Executive Summary

It has been more than 3 years since the beginning of the coronavirus disease (COVID-19) pandemic. Countries around the world are gradually transitioning to endemic phases and shifting to the new normal after COVID-19. A survey by the Economic Research Institute for ASEAN and East Asia (ERIA) on business activities during the pandemic showed that global value chains (GVCs) in the East Asia Summit (EAS) region were robust and resilient. Factory Asia remained resilient throughout the pandemic crisis, reconfirming the continued importance of the manufacturing sector at the core of the regional economy. Maintaining and strengthening competitive GVCs and international production networks (IPNs) is critical for the growth of the EAS region post pandemic. COVID-19 also accelerated the uptake of digitalisation, mainly in the use of communication technologies, which created a positive impact on economic growth. The Association of Southeast Asian Nations (ASEAN) and East Asia countries must use the opportunity presented by the pandemic to accelerate the necessary economic and social transformation.

While we have witnessed the acceleration of information and communication technology (ICT) in the ASEAN and East Asia region, increasingly complicated global geopolitical tensions have emerged. Countries that formerly supported free trade and investment now seek greater control over their economic activities. This political trend may weaken the rules-based trading regime, which negatively affects production, trade, and investment in the EAS region. Furthermore, the Russia–Ukraine war is resulting in inflationary pressures on the EAS economy, as well as food and energy insecurity, which will negatively and unevenly affect people's lives, especially the poor or marginalised communities.

Further, global warming and the quest for a low-carbon economy have heightened environmental concerns. The COVID-19 pandemic temporarily decreased energy consumption and carbon emissions due to the measures adopted to mitigate its impacts. However, it seemed that many parts of the world would concentrate on more immediate problems rather than the environment. Nevertheless, Europe's green movement did not stop and even escalated, while the Biden Administration in the United States (US) rekindled global warming concerns. The Russia–Ukraine War may increase demand for fossil fuels in the near term, but civil society's environmental concerns have not abated. ASEAN and East Asia rely greatly on fossil fuels. Manufacturing-based economic growth is energy-intensive and carbon-emitting. Climate change makes the area vulnerable to natural calamities. ASEAN and East Asia's decarbonisation agenda may not be advanced enough for the global movement.

The ASEAN and East Asia region needs a new development framework with deep consideration of the COVID-19 experience, the impact of digital technology, and the

geopolitical uncertainty. The Comprehensive Asia Development Plan 3.0 (CADP 3.0), the third version of ERIA's development framework for the region, provides such a framework. It covers the following four pillars: integration, innovation, inclusiveness, and sustainability. In ensuring recovery and resilience to global uncertainty, the ASEAN and East Asia region should move towards a more integrated, innovative, inclusive, and sustainable economy laid out in the CADP 3.0.

Pillar 1: Integration – fully use the new wave of the international division of labour by enhancing connectivity

The ASEAN and East Asia region has developed competitive and resilient IPNs by leveraging multinational corporations' strategy of global optimisation of production locations and the relative advantage of economic disparities in the region. The driving force was the reduction in service link costs connecting production units, enabled by early-stage ICT advancement, coupled with a generally liberalised trade environment. Multinationals' production units, located in less developed countries, have promoted building industrial agglomeration there by trading with local firms. Local firms that have engaged in IPNs have obtained indirect access to overseas markets and have acquired technology transfer and managerial know-how from multinationals. For less developed countries, participating in IPNs or GVCs or joining the international division of labour (IDL) became an effective way to develop their economies.

Now, the trend of digital technologies such as robotics and wireless broadband networks (e.g. 5G networks) has dramatically lowered service link costs in terms of face-to-face communication, and is unbundling individual production units or tasks performed by a dedicated group of people in a fixed location into subdivided units performed remotely by discrete people in multiple locations. This is the new wave of the IDL, which is not dependent on location. To illustrate, it allows a person in an urban area to run an agriculture business in a suburban area remotely via digital tools. For example, Upwork Global Inc provides matching services for freelancers throughout the world; Coconala Inc provides a matching platform for online service individuals and customers; Philippines-based enterprises offer business processing services worldwide; and online English lessons from instructors in Cebu compete with on-site lessons in Japan.

Digital connectivity is key to participating in the new wave of the IDL. Upgrading connectivity stands for not only better physical infrastructure, but also smooth and safe information flows in cyberspace. Securing free flow of data with trust is indispensable. The public and private sectors in the region must work together to improve infrastructure, rules and regulations, and the data usage environment.

Efforts to pursue further regional integration are also required given increasing geopolitical uncertainty. The geopolitical tension strengthens the popularity of protectionist policies – weakening the rules-based international trading order, which is an essential condition for effective and efficient functioning of IPNs in the region. ASEAN and East Asian countries should uphold the importance of implementing the trade and investment agenda set by the Regional Comprehensive Economic Partnership (RCEP) and update other regional integration frameworks under ASEAN centrality. In addition, although the dispute settlement mechanism in regional trade agreements has barely been used, we should think of the possibility of harnessing the potential of this mechanism. Ultimately, ASEAN and East Asia should work together and support the World Trade Organization (WTO) as an anchor for the rules-based trading regime.

Pillar 2: Innovation – shift some weight from incremental innovation to disruptive innovation

Digitalisation has remodelled the nature of innovation from incremental to disruptive. Digital businesses have shifted their weight from simply providing a market-matching function to helping to upgrade other industries, including traditional industries. Digital technology has generated vast opportunities for new businesses, and the deployment or social implementation of digital technology itself can be a good business. Newly developed countries also have ample room for exploring the advantage of backwardness by catching up with and even leapfrogging to a higher development stage.

ASEAN can benefit from digital innovation by tapping into the potential of younger generations, which have an affinity for digital technology. The growing number of ASEAN start-ups and unicorns led by young leaders is a positive development. The ASEAN and East Asia governments have played an essential role in establishing Factory Asia and accumulating incremental innovation through research and development (R&D). Now, the region needs to combine the accumulated incremental innovation with disruptive digital innovation. Not only R&D but also the deployment of technology must be emphasised. The ASEAN and East Asia governments should support innovative activities of the private sector.

To do so, they need to provide a favourable ecosystem for start-ups. First, they should create a trial-and-error business environment. For high-risk, high-return investments, venture capital is required. Incubators, co-working spaces, accelerators, and university education for entrepreneurs provide vital technology hubs. Second, they should nurture and attract human capital. Creative entrepreneurs and programmers are required. Urban facilities need to be improved to attract domestic and international human capital and ensure the mobility of educated individuals. Third, they should link global technology stocks and deployment. Universities and research institutions should allocate resources

to start-ups. They should refrain from safeguarding infant industries without careful consideration. Competition, technology, and management skills are crucial.

COVID-19 increased the use of ICT when the second ICT revolution lowered the cost of face-to-face communication online. However, face-to-face encounters still have value, especially in spontaneous encounters amongst intellectuals and intellectual agglomeration. Attracting creative individuals and activating innovation will be an important policy agenda for ASEAN and East Asia. Four urban amenities attract well-educated people: a variety of services and consumer goods, aesthetics, good public services, and speed. Creative jobs and urban amenities reinforce one other. ASEAN and East Asian cities are entering the era of competition. Attracting both foreign and domestic creative talent will be vital for full development.

In the digital age, data and data-related businesses require relevant policies. These policies are frequently not aligned with economic reality. Improper data policies may be costly. The free flow of data offers efficiency, but government action may be required to improve efficiency and productivity and to solve economic and social problems. Policies may be categorised into the following areas: (i) further liberalisation and facilitation; (ii) correcting or mitigating market failures; (iii) reconciling values or social concerns with economic efficiency; (iv) accommodating data flows and data-related businesses in domestic policy; and (v) industry, trade, and investment.

Data governance policy disputes continue. Privacy is contentious and easily politicised. Excessive or ineffective protection may hinder data transfers and lead to digital isolation; worldwide agreement should be sought. Giant platforms need adequate competition, taxes, and information transparency. The digital economy also requires government discipline over private data. Cybersecurity requires international collaboration (e.g. a monitoring system similar to that of the financial market and a joint taskforce to coordinate and/or synchronise actions against fraudulent attacks).

The WTO's Joint Initiative on E-commerce appears to be making headway, although a global policy framework remains impossible in the short term. Even in ASEAN and East Asia, the legislative structure and digital governance philosophy are different. Technological growth and economic innovation are fast, thus an international legislative framework for free flow of data with trust is needed. To develop new international norms, like-minded countries must collaborate.

Institutionalising governance structures and methods (e.g. in-country coordination and dialogue amongst digitalisation authorities, effective stakeholder engagement with industries, and a monitoring system for digitalisation programmes) may also help. Sharing best practices and enhancing collaboration with regional organisations could

strengthen the efficacy of the monitoring system. Institutionalising a governance structure for effective implementation is also required.

Pillar 3: Inclusiveness – address from three dimensions: geographical, industrial, and societal

Inclusiveness or equity is a significant value that cannot be completely realised through economic efficiency. Achieving inclusion may be economically expensive at times, yet inclusiveness and economic efficiency are not always inverses. There are three ways to approach inclusiveness: geographical, industrial, and societal.

The geographical dimension includes income and welfare disparity across countries and regions, as well as urban versus rural areas. Balancing urban and rural regions is a key difficulty in economic growth. Rural communities are often separated from urban growth, so improving connections is crucial. However, connectivity alone may not improve rural well-being. When urban–rural transport costs fall, two economic forces are generated. One is concentration forces. Urban agglomeration produces economies of scale and market proximity. These draw economic activity from rural areas. Dispersion forces are another. Agglomeration causes land price rises, labour increases, traffic jams, and pollution. Rural areas may provide benefits such as cheap labour, which drive the relocation of urban to rural economic activity. Policymakers may relocate certain economic activities to rural areas for geographical inclusion. The equilibrium between concentration and dispersion forces must be assessed. To manage these two forces, rural location benefits such as industrial estates are typically needed.

Three measures may benefit the welfare of rural people. First, providing favourable geographical advantages in rural areas shifts economic activity from the centre. Location benefits include inexpensive labour and industrial estates, with dependable economic infrastructure. Digital technologies, especially communication technology (CT), must be vigorously promoted to boost food processing, cottage businesses, and software outsourcing. Second, rural workers could be enabled to relocate to urban areas and send money home. Industrialisation causes some rural residents to relocate to cities and suburbs, which enriches rural families. However, too much relocation would hollow out rural regions, so both measures must be balanced. Third, the scope of the supply of goods and services should be expanded in rural areas. Rural people's well-being could be greatly enhanced. Digitalised services – including medical, educational, and government services – could be offered to bridge geographical distance by overcoming the digital gap.

The industrial dimension includes multinational corporations versus local firms; large firms versus micro, small, and medium-sized enterprises (MSMEs); and manufacturing versus other industries. Industrial inclusiveness is crucial – there is a massive development gap between large companies and MSMEs. Government subsidies for MSMEs

have long been the subject of argument. However, at least to eliminate market failures, disadvantageous conditions must be removed for MSMEs. At a lower development stage, MSMEs have internal limits on their product quality and delivery schedule, business strategy, bookkeeping, entrepreneurship, and engineers. Building core MSME capabilities should be a priority. At a higher growth level, external limitations become vital. Improved access to finance, market/matching, and technological resources will be necessary.

Filling the gap between multinationals and local enterprises is also an important issue. Several empirical studies indicate vertical technology spillovers in manufacturing – local enterprises acquire access to innovation from multinational purchasers in the same industrial cluster. Firms in developing countries may learn technologies from (i) foreign countries, (ii) local colleges and research organisations, and (iii) multinational plants in the country. While Japan, the Republic of Korea, and Taiwan relied on the first and second channels, ASEAN has used the third for process innovation and efficiency improvements. Agglomeration fosters interfirm links.

Additionally, the aggressive use of digital technologies should be encouraged. COVID-19 has hastened the adoption of CT in GVCs. MSMEs are often sluggish to embrace digital technologies, but they must catch up with the irreversible shift. E-payments and e-IDs continue to spread, which could help MSMEs expand their operations. The digital divide must be overcome. Strengthening digital skills education (the abilities, skills, and knowledge necessary to keep up with digital transformation), as well as technical and financial support for MSMEs, will not only contribute to digitalisation in the region but also help MSMEs overcome their sensitivity to economic shocks in the post-pandemic era.

The societal dimension includes gender, ageing, disability, healthcare, education and human resources development, economic and social resilience, food security, and social protection. The digital divide amongst people has widened during the pandemic – people who can secure a computer and internet connection can continue to work and learn, but those who cannot are left behind. ASEAN and East Asian countries should cooperate in developing digital infrastructure and digital skills at the individual level.

Financial inclusion is another long-term challenge. Smartphones, e-payments, and e-banking have enhanced impoverished rural people's access to the payment system and bank accounts. Digital technology is shifting the paradigm, yet financial inclusion needs to be developed. Social protection is another concern. Ageing populations may require a pension system, but health insurance is a more serious concern. An immediate task is to establish universal coverage. Further, although traditional social protection with familial connections remains, the government burden of social protection such as caring for older persons will certainly increase. The lack of a progressive tax structure and wealth redistribution policies in ASEAN and East Asian emerging nations will be a serious political problem in the future.

Pillar 4: Sustainability – three key areas: energy and environment for low-carbon growth, resource and waste management, and disaster management

For the ASEAN and East Asia region, sustainability is not only a long-term issue but also responds to immediate and urgent problems. The impacts of climate change and natural disasters are more pronounced in ASEAN than in any other part of the world. By 2050, climate change is projected to reduce ASEAN's gross domestic product (GDP) by up to 6%. In 2021, ASEAN adopted the Framework for Circular Economy for the ASEAN Economic Community, developed with the support of ERIA, emphasising the role of digitalisation as one of the strategic priorities.

Fully utilising digitalisation and creating solutions that complement economic development are key for a region with countries at different development stages. Technologies of the Fourth Industrial Revolution have proven to be effective accelerators for the circular business model or circular supply chains in several industries such as ICT, mining and manufacturing, education, and healthcare.

As Parties to the Paris Agreement, ASEAN Member States (AMS) are making vigorous efforts towards a low-carbon energy transition. Following the Glasgow Climate Pact, the ASEAN region will need to intensify such efforts to reach carbon neutrality. Pathways towards carbon neutrality could be diverse between countries as one size does not fit all, and each country's specific national circumstances must be taken into account.

In pursuing their respective carbon neutrality goals, AMS need to explore a variety of options and use all available fuels and technologies. Their decarbonisation pathways also need to ensure other policy objectives – availability, accessibility, and affordability. Given the high priority placed on poverty eradication, affordability is of great importance. Technology development (e.g. carbon capture, utilisation, and storage), international cooperation, and a technology-optimal approach will be needed to minimise the cost of decarbonisation.

ASEAN and East Asia are vulnerable to natural disasters as well as disasters induced by human behaviour, such as drought, floods, typhoons, earthquakes, tsunamis, and volcanoes. Preparedness, early reactions, and recovery are crucial for disaster management. The region's good and bad experiences can be shared. Satellites, early warning systems, and swift rescue schemes should be pursued.

COVID-19 raised concerns about GVC interruptions. Providing additional options for private sector expansion and diversification will make GVCs more robust and resilient. Participation in GVCs by developing countries improves diversification and risk management. The digitalisation of supply chains and trade and market integration improve GVCs' robustness and resilience. Investing in digital technology may help map and monitor supply networks to detect risks and bottlenecks. Facilitating cargo clearance and investing in e-commerce platforms would speed up and secure cross-border trade for economic recovery. Supply chains have been built on private sector efforts and activities, and governments have worked to develop the market environment. Going forward, it may be necessary to work towards quality supply chains through more public–private coordination, including standardising data sharing and creating an ecosystem where not only hyper-scalers but all industry players benefit from digitalising end-to-end supply chains.

Chapter Summary and Policy Implications

Chapter 1: The Conceptual Framework of New Development Strategies

The Comprehensive Asia Development Plan 3.0 (CADP 3.0) reflects the coronavirus disease (COVID-19) experience, the impact of digital technology, the geopolitical uncertainty, and environmental concerns. It covers four pillars: integration, innovation, inclusiveness, and sustainability.

Chapter 2: Trade Facilitation and Non-Tariff Measures

Trade facilitation aims to address bottlenecks to export and import activities both at the border and behind the border. The World Trade Organization (WTO) estimated that trade costs in developing countries are equivalent to applying a 219% ad valorem tariff on international trade. Poor design and implementation of non-tariff measures (NTMs) could result in remarkable trade costs.

As tariffs decline, addressing NTMs has become a focus of the regional economic integration efforts of the Association of Southeast Asian Nations (ASEAN). Remaining challenges include enhancing the technical infrastructure capability of ASEAN Member States (AMS) to support the adoption of harmonised standards. The absence of a coherent mechanism and institution could create difficulties in drafting effective regulations.

Most of the ASEAN Plus One free trade agreements have a general provision on trade facilitation or customs procedures and NTMs. The Regional Comprehensive Economic

Partnership (RCEP) provides a wider scope for addressing measures that impede trade. It also provides a clear period for countries to implement commitments through the provision of implementation arrangements.

The gap between developed and developing countries is particularly stark in terms of digital trade facilitation. This gap reflects the availability (or lack) of soft and hard infrastructure to support digital trade such as information and communication technology (ICT) and a legal framework to manage it. Moderate progress has been seen in cross-border coordination and transit facilitation, as well as transport facilitation. AMS are lagging on paperless trade.

ASEAN+6 Partners may be quite advanced in terms of their own trade facilitation initiatives. Enhanced cooperation with the wider East Asia Summit (EAS) region would contribute to improved implementation. Prioritising investment in ICT infrastructure and building the capacity of ASEAN government officials could also be on the agenda.

Chapter 3: The Importance of Regulatory Coherence for a Connected and Integrated ASEAN

Regulations are important in achieving public policy objectives such as protecting the environment, worker protections, and public health and safety. Regulatory coherence is important to encourage businesses to participate in the market and avoid the dominance of certain firms. This is especially important as ASEAN integrates more fully in the global value chain (GVC).

AMS regulators should (i) develop rules using evidence; (ii) conduct inclusive engagement by obtaining worldwide input or learning from global organisations about regulatory best practices; (iii) consider using international standards while drafting domestic rules or subsidiary regulations; (iv) reduce information asymmetry and encourage practical solutions via international/regional collaboration; (v) ensure regulatory quality at the highest political level; (vi) adhere to transparency and accountability as open government values; (vii) establish committees to monitor, assess, and support good regulatory practice (GRP) implementation; (viii) integrate regulatory impact assessment (RIA) into early policy phases for new regulatory ideas; (ix) conduct evaluations of the stock of regulations to verify that rules are up-to-date, cost-justified, cost-effective, consistent, and achieve policy goals; (x) publish periodic reports on regulatory policies, reform programmes, and governmental agencies implementing rules; (xi) build the ability to improve regulators' assessment and proposal skills; (xii) engage stakeholders and provide mechanisms and/or portals to access documents; (xiii) risk-assess rules throughout development, including implementation costs and enforcement strategies; (xiv) promote regulatory consistency at all levels to minimise redundancy or conflicts of interest; and (xv) offer state and local governments a research team to conduct RIA and analyse current rules.

To promote ASEAN's regulatory quality and economic performance, the ASEAN Secretariat should help AMS create and strengthen their regulatory quality capabilities and monitor their GRP implementation.

Chapter 4: Connecting the Connectivity Plans in Asia and Beyond – International Cooperation for Expanded Supply Chains and Resilient Growth

Asia is the centre of pan-regional connectivity activities. All connectivity programmes – Master Plan on ASEAN Connectivity (MPAC), Belt and Road Initiative (BRI), Asia–Africa Growth Corridor (AAGC), European Union (EU) Global Gateway, and Asia–Europe Meeting (ASEM) – seek to expand Asia's economic vitality to trans-regional partners. Integral to this area are mega-regional integration projects such as the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and the RCEP. ASEAN's notions of connectivity and community development are consistent with European and African thought and may thus be successfully used for pan-Asian, Asia–Africa, and Asia–Europe connectivity. In a global context, however, connection plans compete for space, influence, and outcomes, often for the promoting country.

Developing global connection standards is tough yet achievable. Global development programmes and multilateralism could help in government, regional, and multilateral inter-connectivity efforts. The Bretton Woods scheme monitored money and monetary institutions to support post-war peace and progress. Connectivity is the new worldwide growth strategy; thus, global governance must oversee its different elements and participants. Triangular and multilateral collaboration on connectivity produces more inclusive and sustainable plans owing to better control of project preparation procedures and plan results.

Trans-regional connectivity requires a unified or shared framework for cross-continental transport of commodities and people. Technical requirements, safety management frameworks, the social and economic well-being of sector employees, competition legislation, and customs cooperation are major beyond-the-border problems, notably in rail and road transport. International laws govern air and marine connections, but new cooperation and routes require assessment. Promoting a peaceful, safe, and open ICT environment, including data protection, needs a coordinated regulatory strategy and policies and incentives to bridge the digital gap. Common norms and standards are essential for connection synergy.

Global standards and governance guidelines for infrastructure-related connectivity initiatives may be taken from the commitment to prioritise people and their prosperity. Good governance and accountability must drive strategies for sustainable development and equitable growth. Monitoring plans will be simpler when connectivity plans align with

regional, national, and global development goals. Monitoring and regulatory procedures must guarantee that connectivity schemes are not used to undermine regional leadership or export debt issues from the promoter country or group of countries. Taxation, digital finance, the internet, data ownership and transmission, and artificial intelligence (AI) are undergoing global standardisation. Global agreement on climate change, the Sustainable Development Goals (SDGs), multilateralism, and trade is also being renewed. Global (and regional) methods for monitoring and regulating connectivity initiatives should guarantee that they improve economic and social well-being and build confidence amongst partners.

Chapter 5: Digital Connectivity

Connectivity requires digital hardware and software. In terms of digital connectivity, the region must improve physical and cyberspace infrastructure, implement rules to enable a development-friendly digitalisation environment, and combine national policies and regional partnerships to reduce institutional hurdles. Given the significant development disparities across AMS, latecomers must catch up quickly. Capacity building deserves special attention. Digital infrastructure constraints may be caused by financial or technology limitations. The public sector may need to lead the rise in quantity and quality of public goods. Sustainable development requires private sector participation.

Free flow of data with trust is the most important stage in establishing a regulatory structure to enable the digital economy. ASEAN must remove the threat to free trade and promote digital adoption to preserve regional growth. Restrictions on data flows potentially affect international trade similarly to trade protectionism. The laws and regulations should include classic trade concerns (e.g. tariffs and NTMs, trade facilitation, consumer protection, and intellectual property rights) and emerging ones (e.g. cross-border information flows, privacy protection, data localisation, and source code disclosure).

The RCEP includes a number of digital connectivity issues. Countries must balance the economy, society, national security, long-term advantages, and short-term expenses to reach agreements on these problems. This requires government and business sector partnership.

Chapter 6: Hard Infrastructure Development and Chapter 7: Geographical Simulation Analysis

Chapters 6 and 7 are closely interrelated. Chapter 6 lists the ongoing and planned hard infrastructure projects, which are selected based on the following factors: (i) the impact on the project area; (ii) the medium- and long-term plans of each country, priority projects, and projects related to neighbouring countries; and (iii) the project's feasibility

and capacity to be implemented and/or constructed. In all, 779 potential and exemplary projects were chosen. By sector, the projects are categorised as follows: roads/bridges (176 projects), railways (121 projects), ports/maritime (68 projects), airports (58 projects), other transportation (7), industrial estates/special economic zones (62 projects), ICT (19 projects), energy/power (135 projects), urban development (39 projects), water/sanitation (63 projects), and other projects (31). In terms of subregional aggregation, 396 projects (more than half of the total) are planned for the Mekong subregion,[1] while 361 projects are planned for the Brunei Darussalam–Indonesia–Malaysia–Philippines+ (BIMP+) subregion[2] and 19 projects are planned for the Indonesia–Malaysia–Thailand+ (IMT+) subregion.[3] Chapter 7 conducts an economic impact analysis of the selected projects in AMS and neighbouring countries.

Chapters 6 and 7 reveal that interregional infrastructure initiatives are becoming less important. In 2010 and 2015, large cities required toll roads and other infrastructure projects as quickly as feasible. Because of the progress achieved on these highways in heavily populated regions, infrastructure projects linking cities are less important. Urban transportation, rural infrastructure, and expanding existing infrastructure are gaining governmental attention. Some AMS need to strengthen their transport infrastructure to connect cities and communities. Countries approaching the completion of their core transport infrastructure must confront increasingly tough issues to obtain extra economic advantages, such as deploying ICT infrastructure and introducing energy-saving technologies.

Geographical simulation analysis (GSA) compares scenario outcomes to determine economic impacts in terms of cumulative gross domestic product (GDP) for 2025–2035. One scenario assumes no selected infrastructure development (baseline scenario). Another is a specific infrastructure development scenario. The economic effect is the difference between the baseline scenario and the development scenario. Development scenarios count only infrastructure projects that are scheduled to start operations by 2025.

First is the physical infrastructure scenario. The listed physical infrastructure projects, such as roads and bridges, will have the largest positive economic effect on the Lao People's Democratic Republic (Lao PDR) (110.5%), followed by the Philippines (36.8%), Viet Nam (31.6%), and Indonesia (19.5%).

[1] The Mekong subregion under the CADP has a broader scope than the Greater Mekong Subregion (GMS) program of the Asian Development Bank (ADB), in that we emphasise connectivity between ASEAN and India. The Mekong subregion consists of vibrant industrial agglomerations such as Bangkok, Hanoi, Ho Chi Minh City, and Chennai; cities with high potential to join international production networks in the region such as Phnom Penh, Vientiane, Yangon, Danang, Kunming, and many cities in Thailand; and mountainous regions in Cambodia, the Lao People's Democratic Republic (Lao PDR), and Myanmar.

[2] The Indonesia–Malaysia–Thailand+ (IMT+) subregion under the CADP is an extension of the Indonesia–Malaysia–Thailand Growth Triangle (IMT-GT) in the sense that the IMT+ emphasises connection with nearby industrial agglomerations, i.e. Bangkok and Jakarta.

[3] The BIMP+ subregion in the CADP is significantly larger than the Brunei Darussalam–Indonesia–Malaysia–Philippines East ASEAN Growth Area (BIMP-EAGA), as the BIMP+ expands the geographical scope to include Manila and Jakarta (and Surabaya) as neighbouring industrial agglomerations within the subregion.

Second is the information technology (IT) infrastructure scenario. IT advances are expected to lead to an extensive build-up of facilities in selected metropolitan cities owing to technicians, clients, and associated services. GSA shows that countries with big IT build-ups have considerable economic consequences, and the benefits of IT are not just good for the city where the IT infrastructure is built, but for the whole country where the city is located.

Third is the CT infrastructure scenario. The adoption of 5G and associated services in CT is expected to reduce transit costs and trade barriers in the services sector, since CT allows trade in products and services and might change how they are exchanged. GSA indicates that most AMS areas benefit economically – including Singapore, Brunei, and especially Cambodia.

Fourth is the energy conservation infrastructure scenario. AMS are expected to benefit economically from new energy-saving solutions. The GSA reveals that Cambodia, the Lao PDR, Myanmar, and Viet Nam are economically prosperous.

Fifth is the scenario combining the above four scenarios (combined scenario). The economic effect of the nine AMS excluding Singapore is more than the sum of the four scenarios, which shows synergies between the four scenarios.

Last, we simulate the 'all' scenario, where the remaining key transport infrastructure projects that have a significant economic impact on the region, such as the Hanoi–Ho Chi Minh City expressway, the Manila–Davao expressway network, and the Trans-Sumatran Highway, are added to the combined scenario. Under the 'all' scenario, almost all AMS will receive positive economic impacts.

The GSA findings demonstrate that if infrastructure developments, ICT growth, and the introduction of new technologies to achieve energy efficiency are coupled effectively, many outlying parts of the AMS may expand further. Policymakers should push this. Remaining big projects must be finished, and 5G and new services must be rolled out nationwide.

Chapter 8: Innovation Systems and Digital Transformation

Many AMS have reached middle-income status by engaging in GVCs due to their comparative advantage in labour costs. This development paradigm may seem adequate for nations to reach high-income levels, given that sophisticated technology is expected to flow to AMS via foreign direct investment (FDI), generally in manufacturing. Middle-income AMS struggle to overcome the middle-income trap. Comparing Asian Miracles to middle-income countries, it is difficult to discover FDI-only high-income economies. All Asian Miracles that established innovation systems, built innovation skills, and fostered competitive private enterprises did so in a healthy competitive market environment.

To establish innovation-friendly marketplaces, middle-income AMS must remember empirical lessons about technology diffusion from global frontier enterprises to national firms. Promoting global-level enterprises in a country promotes other national firms, yet national laggards have trouble acquiring global frontier technology directly. Second, building global-level businesses requires stimulating entrepreneurship, FDI for global innovative enterprises, an enhanced educational system, research and development (R&D) activities, industry–university R&D partnerships, and an effective intellectual property rights structure. Third, reducing inefficient and incompetent enterprises improves macro-level innovation. To accomplish this, AMS must cut administrative expenses for businesses and balance employee protection and inefficiency restrictions. Last, product market rules, employee protection, and industry–university R&D collaboration must be eased to allow national laggards to catch up.

ICT will be implemented in all industries – manufacturing and non-manufacturing – and render present business models outdated. Both the business and governmental sectors in AMS economies must grow by transferring weight from accumulated incremental innovation (usually in manufacturing) to disruptive digital innovation (adopted in all sectors). Through the benefit of backwardness, technology use gaps provide the possibility to expand swiftly by catching up to or leapfrogging a higher development stage. AMS governments must remember that arbitrarily subsidising enterprises will not generate innovative firms. Theoretically or empirically, such industrial policies are unjustified. Pro-innovation industrial policies should keep the market competitive and require accountability.

Chapter 9: Skills Development System – Soft Infrastructure for Leapfrogging and Feedback

Formal education is the most significant part of skills development that needs improvement. Most people spend their formative years there, so it can help build life skills. The present education system, built during the first and second unbundlings, must be upgraded for the third unbundling.

Governments may enhance education in numerous ways. First, they can develop a national plan for human resources development. A national strategy focused on meeting the modern economy's requirement for qualified people may provide the political push for change. Second, in many nations, education laws were created decades ago and must be updated to reflect the modern economy. Identifying and empowering high-performing educational institutions and allowing collaboration between educational institutions that create skilled workers and companies that employ them are some proposals. Third, quality needs to be improved. A high-quality education affects not just short-term results such as test scores but also lifelong incomes. Physical infrastructure, the curriculum,

and instructors define a school's quality. This entails investing in teacher development, improving school infrastructure, and establishing a curriculum that encourages cognitive and non-cognitive abilities in demand in the current labour market. Fourth, vocational education may help fill semi-skilled jobs. Comprehensive education policies that integrate general and vocational tracks may enhance the image of vocational education. Fifth, the business sector should cooperate with the government to strengthen the education system. Private sector engagement improves industry–education links, especially in vocational and higher education.

Reskilling and upskilling are also important to update the skill levels of people in the workforce and address the fear of robots replacing humans. Reskilling gives employees a set of abilities closely connected to their present competence, allowing people to execute activities that technology cannot. Upskilling demands a more drastic shift in skill sets and may need rigorous retraining. Much reskilling may happen at work, but it is not free. Businesses must choose between reskilling existing employees or replacing them. Some displacement is unavoidable; therefore, the government must help displaced people reskill and upskill so they can work in new industries. Training must fit local economic realities, and business collaborations are key.

Reskilling and upskilling are connected to lifelong learning, where skills are acquired through time. Lifelong learning helps people adjust to unavoidable but unanticipated economic changes. Adaptability involves the ability to analyse new information and make data-driven judgements. Lifelong learning may be formal (at a school), informal (on the job), or non-formal. This may happen in community learning centres, online platforms, and seminars. As it is decentralised, it needs complementary policy activities. Employment placement services, training programmes, skilling incentives, and labour market laws are examples. Non-formal and informal education, including self-learning, are key to lifelong learning. How do we recognise non-formal skills? Formal testing needs a qualifying structure. Peer recognition and professional network endorsements could be used for informal evaluation. Employers are the greatest judges of a candidate's talents, thus legislation should boost recruiting.

Chapter 10: Global Value Chain, Cities, and Urban Amenities – Case Study of ASEAN and East Asia

East Asia's economy is being transformed by the GVC network. Since 2010, the domestic value added of AMS exports has been reasonably strong and constant. The evolution of GVCs facilitated by digital and communication technology generates new economic prospects. Globally, there is considerable movement from the trading of finished items to the interchange of parts and components. Geographically, GVCs have spread – encompassing a greater range of countries across diverse locations.

To fully harness GVC transformation, AMS need to address weak foundations in the economy. Regional and global value network growth depends on important elements, such as human capital development in skills, technical development and leveraging digital technologies in ICTs, and urban centre development to promote economic and social agglomeration. The following are more specific policy recommendations.

First, human capital in ASEAN is still too low to fully engage in GVC activities. The ASEAN least developed countries (LDC) labour force only has elementary or lower education; higher primary and secondary education is needed. The more developed AMS – Indonesia, Malaysia, Thailand, and Viet Nam – require a more comprehensive human capital development framework that emphasises quality education and enhances upper secondary and post-secondary education, especially in scientific and technical education. Further, there is also a need to create an integrated framework for training and retraining of workers in relevant skills. Aligning industrial and educational policies in the overall development plan will enable coordinated structural transformation of the domestic economy.

Second, services and investment in ASEAN require more openness. Behind-the-border concerns and domestic regulatory burdens still hinder the services industry. The next step of liberalisation might concentrate on important services sectors (e.g. aviation, transportation, banking, e-commerce, educational services, and business services) to strengthen GVC links in the area. Traditional services trade industries in ASEAN LDCs, such as tourism, might be upgraded to green or cultural tourism. Liberalising services is also crucial for innovation and entrepreneurship in building new GVC and services connections in the local economy and the region. Information governance reforms, domestically and regionally, will offer a foundation for developing a region-wide digital framework that will generate a GVC network to enable new innovations and services in the area.

Lastly, liberalisation of services should be connected with the mobility of people, especially semi-skilled and skilled employees. People's mobility will be key to developing city and urban links within the domestic economy and between regional cities. Further, links between cities are needed to facilitate the mobility of people and ideas to boost creative and entrepreneurial activity in the domestic economy. Urban agglomeration is vital for creating competitive suburban and metropolitan regions around cities. These cities' competitiveness will fuel the region's next development cycle. The competitiveness of ASEAN cities will rely on the quality of urban amenities, which boost liveability, attract skilled labour, and promote innovation. Urban amenities will help manage medium- and large-city congestion and increasing living costs. The competitiveness of Asian and ASEAN cities will rely on the quality of urban facilities, which will attract qualified labour and develop innovation and value chain links.

Chapter 11: Realising Smart Cities

About half of ASEAN and East Asia's population resides in cities, which will fuel future development. The ASEAN Smart City Network was created in 2017 as more cities explored smart solutions to solve economic, environmental, and social concerns. Planning, economic growth, robust water supply, and linked data and security systems are straining cities. Smart cities need to address how digital infrastructure choices may help manage resources. The emerging concept of smart cities uses highly advanced technologies in urban design, where energy service is becoming one big and highly complex cyber-physical system in which computer-based algorithms improve the quality of life of city residents and build a sustainable and clean environment for them. ICT-enabled service delivery is smart city architecture.

Smart cities gather data via instrumentation, integrate it, and analyse it to enhance city services. Interconnecting enabling technologies via a platform offers a substructure that improves service to connected consumers/users. Sensor services and instrumentation equipment may monitor resource usage or people's movement in energy, transport, waste, and water. Automated optimisation uses camera, sensor, and anonymised mobile phone data to optimise traffic patterns in real time. Predictive analysis tracks and predicts anything from rainfall to typhoon landslides, boosting business continuity strategies. Evidence-based decision-making and planning may monitor milestones and objectives so that cities can take corrective action as required to meet productivity goals cost-effectively.

Smart cities foster innovation. Cities share local data with the public via open data, fostering openness, accountability, and collaborative problem-solving. Using living laboratories, governments designate sections of the city as test beds to jointly pilot-test novel concepts. Cities collaborate with local universities and businesses via incubation centres to seed transdisciplinary research institutions with systematic access to local city data.

Smart city initiatives should serve all inhabitants. Three regional trends are noteworthy. First, using data to target the most disadvantaged, as Singapore is doing by creating a database of socioeconomic and physical indicators to prioritise housing projects. Second, using open data to enhance accountability, such as mapping facilities, pollution, and community needs in Salem. Third, using mobile connections and citizen involvement for participatory government and crowdsourcing polluting vehicle detection, as in Jakarta.

The third unbundling will be caused by smart technology and data explosion. Cities could catalyse this by becoming living laboratories for smart technologies that transform local experiments into global knowledge and global knowledge into local solutions. Accelerating development requires multilevel efforts. ASEAN and East Asian cities may

adopt open internet of things (IoT) devices and data collecting standards. This would prevent dependence on a few tech giants. It would also make it simpler to exchange solutions like a Jakarta-developed application programming interface that can be quickly implemented in Kuala Lumpur via mutual recognition agreements. Local governments may address the fragmented structure of their bureaucracy and obsolete rules to create and implement an integrated ICT system that allows the flow of people, information, and ideas across city/national borders.

Chapter 12: The Role of the Automotive Sector in Regional Economic Development

By 2040, most AMS will be high-income. AMS should improve manufacturing and promote sustainable industrial growth for a successful, healthy society. Automotives and the motorisation society[4] also harm society. ASEAN and East Asia require electrification and autonomous driving infrastructure. Rapid vehicle and motorisation advancement harms our towns.

Connected, autonomous, shared/service, and electrified (CASE) and Mobility as a Service (MaaS) can reduce the societal costs of the motorisation society. AMS must incorporate these waves into automobile industry rules. Connected vehicles will enable autonomous driving, but they must be secure and private. Digitalisation and CASE enable sustained motorisation and economic development. Increasing connectedness improves the socio-economic well-being of each country and the region.

Some AMS lag in infrastructure development, yet the lack of current infrastructure would enable them to establish new energy vehicle infrastructure (e.g. charging stations). ASEAN wants vehicle-to-Infrastructure (V2I) technology to unify autonomous cars and infrastructure. To adopt CASE and MaaS, ASEAN requires physical and institutional interconnection.

AMS must promote the circular economy to dominate the global automobile sector. Telecom connections, sophisticated transportation networks, and high-speed charging stations must be implemented. ASEAN approved the Automotive Mutual Recognition Arrangement in 2019. Smart City Development is crucial to green transportation. Automotive sector growth will depend on education and human resources. CASE and MaaS, powered by digital technology, will be the 21st-century automotive infrastructure for decreasing societal costs.

[4] 'Motorisation' refers to the social transformation that happens when many individuals are able to own their own vehicles owing to a rapid rise in incomes.

Chapter 13: Inclusive Growth

Cambodia, the Lao PDR, Myanmar, and Viet Nam have achieved considerable development gains in the last two decades. Viet Nam is an example. As in many locations across the globe, growth tends to favour urban over rural regions, creating large disparities. Rural development has size and capacity issues, fragmented populations, and lack of economic connectedness. By recognising the rural economy's unique qualities, authorities may establish effective policies. AMS may enhance rural inclusion via social, geographical, and sectoral development.

Despite its small scale and non-viable investment features, investing in rural development is important for several reasons: (i) people in rural areas have the same rights as people in urban areas to fulfil their basic needs; (ii) the potential of rural areas is significant and influential at a macro level; (iii) the linkages between rural and urban areas show their interdependence; and (iv) successful urbanisation depends on the quality of migrants, who mainly come from rural areas.

China and other countries have had success investing in rural infrastructure and development. Viet Nam's economic growth and productivity stem from enormous investments in infrastructure, education, and healthcare. Electricity in Bangladeshi villages improved output, profit margins, business growth, women's empowerment, quality of life, and human capital development. The EU designed the common agricultural policy to contribute to innovation, the environment, and climate change mitigation and adaptation.

The efforts of AMS to enhance rural living, particularly in the Mekong subregion, should be appreciated and sustained. Partnerships with the international community (as a lender and through technical assistance) and local communities have produced beneficial results. Other approaches include engaging private sector engagement through mutually advantageous schemes; connecting rural areas to bigger economic regions, notably cities and neighbouring nations; integrating rural–urban development planning; and adopting a market-based strategy.

Green bonds and development bonds could help fund market-based social infrastructure. The Cambodia Rural Sanitation Development Impact Bond (DIB) is the world's first DIB for sanitation. It seeks to reduce Cambodia's high rates of open defecation and promote universal sanitation. The DIB encompasses six provinces and attempts to alleviate stunting, sickness, and water pollution. Green bonds may be issued for rural energy sector development under the climate change adaptation plan.

Chapter 14: MSME Responses to the COVID-19 Pandemic and Their Way Forward

MSMEs play a crucial role in a nation's economy and growth. They dominate the enterprise population and employ a significant proportion of the workforce. The firms are strong pillars of industrial growth, particularly in the construction of industrial agglomerations and worldwide production networks. The global economy had a severe recession in the second quarter of 2020 and had not completely recovered by the year's end. The purpose of this chapter is to provide suggestions on how policy should be tailored to support MSMEs more efficiently.

First, boost MSMEs' use of e-commerce. During the pandemic crisis, numerous MSMEs in several nations onboarded to e-commerce platforms. Because of social distancing during the pandemic, e-commerce reached a larger number of consumers. The intensive margin may be improved through product quality, customer service, etc. As for the extensive margin, government programmes supporting MSMEs could be spread to as many e-commerce platforms as possible. However, MSMEs' onboarding to e-commerce platforms is not easy. Most micro and small businesses require the knowledge and skills to join such platforms. This requires micro and small businesses' digital literacy. Governments can assist in improving digital literacy. Lack of internet infrastructure is another hurdle, particularly in rural regions. Governments must invest to fix this issue. Further, discount vouchers, particularly those sent digitally via e-commerce platforms, may be used to help MSMEs survive.

Second, build the capacity of MSMEs. To shift to a new business model, MSMEs need capacity building support. Capacity building programmes should work with digital business players (e-commerce, marketplaces, digital payments, logistics, etc.), business groups, and corporations to provide practical know-how. Successful capacity building programmes have these features: (i) coaching and mentoring with close trainer–entrepreneur contact, (ii) entrepreneurial acumen training, and (iii) adaptability for company requirements. Capacity building programmes for industrial clusters will also help boost company innovation capabilities.

Third, streamline MSME funding. Companies need financial aid to survive economic crises like the pandemic. MSMEs are less linked to official financial or banking systems, hence their necessity is much greater than that of large companies. The pandemic makes it crucial to develop fintech as an alternate source of funding for MSMEs. Fintech's easier procedures and rapid processing times are made possible by digitising the back-end credit review process. Fintech services may help MSMEs finance working capital if the cost of borrowing can be met by the operating margin.

Chapter 15: Healthcare

ASEAN and East Asian nations are witnessing a significant demographic transformation that will increase the number and percentage of older persons. Population ageing poses substantial sustainability challenges for societies, including demands on health systems and social care. Long-term care needs are set to grow. Under the present demographic scenario, it may be more vital than ever to create new models of care in the health industry to better meet the requirements of an ageing population. To overcome their healthcare concerns, numerous nations have resorted to ICT. We highlight five critical aspects for a digital healthcare strategy.

First, people and new ways of thinking and doing are more important than technology for effective healthcare digitalisation. Failures in technology initiatives are usually due to poor conceptualisation and execution, not the technology itself. Leaders and decision-makers must be able to envisage and accept new ways of working and rethink present procedures. Executives must establish a change-receptive culture and change management methodology. When organisations and people are open to change and have the right mentality, tools, skills, and knowledge, technology adoption is more successful.

Second, the technologies with the most immediate advantages were specifically developed to make people's work or patient interactions simpler. Where technological interventions have failed, inadequate attention was paid to the architecture of the system or the interventions were simply put on without careful study, on top of existing structures and work patterns, resulting in increased effort and user aggravation. For technological solutions to fulfil user demand and address their issues, detailed knowledge of the job and worker needs is essential. Organisations must strike a balance between installing an off-the-shelf package solution and knitting together current healthcare systems. Top-performing digital hospitals combine a core package solution with a few clinical specialists.

Third, while healthcare digitalisation provides the opportunity to collect and store big data more easily than with analogue records, the best use of these data will be constrained without comprehensive data management and analytics. Improving efficiency involves rethinking work processes; using predictive models to decrease variance, manage resources, anticipate demand, and act early; and learning and adapting. Successful healthcare digitalisations have invested in data analytics to generate insights from clinical and non-clinical data. All data systems are concurrently mined using powerful search tools and hyper-indexing. Investing in and expanding a professional workforce's data analytics skills may enhance operational and clinical operations, population health management, and medical care.

Fourth, interoperability and data security must be considered from the outset. Data sharing across contexts is crucial for coordinated treatment and realising the full advantages of digital technologies in healthcare. Shared clinical information systems that meet national data and interoperability standards may benefit the whole health industry. Sharing data requires sophisticated security mechanisms and data governance in the form of privacy regulations and enforcement rules, especially in the face of cyberattacks and data breaches. Data governance procedures must be put in place to reassure patients and healthcare professionals as they transition away from paper-based systems. National and local actions are needed to assist organisations in storing and distributing data properly and in preserving medical records.

Fifth, it is a given that technology will become outdated over time. Continuous iterations and upgrades are required alongside new process and product improvements. Constant growth and adaptation of digital technologies enable them to reach their full potential. Natural language processing allows free text to be structured and analysed; AI, decision support, and cognitive computing offer opportunities for more automation and improved decision-making; and the increasing intelligence and reach of devices supported by IoT and sensor technology will open new possibilities for better resource management, patient segregation, and more.

Chapter 16: Food and Agriculture

Food and agriculture confront numerous obstacles. Accelerating the development in agriculture and food production is required to feed the expanding regional and global population, yet natural resources such as fertile agricultural land and fresh water are becoming scarce. Recent external shocks, such as the COVID-19 epidemic and droughts and floods, have reminded us of the need to strengthen agricultural productivity and food supply systems. Food and agricultural output need to be increased while lowering the environmental strain using digital technology.

The ASEAN Guidelines on Promoting the Utilisation of Digital Technologies for ASEAN Food and Agricultural Industry are the first digitalisation guidelines for the food and agriculture sector and will be a standard for digital transformation. In the near future, each AMS may consider establishing a country- and sector-specific road plan for digitalising food and agriculture, taking into account each country's agricultural status and growth strategy.

The cold chain system adds value to food and agriculture while lowering the environmental impact. The cold chain system reduces post-harvest and food loss, lowering the environmental impact. Many developing nations struggle to create a modern cold chain and involve smallholders. The best method to improve the situation, particularly for LDCs,

is to provide a successful model case to smallholders and other stakeholders. This would improve stakeholders' understanding of cold chain benefits and modify smallholders' mentality.

A sustainable food system is gaining worldwide attention. This concept includes smart farming, smart food chains, low greenhouse gas (GHG) emissions, organic farming, a competitive food industry with decarbonised and environmentally friendly technologies, food loss reduction, sustainable material sourcing, investment for development, and the diffusion of innovative technologies. Some nations and areas, particularly wealthy ones, have constructed sustainable food systems. ASEAN should establish region-specific rules, policies, or plans for a sustainable agricultural and food system in partnership with dialogue partners and international organisations.

Chapter 17: Energy Infrastructure Development

Stable economic and demographic expansion will boost EAS energy demand. It will continue to rely on coal, oil, and gas until 2040 under the business-as-usual (BAU) scenario, even with increased crude oil prices (about $120 per barrel in 2040 at 2016 constant prices). Governments focused on the epidemic, employment, and the economy may not prioritise energy conservation and climate change. Reassessing China's technological dominance might reduce reliance on Chinese solar panels. Nationalism's rise and globalism's decline will hurt national, regional, and global climate change efforts. Since governments prioritise epidemic spending and rescuing people and small companies, renewable energy investment and subsidies will be restricted. During economic strife, inexpensive energy is a higher priority, so domestic energy supplies and coal might survive longer than projected before the epidemic.

Ongoing social distancing practices, such as moving almost all activities to the internet (e.g. meetings, works, and shopping), the modal shift from mass to private transport, and avoiding long-distance air travel, could change the energy consumption pattern and lessen energy use, air quality, and carbon emissions. ASEAN and East Asia should have used low fossil fuel prices, particularly in 2020, to phase out ineffective fossil fuel subsidies.

If nations execute their energy efficiency and conservation (EEC) policies and promote low-carbon energy technologies, such as nuclear power and solar photovoltaic (PV)/wind, the region could realise substantial energy savings – mainly via decreased fossil fuel consumption – and greatly reduce carbon emissions. Many nations' alternative policy scenarios (APSs) are suitable since their estimated carbon reduction is the same as or more than their intended nationally determined contribution (INDC) objectives. ASEAN

and East Asian nations must use the Plan-Do-Check-Act (PDCA) cycle to promote their EEC and renewable energy policies, including energy-saving objectives and action plans.

Natural gas will expand the fastest amongst fossil fuels through 2040 and will be an essential fuel in the transition to a new energy system because of cheaper pricing than crude oil, varied import sources, and fewer carbon emissions than oil and coal. Creating a transparent liquified natural gas (LNG) market in Asia, removing the destination clause, and consumer engagement in LNG production are advocated to achieve this rise.

Future energy demand research suggests that energy efficiency operations will save a lot of energy, notably on oil and power consumption by end users. Therefore, these EEC policies should be promoted: (i) standardise the labelling system for appliances and energy facilities such as boilers and compressors; (ii) develop energy-saving companies; (iii) increase next-generation vehicles including hybrids, electric vehicles (EVs), plug-in hybrids, and fuel cell vehicles; (iv) establish and implement a green building index; and (v) develop an advanced energy management system.

Increasing the amount of renewable energy (hydro, geothermal, solar PV, wind, and biomass) would decrease fossil fuel use and carbon emissions, contributing to the INDCs and the SDGs. This requires appropriate government policies, such as renewable objectives, legal procedures, and improved feed-in tariffs to incorporate bidding and tendering processes.

EAS energy security is a primary concern. EEC and renewable energy reduce fossil fuel usage and increase domestic energy use, boosting regional energy security. Regional energy networks like the Trans-ASEAN Gas Pipeline, which transports LNG as a virtual pipeline, and the ASEAN Power Grid (APG) may diversify energy supply sources. The Lao PDR, Thailand, and Myanmar is where the APG begins. Oil hoarding and nuclear power production are potential options for regional energy security. Clean coal technology and carbon capture and storage will make the region's coal power facilities carbon-free. Hydrogen technology may be used in power production, manufacturing, and road transport as an alternative to fossil fuels.

The EAS nations will require $4 trillion for power plants, refineries, and LNG-receiving terminals under BAU, with power plants accounting for $3.5 trillion. ASEAN requires $686 billion in BAU for power production, refineries, and LNG terminals, and $605 billion in the APS. Refineries and LNG terminals save oil and gas, causing the disparity. Under BAU, a lot of money will go to coal power plants (clean coal technology), while under the APS, more money will go to low-carbon energy electricity, such as nuclear, geothermal hydropower, solar PV/wind, and biomass.

Developing energy infrastructure will require public–private partnerships, international/regional bank public funding, the Clean Development Mechanism, and/or the Joint Credit Mechanism. As part of the COVID-19 recovery, governments are designing economic stimulus packages that might create opportunities for high-quality low-carbon infrastructure projects. AMS should take advantage. A cross-border electrical network could bring energy security and climatic advantages.

Chapter 18: Environment and Sustainability

As Asian countries shift from GDP-driven economic development to well-being standards of sustainable and inclusive growth, demand for innovative environmental technology rises. Transformational changes are possible, but they will not happen effortlessly. Proactive and collaborative approaches – involving politicians, technological champions, academics, and international organisations – will be necessary at the regional level to provide maximum sustainability benefits and increase resilience.

Governments, international organisations, academics, and industry all play roles. In the early phases of digital technology adoption, markets alone will not provide enough incentives. Most AMS are low- and middle-income countries, and governments must discover solutions to stop environmental damage with regulations that keep up with rising technology penetration. This involves enabling governments and localities to experiment with innovative technologies to manage environmental concerns. Regulatory systems need to be reformed to use digital technologies to better assess and regulate environmental hazards and resilience concerns.

Technology companies and entrepreneurs may promote the development and worldwide deployment of technologies for environmental sustainability and resilience by creating business models. New business models are required for satellite and drone fleets that can supply crucial new data streams, and for algorithms and computer programmes that can turn those streams into planning tools for improved natural resources management, pollution control, and climate resilience. Governments and communities could regard such business models as public benefits.

The following collaboration frameworks are necessary. First, dialogues and collaborations that bring Industry 4.0/digital/smart technology developers and suppliers together with environmental specialists to co-develop innovations for public benefits, i.e. sustainability, while minimising cybersecurity concerns. Second, innovative investment platforms, funding arrangements, and business models that can scale potential eco-innovations enabled by smart technology, whether they have a clear commercial pitch or less

lucrative environmental advantages. Third, partnership with other and international organisations to establish shared and adaptable institutions and governance systems, including common policy principles for handling emerging technologies, data protocols, and transparency methods. Last, regularly assessing and amending the growing legal and regulatory framework to clarify and fully express the roles of new technologies that boost environmental benefits and promote family and community resilience.