with an overview of the challenges to the upgrading of the IDE-GSM and describes the structure of the remainder of the report.

2. IDE-GSM and the changing world economy

The IDE-GSM is suitable because of the rapidly changing state of the world economy. In 1995, the 28 EU countries had a 31.0% share of world gross domestic product (GDP), Japan had 17.6%, and the US 24.7%. China had a share of 2.8%, ASEAN 2.3%, and India only 1.2%. By 2015, the GDP share had changed significantly. While the US's share of GDP had changed little at 24.3%, the share of the 28 EU countries had fallen to 22.1%. In particular, Japan's share fell sharply to 5.9%, while China's share grew to 15.6%. ASEAN and India also increased their share of GDP.

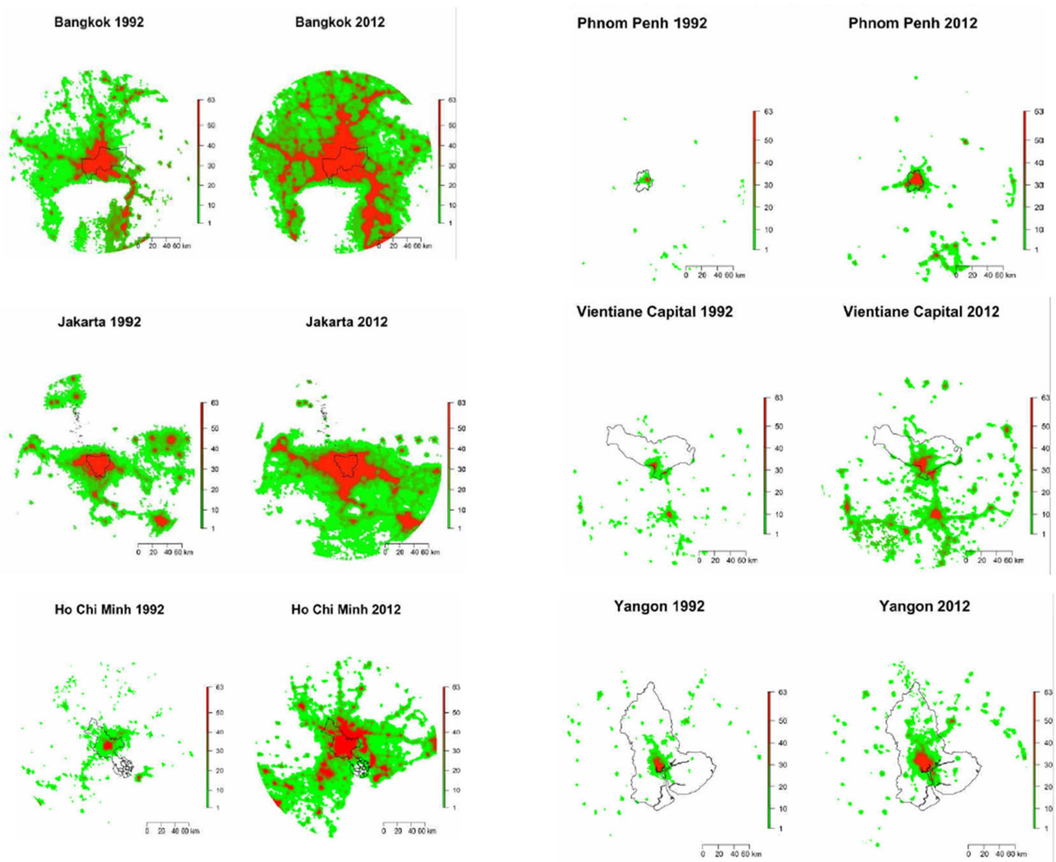
In terms of trade, the main players changed between 1990 and 2010. In 1990, Japan and the US were the main trade players in the Asia-Pacific region. Trade in intermediate goods between Japan and ASEAN began to increase, but trade between Japan and China and between China and ASEAN, as well as trade within ASEAN, remained low. By the late 1990s, China's trade with the US and EU had grown substantially, and it also had a large share of the trade within ASEAN and from ASEAN to the US. In 2009, trade between China and ASEAN and between ASEAN and India more than quadrupled from a decade earlier. The value of trade from China to the US and from China to the EU has come to dominate the others, and trade between Japan and the US, which was dominant in 1990, has declined in relative importance.

These changes were led by the establishment of production networks by Japanese and other manufacturing multinationals. The multinationals traded intermediate goods within Japan, China, and ASEAN, and assembled the final goods in China and ASEAN for sale around the world. However, the firms' behavior, cited as an example of such production network building, was not a phenomenon seen everywhere in China and ASEAN. In 2005, production clusters for automobiles and electrical and electronic products were located in a limited number of regions, including coastal China, around Bangkok, in areas of the western part of the Malay Peninsula, around Jakarta, and in Manila. To attract foreign direct investment (FDI) and increase domestic employment, countries have strengthened the infrastructure of roads linking industrial parks near their largest economic cities with trade gateway ports and gateway airports. However, infrastructure development in other areas has lagged behind. The expansion of the production network to Cambodia, Laos, Myanmar, and Vietnam (CLMV) countries has not advanced. Trade in intermediate goods was prominent, but tariffs on final goods were high and trade in final goods was slow among ASEAN member countries. There was no phenomenon of service companies from an ASEAN member state being active in other ASEAN member states, as is the case today.

At the same time, the economic development of ASEAN countries has led to an influx of people to the largest economic cities in each country, which have expanded geographically. This has been the case not only in existing major cities such as Bangkok and Jakarta, but also in cities in the CLMV countries. Figure 1-1 shows the geographic expansion of economic activity in the largest economic cities of each country, as measured by nighttime light.

In some countries, the quality of infrastructure was poor, even on important national roads. For example, Bhutan's National Highway 1, an important east-west road running through the center of the country, is of poor quality and prone to accidents, as shown in Figure 1-2. Myanmar's National Highway 1 is also a very important road between Yangon and Mandalay, but it is lined with trucks and oxen/horse-powered carriages. Although an expressway has been completed between Yangon and Mandalay, the demand for transport is concentrated on the existing national highway, which connects small towns and villages and does not require a toll.

Figure 1-1: Expansion of the ASEAN Major Cities



Source: ERIA (2015).

Figure 1-2: National Highway 1 in Bhutan and Myanmar

Source: Author.

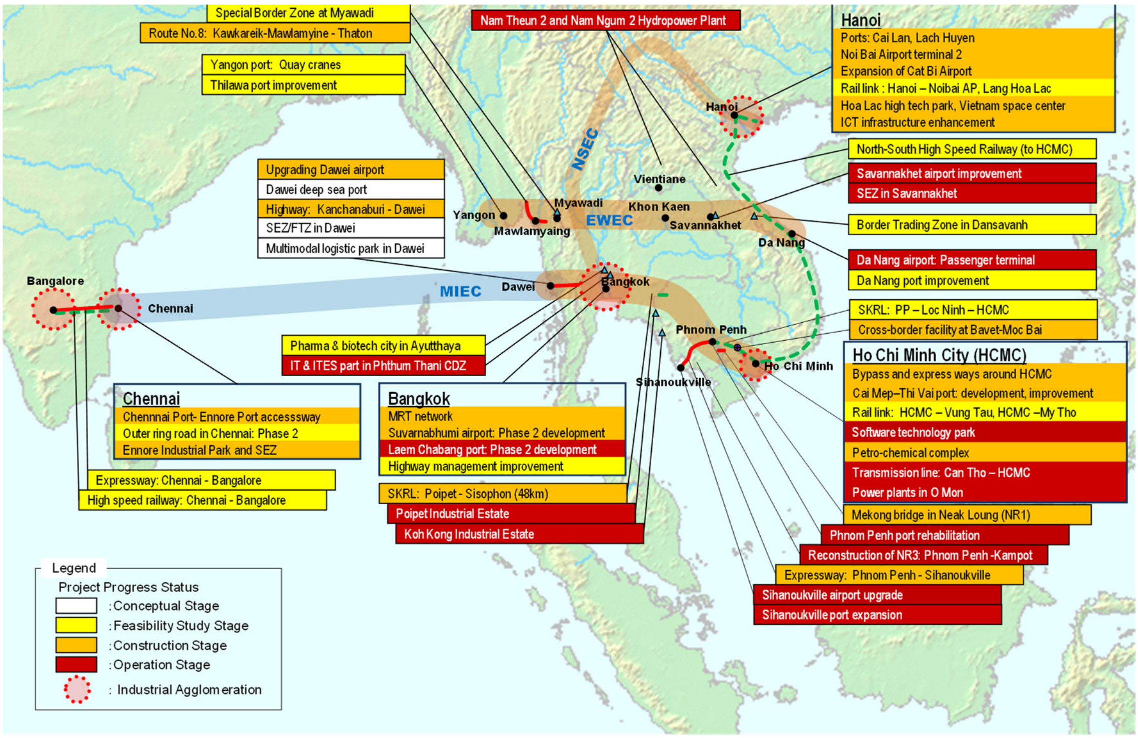
ERIA's CADP (ERIA 2010), CADP 2.0 (ERIA 2015), and CADP 3.0 (ERIA, forthcoming) present a strategy to leverage and upgrade existing economic clusters and to disperse some of the economic activities of existing clusters to peripheral regions. As a concrete instrument of this strategy, it lists priority infrastructure projects in ASEAN and neighboring countries. Many roads linking major cities and many ports and airports are listed as projects, indicating that many infrastructure projects exist and have been vigorously constructed during this period (Figure 1-3).

At the same time, the ADB's concept of economic corridors was widely recognized in the Mekong region. The economic corridors are intended to link existing economic clusters and gateway ports as well as to disperse economic activities to other areas on the economic corridors. The East-West Economic Corridor, the North-South Economic Corridor, and the Southern Economic Corridor attracted a great deal of attention, infrastructure projects were prioritized, and companies were located in the areas along the corridors.

In addition to physical infrastructure and business activities, institutional economic integration has also progressed. The average tariff rate within ASEAN fell from 4.4% in 2000 to 0.6% in 2013. For the original six ASEAN members, the average tariff rate was 3.6% in 2000 and reached 0.0% in 2010. Initially, multinational companies built up their production networks in anticipation of a scheme that would exempt tariffs only on imports of intermediate goods, but tariff rates have fallen, including on final goods. In addition to tariffs, economic integration efforts were also undertaken in other areas, including trade in services, investment, and the digital sector, leading to the establishment of the ASEAN Economic Community at the end of 2015.

This economic and institutional context in East Asia has provided IDE-GSM with a platform to play an active role. While economic development was a key theme for governments, politically, they had to be concerned with reducing inequalities. A major challenge was the development of transport infrastructure, particularly key infrastructure such as city-to-city links, and the expansion of existing infrastructure. Congestion was accelerating in the big cities as populations poured in, while rural areas and less developed countries still had very poor infrastructure.

Figure 1-3: CADP Priority Projects in the Mekong Region (2013)



Source: ERIA website, www.eria.org/projects/CADP.html, retrieved in January 2014.

Governments recognized that the development of transport infrastructure was an important policy issue, but also faced financial constraints. This necessitated the prioritization of infrastructure projects. In addition, socio-economic data were not well developed and many data were not available. Urban congestion was a problem, but there was also concern that providing infrastructure that relieved congestion would lead to further population inflows.

The IDE-GSM was a timely way to analyze the economic impacts of roads and highways connecting provinces, specific ports and airports, border facilitation, and institutional integration such as free trade agreements (FTAs). The IDE-GSM has county-level data and has provided indicators to national governments, local governments, donor agencies, and donor countries on how infrastructure should be prioritized. Although we do not have access to the kind of accurate data that are available in Europe and other industrialized countries, our research approach has resulted in many applications of simulations that make the best use of current data to inform policy recommendations, rather than waiting for more accurate data to become available.

In fact, the results of the simulations have influenced the policies of governments, funding donor agencies, and donor countries through policy recommendations. For example, the CADP (ERIA 2010) proposed a development strategy with three economic corridors in the Mekong region—the Dawei deep-sea port, a sea corridor connecting the Malay Peninsula and Sumatra, and a sea corridor connecting the Philippines and Indonesia. The simulation analysis of the IDE-GSM showed that the combination of these land and sea corridors would bring high economic benefits to the region. The simulation results were cited in the MPAC (ASEAN 2011) as the basis for the strategy. Furthermore, at the Infrastructure Ministerial Meeting of the Government of Japan in 2013, those land and sea corridors were presented as a conceptual framework for Japan's support for ASEAN connectivity, and were identified as a basic item of support.

From the beginning of the IDE-GSM development in 2007 to the present, simulation results have been provided to meet the needs of policy makers. However, in ASEAN and East Asia, the policy agenda is changing. There has been a relative decline in the importance of new physical inter-regional transport infrastructure in policy. This indicates that the steady development of inter-regional transport infrastructure in ASEAN and East Asia has resulted in fewer inter-regional transport infrastructure projects that can have a significant economic impact on the regional economy. In low-income countries, improvements to existing roads have been completed, and the construction of expressways linking key cities has begun.

Policy attention to transport infrastructure projects has shifted to urban transport, rural infrastructure, and the maintenance of existing infrastructure. Furthermore, policy issues outside the transport sector, such as ICT, environments, and energy, have become increasingly important in ASEAN's economic integration. As a result, the areas in which the IDE-GSM can be used effectively in ASEAN and East Asia have become only a part of a wide range of policy makers' interests.

3. Characteristics of the IDE-GSM

The IDE-GSM is based on spatial economics, which deals with the interaction between dispersion and agglomeration forces. In general, the dispersion forces include barriers to trade, transport and communication costs, land and property prices, congestion, language and cultural differences, and product differentiation. Agglomeration forces include production factors that adhere to a particular region, concentrations of consumers, economies of scale in production, regional business networks, and the local presence of good infrastructure. The most basic theoretical models in spatial economics use transport costs, product differentiation, and economies of scale in production. Our model also relies on these three factors. In addition, our model deals with barriers to trade, land costs, congestion, and language and cultural differences. Differences in transport costs due to differences in infrastructure are central to the analysis. Consumer agglomerations emerge endogenously. The differences in region-specific infrastructure were then treated as part of the parameters.

As of 2020, there is no explicit government sector or government expenditure on the IDE-GSM. There is also no tax collection in the model. Government debt is also not treated. There is no explicit savings or investment. Owing to the nature of the simulation, exchange rate fluctuations are not taken into account, nor does it consider inflation and changes in money supply. On the other hand, the IDE-GSM deals explicitly with the behavior of firms and consumers. In addition to natural population growth, it also deals with social population movements. Population movements are caused by the migration of workers between industries and regions. Changes in prices are brought about by competitive relationships, both national and international.

Due to the absence of taxes and government spending, the economic impact analysis of infrastructure development only examines how the economy would respond if the infrastructure were provided. No constraints are imposed, such as the levying of higher taxes to pay for infrastructure or the issuing of government bonds to be repaid over time. This is one of the limitations of the model. There is a concern in Asia that the issuance of government bonds for infrastructure may make it more difficult for governments to implement other policies over the medium to long term, and the IDE-GSM does not provide an answer to this question. On the other hand, in Asia, forecasts of infrastructure development costs are often far off, with frequent project delays leading to higher development costs. Discussing medium- and long-term fiscal constraints requires a number of assumptions that are beyond our ability to make at this time. It is hoped that these will be used in conjunction with an analysis using alternative cost-benefit analysis tools.

The main feature of the IDE-GSM is that it deals with smaller regional units rather than national levels. This makes it possible to analyze the impacts of the development of transport infrastructure between provinces. To date, there has been no mechanism in East Asia for public authorities to provide regional units smaller than a country according to certain unified criteria. For this reason, we have developed our own dataset within the IDE-GSM project (see Chapter 3 of this report for details).

The features of the IDE-GSM as a regional economic model can be summarized in three points. The first is that it deals with labor migration. The second is that it deals explicitly with transport costs. Third, the economic impacts of transport infrastructure projects are derived from changes in the behavior of firms and households, rather than from coefficients.

Labor migration occurs in both the baseline and alternative scenarios. Within a region, workers move from industries where the real wage earned is lower to industries where it is higher. Here, there is no instantaneous equalization of real wages, and the amount of labor mobility follows dynamics based on the ratio of the average real wage within the region. Between regions, workers move from regions where the real wage earned is lower to regions where it is higher. Again, the equalization of real wages does not occur instantaneously. These reflect the cost of travel and the fact that workers are not homogenous, and in reality, only a limited number of workers can move to industries and regions where they can earn higher real wages.

Interregional transport costs are determined not only by distance, but also by the use of different transport modes. A transport cost function was developed to determine the transport costs in a broad sense. The transport cost function is developed as follows: First, based on a survey of firms, the pattern of transport mode decisions of firms when selling goods is analyzed using a multinomial logit estimation. The multinomial logit estimate shows the following trends in firms' behavior: For domestic sales partners, firms use land transport whenever possible; for foreign partners, the greater the distance to the partner, the more often sea or air transport is used. In addition, the electrical and electronics industries are more likely to use air transport, while land transport will be used if the border clearance is smooth.

To replicate the mode choice pattern of the firms, a linear transport cost function was established. This leads to a transport cost in monetary terms, consisting of the total transport time, including transshipment time and customs clearance time multiplied by the time cost, the monetary cost of using the transport mode, and the monetary cost of transshipment and customs clearance at the border. The required parameters are obtained from estimates, other literature, and additional assumptions.

The minimization of transport costs by this transport cost model allows the model to determine the optimal choice and combination of transport modes for firms in each region and industry to sell to other regions. For example, the electrical and electronics industry located in Ayutthaya, Thailand, uses land transport to Lamphun, Thailand, mainly for air transport to Phnom Penh, Cambodia, and land transport to Kuala Lumpur, Malaysia. Since Lamphun is a domestic transport destination, firms mainly choose land transport. As the border clearance between Thailand and Cambodia is assumed to be time-consuming, firms in the electrical and electronic industries prefer air transport. In this case, the goods are transported by land from Ayutthaya to Suvarnabhumi International Airport, transshipped to airplane, transported by air to Phnom Penh International Airport, and transshipped to truck at Phnom Penh International Airport to reach the destination customer site in Phnom Penh. As the border clearance between Thailand and Malaysia is assumed to be relatively smooth, firms in the electronics industry choose to transport their goods by land only, even though they are trading internationally. These findings are not only consistent with the results of the business survey but also with the results of the business interviews.

In addition to the above transport cost model, policy and cultural barriers (PCBs) have been added to the calculation since 2011, capturing transport costs in a broader sense than the costs incurred in transit in reality. For example, a company must find a supplier and pay customs duties. Companies must also learn what procedures are required for international trade. Where administrative procedures are unclear, companies may have to pay additional coordination costs to avoid delays.

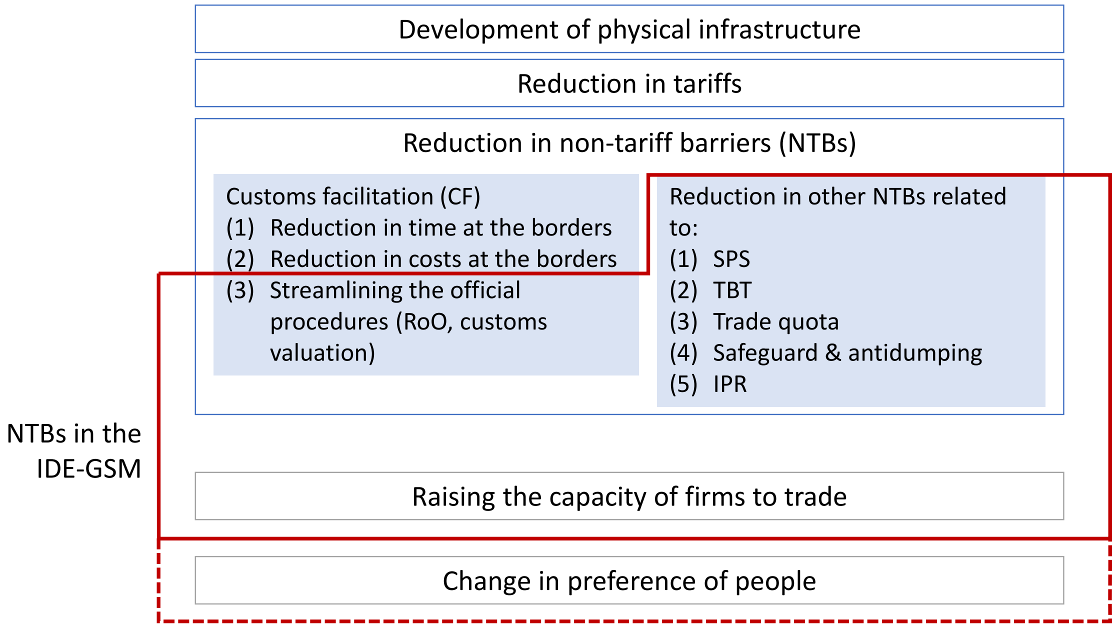
PCBs are set in the calibrations to account for the difference between the national and international trade values calculated using the IDE-GSM transport cost model and the actual national and international trade values. Therefore, in addition to the above costs, PCBs also include differences in people's preferences in each region. Subsequently, tariffs were separated out from PCBs by creating a separate database, and the remaining PCBs were referred to as non-tariff barriers (NTBs).

Transport and trade facilitation measures, which change transport costs in a broad sense, can be divided into five main types in the model (Figure 1-4). The first is the construction of physical infrastructure to reduce the time and cost of using transport modes. This could include the construction of roads, the extension of roads to higher standards, and the construction or extension of ports and airports to allow the operation of larger ships and aircraft. The second is a reduction in tariffs, either through reductions in most favored nation (MFN) tariffs, or through bilateral or multilateral FTAs. In the case of FTAs, the tariff reduction/removal schedule is reflected in the model. The third to fifth items include general non-tariff barriers and other elements. The third is a reduction in time at borders, seaports, and airports. The fourth is the reduction in non-tariff financial costs at borders, seaports, and airports. Simplifying rules of origin (RoO) and customs valuation procedures can be considered part of trade facilitation. Some of the measures that could be considered as part of reducing general non-tariff barriers are to reduce trade impeding sanitary and phytosanitary (SPS), technical barriers to trade (TBT), trade quota, safeguards and antidumping measures, and to stop the abuse of the intellectual property rights (IPR) system.

In addition, the reduction of NTBs in the IDE-GSM also involves behavioral changes of companies and consumers. NTBs will fall as companies learn more about and become more proficient in how to trade internationally, through information exchange with other companies and public awareness campaigns by governments. Another factor in reducing NTBs is that people become more familiar with the products and services of other countries.

The third feature of the IDE-GSM is that the economic impacts of transport infrastructure projects are derived from changes in the behavior of firms and households, rather than from coefficients. While some transport improvement models derive economic impacts by estimating or calculating a coefficient and multiplying the time savings by the coefficient, the IDE-GSM does not use such a coefficient. For example, the economic impact of the IDE-GSM on road improvement is derived as follows: First, the improvement of the road allows companies using the road to sell their goods to transport them faster. This leads to a reduction in time cost. This means that firms can sell their goods at a lower cost, which increases their sales. More sales by firms means more employment, which can lead to higher nominal wages for workers. As workers are consumers, the consumption of consumers in the area increases, allowing firms to sell more. Consumers will also be able to buy goods from more areas, which will increase their real wages in terms

Figure 1-4: IDE-GSM transport and trade facilitation measures



Source: Author.

of the indirect utility function. Thus, households and firms from other regions move to a more favored region. As this difference accumulates for a certain number of years after road improvements, the distribution of economic activity will differ from that in the baseline scenario. The difference between GDP in a given year in the alternative scenario with road improvements and GDP in the baseline scenario without road improvements is therefore the economic impact.

Because it incorporates changes in the location of workers and firms, it is more complex and includes more effects than the economic impacts of multiplying the time savings by a factor. It is also more complex than a model with coefficients for trade patterns between industries and regions because it includes the movement of workers between industries in both the baseline and alternative scenarios. For example, the economic impacts of the conclusion of an FTA include not only the effects of increased international trade and production in each region and industry, but also the effects of the movement of workers to regions and industries where they are more advantageous.

These features of the IDE-GSM are the result of the extension of the IDE-GSM to better explain the economic situation in East Asia, as described in Section 2. In the context of China's growing presence as an economic actor in the world, the movement of population from rural to metropolitan areas in various countries, and the diverse quality of infrastructure, the analysis using models with fixed coefficients of inter-industry and inter-regional trade patterns cannot capture the characteristics of regional dynamism. The IDE-GSM analysis, which assumes that the distribution of international economic activity, trade patterns, the relative competitiveness of countries, and the distribution of population can all change as a result of the vigorous development of infrastructure in a given country or region, is more appropriate for East Asia.

4. Examples of analysis

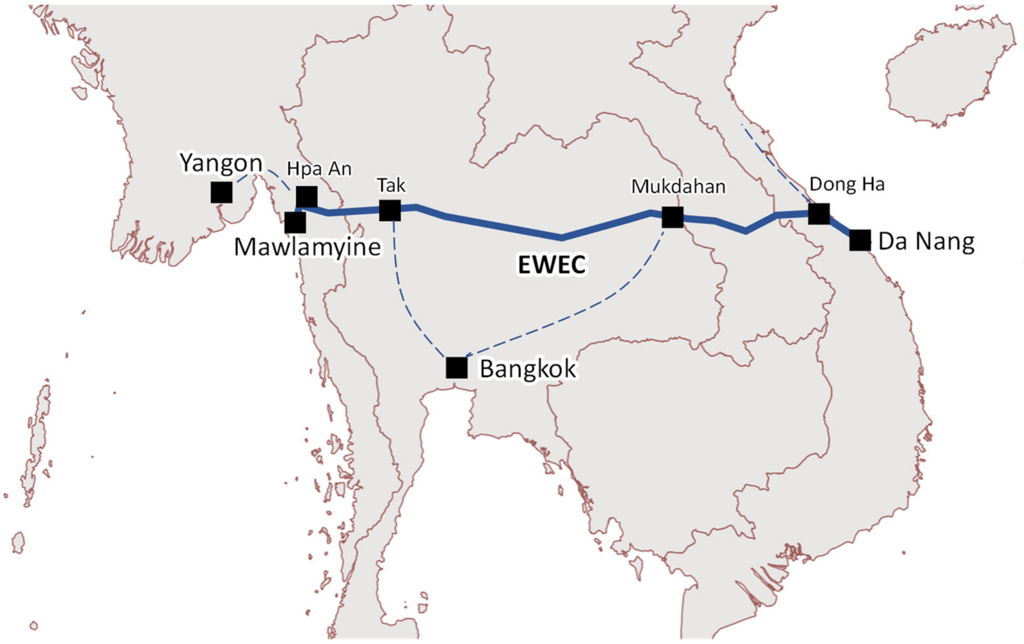
This section presents examples of analyses that have been carried out by the IDE-GSM and illustrates how simulation analysis has changed to account for reality and respond to policy requests.

4.1. Economic impact analysis of the East-West Economic Corridor

At the 8th GMS Ministerial Conference in 1998, the previous nine priority road projects were reorganized into three economic corridors. These were the North-South Economic Corridor, the East-West Economic Corridor, and the Southern Economic Corridor. The naming of these corridors is well known to many people. Of these, the East-West Economic Corridor (EWEC) linking Mawlamyine in Myanmar and Da Nang in Vietnam has seen a concentration of infrastructure development. In particular, the construction of the second Thai–Laos Friendship Bridge between Mukadhan and Savannakhet in 2005 was a key milestone. The completion of the bypass between Myawaddy and Kawkaleik in 2015 eliminated the need to travel on poor mountain roads that previously operated in only one direction per day.

One of the reasons why the EWEC attracted so much attention was that it passed through the areas of Thailand, Lao PDR, and Vietnam, which were far away from the largest economic cities and needed to be revitalized by policy (Figure 1-5). At the same time, the EWEC was criticized by some as not being an economic corridor because the actual trade of goods took place between an area along the corridor and the major cities such as Bangkok, Vientiane, Hanoi, and Ho Chi Minh City. It has been pointed out that the EWEC will increase transport demand and economic activities between Mukdahan and Dong Ha, which is a part of the transport route between Bangkok and Hanoi, and between Tak and Hpa An, which is a part of the transport route between Bangkok and

Figure 1-5: East-West Economic Corridor



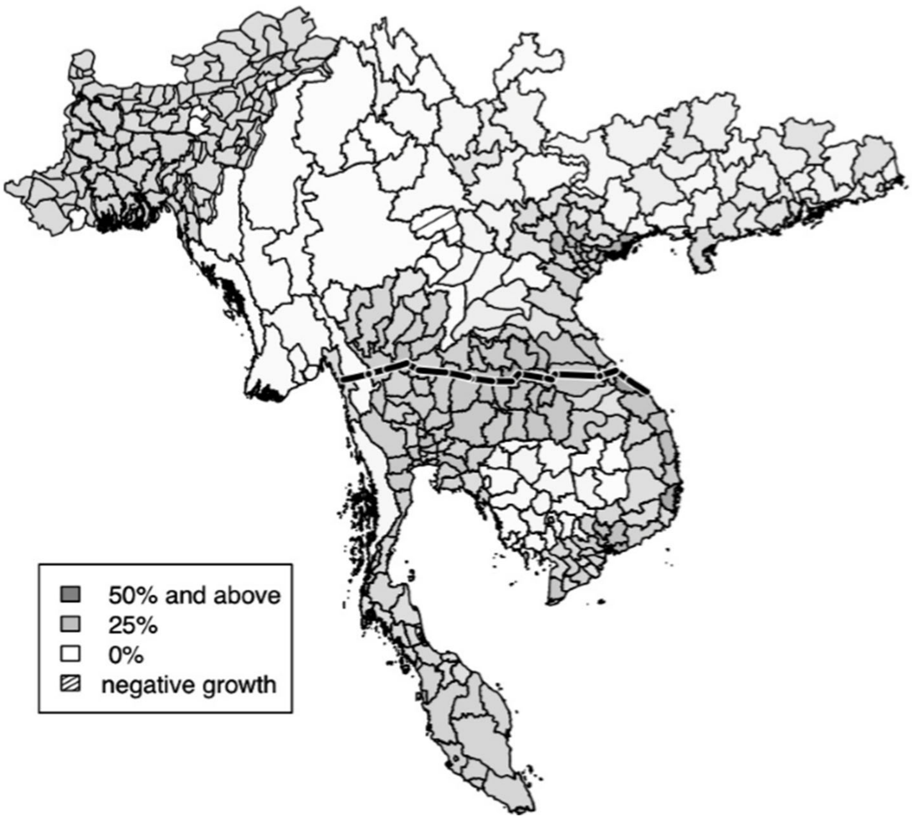
Source: Author.

Yangon, while it will not have a significant impact on economic transactions along the EWEC, especially in Thailand (Banomyong and Sopadang 2009).

The IDE-GSM has continued to evolve its model and extend its geographical coverage,[2] and has conducted further economic impact analyses of the EWEC. Figure 1-6 shows the economic impact by a still near prototype version of the IDE-GSM in 2008. It is assumed that the speed of all roads along the corridor will be increased to 80 km/h, and that time at the borders will be reduced to a level comparable to that between Singapore and Johor. While Thailand, Vietnam, and southern Laos would reap large positive economic benefits, Myanmar's economic impact would be relatively small. In contrast, Bangladesh and northeastern India have high economic impacts.

[2] See Chapter 2 of this report for the progress of the IDE-GSM extension.

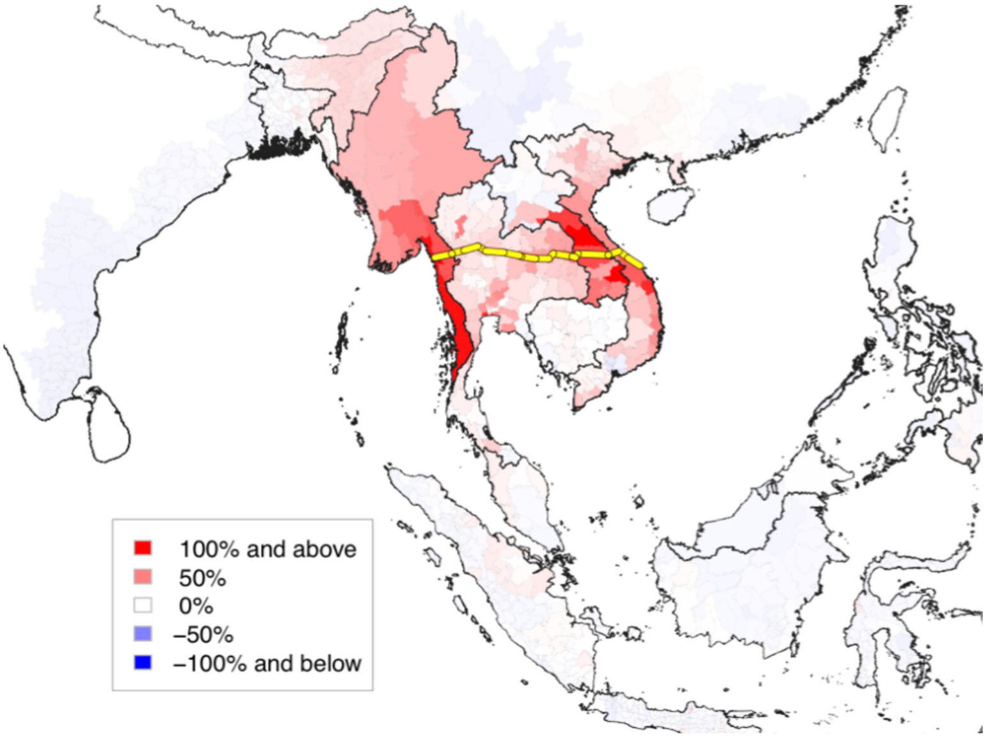
Figure 1-6: Economic impact of the development of the East-West Economic Corridor by IDE-GSM in 2008 (2025)



Source: Kumagai et al. (2008).

In the analysis in ERIA (2010), the geographical scope was extended to the whole of ASEAN and parts of China and India. The aforementioned transport cost model was introduced, with parameters for road speeds and time at borders closer to reality. The results of the analysis show a relatively smaller economic impact for Thailand, while the economic impacts for Myanmar, central Laos, and central Vietnam are now shown to be larger, which is in line with expert opinion (Figure 1-7).

Figure 1-7: Economic impact of the development of the East-West Economic Corridor by IDE/ERIA-GSM in 2010 (2011-2020, cumulative effects)



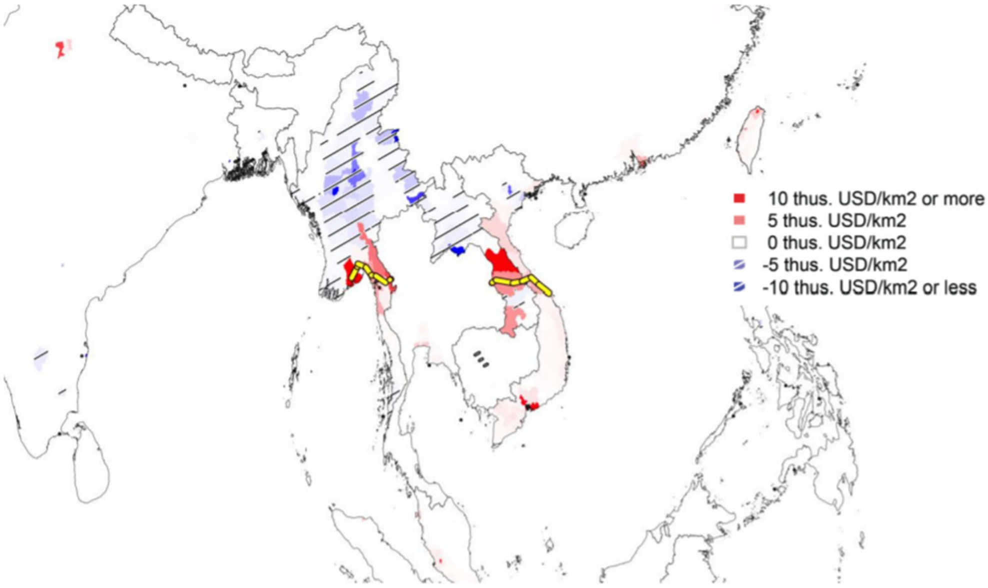
Source: ERIA (2010).

ERIA (2015) further assumes that roads will be built only in the central Laos–Vietnam and Myanmar sections, and that the time and costs at the border along the EWEC will be reduced (Figure 1-8). This is because although the road along the EWEC is being widened to four lanes in Thailand, there is already a high standard road and the traffic volume is relatively low. We also added the recommendation that the EWEC should be extended to Yangon to stimulate economic activity, and we made the assumption that the road should be improved to Yangon.[3] In the analysis, Myanmar's regional divisions were subdivided.[4] Also, unlike in ERIA (2010), PCBs were introduced and trade volumes no longer increase dramatically in scenarios where PCBs are not reduced and only time and costs at border clearance are reduced. As a result, the economic impact is limited to southern Laos and central Vietnam. Negative economic impacts are seen in northern Myanmar and northern Laos due to population outflows. To illustrate the figure, the economic

[3] In fact, ADB's EWEC has also been extended to Yangon since 2016.

[4] See Chapter 3 of this report for more about socio-economic data construction.

Figure 1-8: Economic impact of the development of the East-West Economic Corridor by IDE/ERIA-GSM in 2015 (2030, Impact Density)



Source: ERIA (2015).

impact per area is now used, which shows where the economic impact is concentrated on a comparable scale.

The IDE-GSM analysis has also been used in the economic impact analysis of the railway construction project along the East-West Economic Corridor under consideration in Thailand and the results of the analysis have been delivered to Thai policy makers (Isono 2019) with the result that the economic impact is relatively small and that the project will be used as part of a transport link between Bangkok and the provinces.

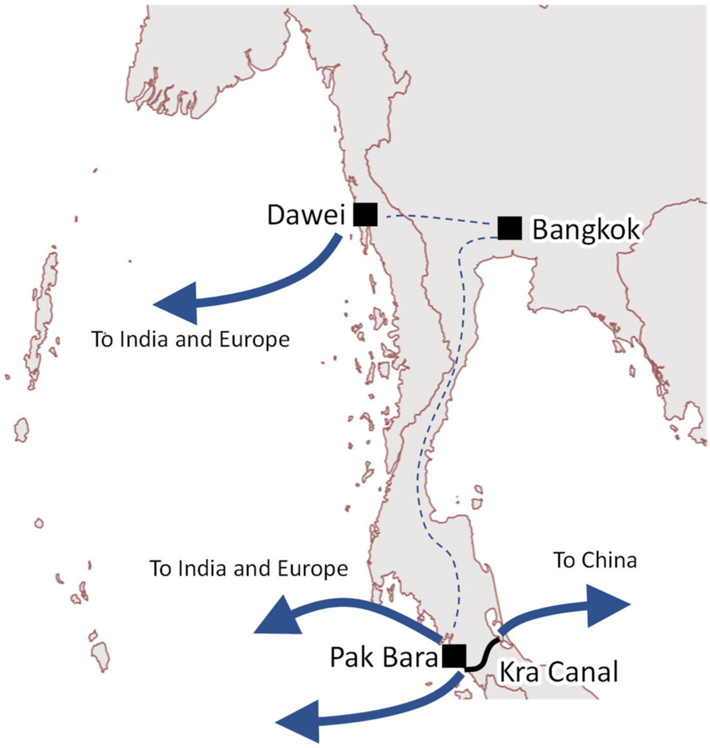
As discussed above, as the IDE-GSM is elaborated and the assumptions become closer to real projects, it becomes clear that the economic impacts of the EWEC are limited to a few regions. Furthermore, the simulation results can now explicitly demonstrate the issues discussed by experts and can be compared with other economic corridors such as the North-South Economic Corridor and Southern Economic Corridor.

4.2. Economic impact analyses of new ports on the Andaman Sea coast

Although maritime transport still plays an important role in international trade, in ASEAN, due to the presence of the Malay Peninsula, goods from Vietnam, Cambodia, and Bangkok to India and Europe by sea must bypass the Malay Peninsula and pass through the Strait of Malacca. To solve this inconvenience, several initiatives and projects are planned on the Andaman Sea coast (Figure 1-9).

One is the construction of a deep-sea port at Dawei in Myanmar and a motorway link between Bangkok and Dawei. Although this idea has been around for many years, the project has not been completed, with only a small port being built at Dawei. There have been two major project initiatives, one to build a deep-sea port at Pak Bara or Ranong in Thailand without the need for bilateral talks. There is also the Kra Canal initiative, which envisages the construction of a canal in Thailand, with ports on the eastern and western sides, allowing direct passage by ships through the canal.

Figure 1-9: New port development concept on the Andaman Sea coast



Source: Author.

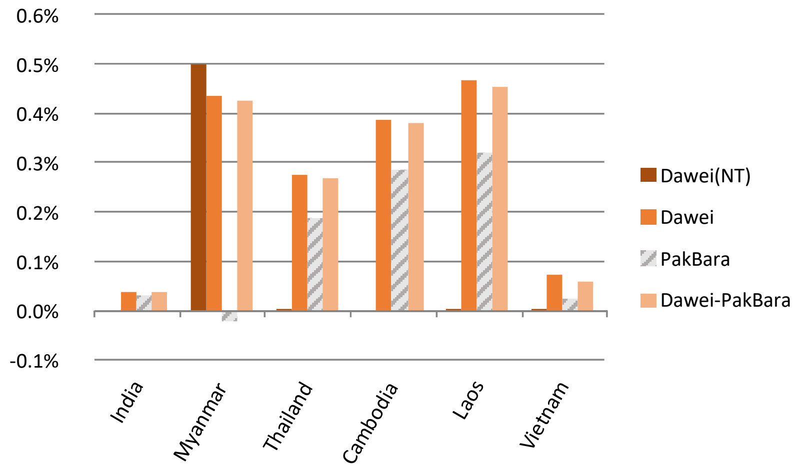
One of the features of the IDE-GSM is that it can conduct a preliminary economic analysis of such projects at the conceptual stage before undertaking a detailed feasibility study, and provide the results to policy makers. For example, Kumagai and Isono (2011) compared the economic impact of the development of the Dawei and Pak Bara ports, using the following four scenarios:

- Dawei (NT) Scenario: Dawei Port is built, but no transit transport of goods from other countries to a third country is allowed within Myanmar, meaning that Thailand cannot utilize Dawei Port to trade with India and Europe.
- Dawei Scenario: Dawei Port will be completed, and Thailand will be able to use Dawei Port to trade with India and Europe.
- PakBara Scenario: Pak Bara port is completed.
- Dawei-PakBara Scenario: Both Dawei and Pak Bara ports are completed. Thailand can use the Dawei port for trade with India and Europe.

The Dawei (NT) scenario, in which Thailand has no access to the Dawei port, is beneficial for Myanmar but has little impact on other countries (Figure 1-10). In the Dawei scenario, there are high economic impacts on Thailand, Cambodia, Laos, Myanmar, Vietnam, and India. In the PakBara scenario, Thailand, Cambodia, and Laos have positive economic impacts, but less than in the Dawei scenario, because the distance from Thailand to the port is greater than in the Dawei scenario. Vietnam's economic impact will be close to zero, and Myanmar has a negative economic impact. Furthermore, in the Dawei-PakBara scenario, Myanmar, Thailand, Cambodia, Laos, and Vietnam all receive economic impacts similar to the Dawei scenario, but less than the Dawei scenario. Therefore, when both Dawei and Pak Bara deep-sea ports are completed, the results are worse than when only the Dawei port is completed, resulting in wastage of development funds. When Dawei Port is also present, Pak Bara Port is only useful near the area where Pak Bara Port is located.[5]

[5] Although it was concluded that the construction of Dawei Port would be beneficial for Myanmar, the expansion of Yangon Port was not included at the time of this 2011 analysis, which was based on the idea that Dawei would be the gateway port to Myanmar and that Dawei would be the starting point for Myanmar's economic opening up. In the context of the development of Yangon

Figure 1-10: Comparison of the economic impacts of the Dawei and Pak Bara deep-sea port initiative (2030)



Source: Kumagai and Isono (2011).

Chen and Kumagai (2016) conducted an economic impact analysis of the Kra Canal and found that the impact spills over to many countries. On the other hand, Malaysia and Singapore are relatively less competitive and suffer from negative economic impacts. It is interesting to note that negative economic impacts also occur in southern Thailand, where the Kra Canal is located. This is because the completion of the Kra Canal is expected to increase the economic competitiveness of the Bangkok area within Thailand, leading to a further outflow of population from southern Thailand compared to the base-line scenario. Thus, a project that affects an entire region may have the contradictory result of not having a positive economic impact on the region where the infrastructure is located.

Port, Dawei Port is positioned as a project to promote the economic development of southern Myanmar.

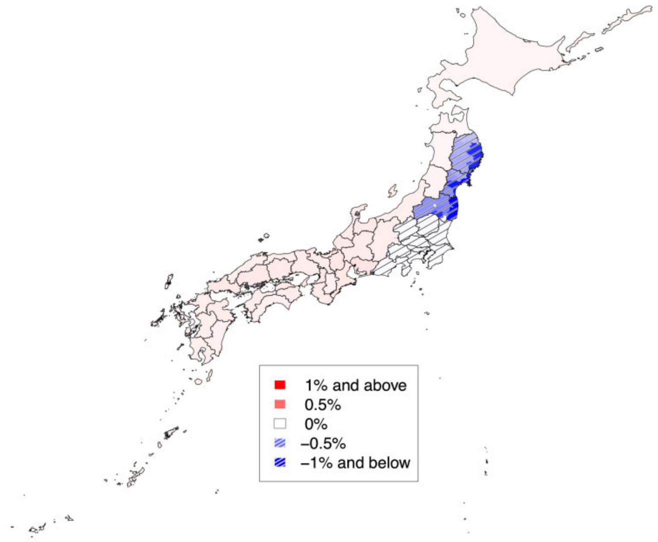
4.3. Economic impact analysis of disasters

The IDE-GSM has been used not only to analyze the economic impact of infrastructure development, but also to analyze the medium- to long-term economic impact of disasters. Similar to the immediate analysis at the conceptual stage of infrastructure development, disaster analysis has been carried out in the immediate aftermath of a disaster when data are not available.

One of the analyses is the economic impact analysis of the Great East Japan Earthquake of March 11, 2011. In the analysis, we use a baseline scenario that assumes that the earthquake did not occur in 2011, and we examine the extent to which the earthquake will have an impact (Isono and Kimura 2011). For example, we simulate the impact in 2030 when the industrial infrastructure in three Tohoku prefectures, especially in the coastal areas, is destroyed by an earthquake and recovers in three or five years. As a result, even if the industrial infrastructure is fully restored, households and businesses will temporarily move to other Tohoku prefectures, western Japan, or even China and India. These movements will shift the economic situation to western Japan and Asia. This means that even if the industrial infrastructure recovers in three or five years, some companies will not return to the three Tohoku prefectures or Japan. This will have a negative impact that will remain even after 2030 (Figure 1-11).

To prevent this hollowing-out effect, the simulation results illustrate that hollowing out can be prevented not by restricting business relocation, but by making East Asia more developed and by strengthening the linkages with Japan, which will in turn make Japan more developed and thus prevent hollowing out.

Figure 1-11: Economic impact of the Great East Japan Earthquake on Japan (2030)



Source: Isono and Kimura (2011).

The second was an economic analysis of the 2011 floods in Thailand, which disrupted supply chains, which the media noted were vulnerable, and discussed the possibility that the FDI may flee Thailand to other countries. To answer this question, an IDE-GSM analysis was conducted (Isono and Kumagai 2015).

The results are as follows. The relocation of Thai industry out of the country is limited. Firms first look to substitute production in Chon Buri and Rayong. As a result, relocation will remain mainly in Thailand. In fact, the simulation results show that Chon Buri and Rayong gain positive economic benefits from the presence of floods. The impact on Thailand will remain in the medium- to long-term, but will not be as negative as it was in 2011. The research also showed that higher growth can be expected if the right policies are implemented to promote connectivity.

In April 2020, the impact of the novel coronavirus (COVID-19) on the global economy was estimated using the IDE-GSM. If the situation at the end of March 2020 (end of February for China) continues for one month, it is expected to reduce global GDP by up to 4.2% per year (Kumagai et al. 2020). Although the validity of the figures themselves cannot be argued, as the global infection situation has changed significantly since the time of the analysis, this is an example of how the IDE-GSM can be used to provide a rapid analysis of the medium- to long-term economic impact of disasters.

5. Conclusion

As discussed above, the IDE-GSM has functioned effectively in the process of economic integration in ASEAN and East Asia, and has provided appropriate recommendations to policy makers. Even now, as in the case of the COVID-19 analysis, it remains possible to conduct provisional analysis before accurate data are available, and thus its usefulness still exists.

On the other hand, the policy agenda for economic integration and development has expanded beyond infrastructure projects, and the focus of attention has shifted to rural and inner-city infrastructure, as the infrastructure linking provinces is now in place. In this context, upgrading of the IDE-GSM itself must be carried out. However, there are technical constraints to this upgrading.

In addition to the first chapter, this report consists of the following two chapters.

Chapter 2 provides an overview of how the IDE-GSM has been extended and discusses the technical challenges for this extension. Future directions for the extension of the IDE-GSM include 1) finer administrative divisions, 2) finer industrial sectors, 3) heterogeneity of firms, labor, and products, and 4) route congestion and capacity constraints; the prospects and technical constraints of each are discussed.

Chapter 3 outlines the improvements that have been made in the production of socio-economic data, which is an essential part of the IDE-GSM project, and describes the extensions and technical challenges that are currently being undertaken. Methods of following surveys and economic censuses, estimating socio-economic data using remotely sensed data, and using machine learning to identify economic activities underlying socio-economic data are outlined. In each of these methods, there are discrepancies with the data required for the simulation analysis of the IDE-GSM, and further research and coordination are required.

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