

Research



COVID-19 Related Projects



1. 10+3 Cooperation for Improvement of Supply Chain connectivity (SCC)

The 21st ASEAN Economic Ministers Plus Three Consultations reached a consensus to carry out a Joint Study on '10+3 Cooperation for Improvement of Supply Chain Connectivity (SCC).' On the sidelines of the 21st ASEAN Plus Three (APT) Summit in November 2018, the parties involved announced the launch of the Joint Study and appointed their research institutions to conduct it. The institutions are Chinese Academy of International Trade and Economic Cooperation (CAITEC), Economic Research Institute for ASEAN and East Asia (ERIA), Japanese External Trade Organization (JETRO), and Korea Institute for Foreign Economic Policy (KIEP).

ASEAN has been taking its own initiatives to improve the trade facilitation environment amongst its member states through reducing trade transaction costs by 10% in the region by 2020 as agreed by the ASEAN Economic Ministers (AEM) at the 23rd AEM Retreat held in March 2017. In this regard, the ASEAN Seamless Trade Facilitation Indicators (ASTFI) and Trade Transaction Costs (TTC) projects, conducted in cooperation with the ASEAN Trade Facilitation Joint Consultative Committee (ATF-JCC), Coordinating Committee on Customs (CCC) and the ASEAN Secretariat (ASEC), are studying the trade environment in ASEAN by conducting surveys of the government agencies and measuring trade costs through conducting a Time Release Study and dwell time data. Simultaneously, the recently

updated ERIA–UNCTAD Non-Tariff Measures (NTMs) database which was shared by ERIA to ASEAN Member States (AMS) to populate their respective national trade repositories (NTRs) will contribute towards increased transparency. In addition, managing NTMs in ASEAN project will help provide the necessary approaches to streamline NTMs. Further, ASEAN has also adopted the Guidelines for the Implementation of ASEAN Commitments on Nontariff Measures on Goods to address and manage future NTMs.

The proposed Joint Study on '10+3 Cooperation for Improvement of Supply Chain Connectivity (SCC)' would, therefore, complement the ongoing trade facilitation initiatives in ASEAN, help improve trade amongst ASEAN Member States, and enhance supply chain connectivity between ASEAN and CJK countries. The APT members, geographically from Northeast Asia to Southeast Asia, comprise developed countries and developing countries, whose population accounts for 57%, GDP for 88%, and trade volume exceeds 50% of Asia's total. Extension of the scope of SCC research to the APT countries will not only boost the region's economic development and increase the scale of trade between these countries, but will also be of great significance for SCC building in Asia or even worldwide.

On 14 April 2020, the Special ASEAN Plus Three Summit on COVID-19 was held via video conference. In the Joint Statement 1, the Leaders reaffirmed their commitment to APT cooperation and mutual support. The Leaders agreed that APT countries need to enhance macroeconomic policy coordination, ensure the smooth functioning of the industrial and supply chains, and gradually

restore social and economic order. Facing the unprecedented challenges of COVID-19, APT countries need to work together to overcome the pandemic and restore economic vitality as soon as possible by taking effective measures to strengthen SCC cooperation in the region.

Policy Implications:

- An overview of the general situation of SCC in APT countries.
- Constraints and risks encountered by enterprises in the APT countries, through desk research and interviews, in relation to physical infrastructure, logistics, trade facilitation environment regulations, amongst others, including how they have been affected by the current pandemic.
- Policy recommendations to improve SCC in the APT countries.

2. Survey of the Impact of COVID-19 on Business Activities and Supply Chains in East Asia and the ASEAN Region

COVID-19 has seriously affected the economies of East Asia and Southeast Asia through disruptions in the movement of goods and services in the global value chains of the region and a fall in demand resulting from social distancing and lockdown measures. Moreover, the uncertainty of when the pandemic will end puts pressure on economic activities. The economic shock caused by the COVID-19 crisis is likely to more significantly impact the real economy than the recent financial crisis. In particular, in East Asia and Southeast Asia, which have established themselves as the 'factory of the world', concerns about the impact of the pandemic

on their corporate activities and production networks are prevalent.

In November 2020–February 2021, the Economic Research Institute for ASEAN and East Asia (ERIA) surveyed local and foreign companies in ASEAN and India to understand the impact of COVID-19 on business activities and supply chains.

Key findings of the survey include the following:

1. The COVID-19 impact promotes changes in the supply chain, whose effects are larger than the trade frictions between China and the United States (US).
2. Many of the respondents have already implemented changes on the customer side of supply chains. Changes on the supplier side and in production locations are still being considered.
3. About 40% of the manufacturing respondents have already implemented changes to or planned to change the production location in response to the COVID-19 pandemic.
4. Many respondents have resorted to cost reduction and optimisation as supply chain measures in response to COVID-19, but not many have adopted digitisation.

Deepening Economic Integration



1. Dynamics of Global Value Chains in Asia

The COVID-19 pandemic has tested the endurance of global value chains (GVCs) in Asia and other parts of the world. In many places, the production crisis and the health crisis became conflated. Putting the saving of lives over economic output has become the policy choice, resulting in severe shocks to production and demand.

The shocks and disruptions in GVCs have led businesses to consider diversification of investments and restructuring of supply chains. In the medium- and longer-terms, investments in manufacturing, and even research and technical cooperation, will encounter structural and geographical changes, in which new centres of production and consolidation and integration of supply chains in Asia, Africa, and Europe are likely to emerge. Geographically and industry-wise, change in investment patterns and GVCs has started to emerge in the past few years as shown by declining GVC integration since the global financial crisis, vertical integration in China resulting in companies in Asia moving supply chains to Southeast Asia, an overall decline of value chain participation of Asian countries with China, and a plateauing of China's trade with the US, etc.

The study will discuss the importance of investment linkages in the context of GVCs, links between relationship-specific investments by lead firms, and the resilience to shocks of a GVC. The study will plot recent trends in foreign direct investment (FDI) in Asia, using data from United Nations Conference on Trade and Development and Organisation for Economic Co-operation and Development. The study will discuss the role of micro, small, and medium-sized enterprises as

second- or third-tier suppliers in GVCs, issues of domestic linkages, and the ability of firms to make local supplier linkages. The study will examine the impact of the COVID-19 pandemic on FDI and GVC development, underlining the initial tensions in key GVC sectors such as medical products, pharmaceuticals, and, potentially, food products. The study will also analyse subsequent supply responses, and investment patterns in manufacturing activities in selected economies highlighting the vertical integration in the value chains in Southeast Asia, South Asia, and China. Policy areas framing investment flows in major partner economies, particularly the EU, the US, and Japan, will be highlighted. Trade policy response to the COVID-19 pandemic will be reviewed using data from the Global Trade Alert. In digital economy value chains, the study will demonstrate if service GVCs or manufacturing GVCs with strong service components can promote growth in the same way as traditional manufacturing GVCs.

2. Handbook of Asian Economic Integration

ERIA has been working together with Edward Elgar Publishing to produce a handbook on regional economic integration in Asia. The volume will provide an opportunity for the wide range of ERIA's publications relevant to this topic to be compiled and placed in the context of related research in this field. This highlights ERIA's significant contribution to the field and assists in identifying priorities for future work.

Elgar Handbooks are works designed to provide a broad overview of research in a given field at the same time as creating a forum for more challenging, critical examination of complex and often under-explored issues within that field. Often widely cited, individual chapters present expert scholarly analysis and offer a vital reference point for advanced research. Taken as a whole they achieve a wide-ranging picture of the state-of-the-art. The Handbook will be made up of original, specially commissioned chapters.

In addition, the publisher will establish a companion website for the book, which will include all data presented in all chapters (tables and charts) and materials recorded by authors to assist with using the Handbook for teaching and lecturing purposes.

3. Cities, Urban Amenities, and the Global Production Value Chain: New Developments in Trade and Services Liberalisation in East Asia and ASEAN

The regional and global supply chain activities in Asia and ASEAN are growing and deepening as more mature economies are moving to the second stage of production fragmentation and newly emerging ASEAN countries are already building up the industrial base for the first stage of production fragmentation. However, we are also observing certain challenges emerging in the Asian region. The level of liberalisation and in particular services and investment liberalisation is losing momentum. Asian cities are plagued by high population densities, which decreases the returns to urbanisation (pollution and congestion) and limits their productive contribution to regional growth.

The level of trade and investment liberalisation in the multilateral agreements, such as the Regional Comprehensive Economic Partnership (RCEP), is becoming weaker and tends to be of a very low denomination for further regional integration. There are several policy issues that have to be addressed as East Asian and ASEAN economies are at different stages of growth in the global production value chain. Most of the developed ASEAN countries of Indonesia, Philippines, Thailand, and Viet Nam are in the middle stage of the second unbundling; Malaysia is in the later stage of the second unbundling; and the ASEAN LDCs of Cambodia and Lao PDR are now in the beginning stage of the second unbundling. Singapore is already in the beginning stage of the third unbundling. The current study focuses on the role of cities in creating urban networks and urban amenities, attracting and developing skills and human capital, as well as driving creativity. This in turn supports the development and liberalisation of the services sectors and the operation of the global production value chain in the Asian region. In particular, the study focuses on:

1. The regional competitiveness and productivity of cities and what drives creativity in urban areas, leading to innovation and more extensive entrepreneurial activities;
2. An industrial policy that balances 'agglomerative' effects with 'dispersion' effects will be critical for the next stage. In fact, industrial and social policies to create sustainable as well as inclusive growth will be critical for the next stage of growth for the East Asian and ASEAN countries;
3. Human capital development will be critical and labour market implications of task-based activities will have direct impact on education and human capital development (training) policies in East Asia;

4. Skills development and the preparation for workers to move from skill-based activities to task-based activities will be critical and the relevance of their human capital for future skills will be critical. The study will focus on the labour market implications of task-based activities;
 5. There is a need to understand services liberalisation and policies needed to manage the services liberalisation in the third stage unbundling;
 6. There is a need to understand the transition (linear or nonlinear effects) and market structure from the second stage unbundling to the third stage unbundling as there might be significant structural adjustments in the domestic economy. There are likely to be economic as well as social cost due to the structural adjustments in the domestic economy; and
 7. The third stage unbundling will highlight the importance of digital economy and services sector development in the region. 'New Age' free trade agreements will have to be developed to manage information flow ('oil' for the new economy) and issues such as localisation versus globalisation, e-commerce, virtual-migration, virtual-SMEs, and artificial intelligence (AI) and robotics will be important. The project is expected to contribute to key policy discussions on the development of services liberalisation and development of services supply chain in the region.
2. It will draw out the implications for supply-chain activities and the implications of their development, with these drivers, for regional multilateral trade agreements such as RCEP that is currently under negotiation in Asia;
 3. Services liberalisation will be crucial for regional integration and for a well-developed supply chain (in goods and in services) which will allow countries in the region at various stages of development to participate effectively;
 4. The study intends to map the fundamental factors such as contribution of cities in Asia, urban amenities, institutional reforms, soft and hard infrastructure for various stages of the services supply-chain activities in the region; and
 5. Because of the nature of international business in services, it is expected that the project will include treatment of investment and the movement of people, in the cases where these factor flows are linked to transactions in other modes.

4. Non-Tariff Measures in Australia, China, India, Japan, Republic of Korea, and New Zealand

Non-Tariff Measures (NTMs) are the new frontier for regional integration and market access, as tariffs have been continuously decreasing. NTMs are at the border and behind-the-border requirements. It is not new that these are relevant, probably more so than tariffs, in determining trade patterns, and flow magnitude and direction. Still, they often go unseen and do not receive appropriate attention. Negotiations amongst countries for deep integration through trade agreements often include NTMs as a key area, and often negotiations in this area are amongst the hardest. This shows the crucial

Policy Implications:

1. The research is expected to contribute to the understanding of the relationship of urbanisation to creativity and innovation, including entrepreneurial activity and various dimensions of city performance;

importance of NTMs, including all the policy areas that fall within this definition.

This report (published on 5 October 2020) highlights the results of the first-time data collection work in RCEP negotiating countries: Australia, China, India, Japan, New Zealand, and the Republic of Korea, apart from the Association of Southeast Asian Nations (ASEAN), which has been presented in other reports (ERIA and UNCTAD, 2016 and 2019).

These data contribute to a global NTM database that opens for the public as a form of transparency on the information for researchers, businesses, and policymakers. Data collection was done with consistent methodology across all countries. This work was possible through the joint work of Economic Research Institute for the Association of Southeast Asian Nations and East Asia (ERIA) and United Nations Conference on Trade and Development (UNCTAD) in the area of NTMs.

Narrowing Economic Gaps



1. **The India–Myanmar–Thailand Trilateral Highway and its Possible Extension to Cambodia, Lao PDR, and Viet Nam: Challenges and Opportunities**

The Trilateral Highway (TLH) exemplifies the letter and spirit of connectivity between India and the Association of Southeast Asian Nations (ASEAN). It connects India, Myanmar, and Thailand, and is

linked with ASEAN's connectivity plans. Still a project under construction, its potential contribution to the economic growth and development of the region is indubitable. This study examines the maximising of these objectives through a proposed extension of TLH to the Lao PDR, Cambodia, and Viet Nam.

Based on a mandate from the ASEAN–India Summit Meeting of 2018 and commissioned by the Government of India, the Economic Research Institute for ASEAN and East Asia (ERIA) has studied the feasibility of establishing a seamless, efficient, and end-to-end transportation corridor along the existing TLH and its extension towards Cambodia, Lao PDR, and Viet Nam. This study offers physical, institutional, and economic pathways, along with policy recommendations for the development of TLH and its eastwards extension. The need for seamless physical connectivity and resilient supply-chains has been especially underlined in the COVID-19 crisis. The study on the TLH and its eastward extension fulfils this current need, and also lays down pathways for medium- and longer-term integrated connectivity solutions between India and ASEAN. The study was presented to the Senior Economic Official's meeting and to the ASEAN–India ministerial meeting. The study is being used to develop for developing the plans for new supply-chain linkages between India and ASEAN, and in other regional and inter-regional architecture such as the Asia–Africa Growth Corridor, Australia–Japan–India, and the Indo–Pacific.

The report of this project was published under ERIA Research Project with two volumes – an integrative report and background papers – on 15 June 2020.

2. Outcomes of Long-term Care Insurance Services in Japan: Evidence from National Long-Term Care Insurance Claim Data

The goal of this study is to clarify the structural and procedural factors associated with the sustainment or improvement of residents' care needs in long-term care facilities. Residents in long-term care facilities, day-service users and day-care users will be included in this research. We will carry out statistical analyses by combining national long-term care insurance claim data, vital statistics data, and a survey of institutions and establishments giving long-term care. The period to be studied is September 2015 to March 2017. We will focus on incentives designed to boost the quality of care, and will clarify their effect on the outcomes of residents. A multilevel logistic regression will be used to clarify facility effects after adjusting for the different characteristics of residents. To ensure the continuous improvement of long-term care, and to explain how Japanese long-term care services contribute to maintaining and improving the health of long-term care service users, it is necessary to clarify the structures and processes that contribute to the improvement of outcomes.

The report was published as an ERIA Research Report on 28 October 2020. Japan has the oldest population structure in the world, with a share of 28.1% of people aged 65 years or above in 2018, and this rate is still increasing. In 2000, Japan introduced a compulsory public long-term care insurance (LTCI) programme to meet the challenges of its rapid population ageing and ensure equitable access to long-term care services. All citizens and foreign residents aged 65 years or above are eligible to receive LTCI services if they are certified to be the

beneficiaries of LTCI based on the care-need level assessment. The method of assessment is specified by the national government and Japan retains all information on beneficiaries' long-term care insurance claims, making it easier to observe their functional changes over time. This study aims to investigate the predictors of care-need level change by focusing on the users of long-term care facility services, adult day service users, and day care users by applying national-level long-term care claims data.

3. Preparation for Ageing Society in Thailand

Thailand is heading towards rapid population ageing. The Centre of Excellence for Ageing Business and Care Development (ABCD) of Thammasat University was established to provide policy recommendations related to population ageing, and guidelines for both government and the private sector. The ABCD also works on research collaborations on ageing societies. This project consists of the following four parts.

Policy Recommendations:

1. To provide strategic recommendations on government and private sector management of population ageing, including guidelines on cooperation on healthcare and long-term care for older people between the government, private sector, NGOs, international organisations, the medical sector, and researchers;
2. To provide data on existing care business start-ups, and market and innovation trends related to older people, and contribute to the development of effective cooperation between the public and

private sectors. These are necessary to create active ageing societies;

3. To propose policies and policy modifications that encourage older people to make smarter financial choices;
4. To provide the government and membership-based organisations with the appropriate policy measures to prepare for the ageing of informal workers; and
5. To serve as a platform for a broader study on informal workers

4. Human Capital in ASEAN

Rapid technological advancements and shifting patterns of specialisation and trade have required Asian economies to accelerate accumulation of human capital. While much has been written about the state of human capital at the aggregate level, understanding the factors affecting human capital formation at the level of individuals and households, particularly in developing and emerging countries, is limited. Empirical research grounded in economic theories of human capital investment can provide insights for policymakers.

Various strands of economic literature can contribute to a better understanding of the process of human capital development. A multi-dimensional conceptualisation of human capital, involving cognitive and non-cognitive characteristics as well as health, is widely accepted. Each component of human capital undergoes a formative process. In one important strand, researchers conduct structural estimation of the human capital production function to uncover the contribution of various factors to overall human capital. The

estimates from these models can identify where policy interventions can be most effective.

Most observers of Southeast Asian economies concur that the region faces a risk of skills shortage. Amongst the wealthiest ASEAN economies, Thailand and Malaysia face an ageing population, Indonesia and the Philippines have poor education infrastructure, and Singapore has a small workforce. The World Bank's Human Capital Index gauges the amount of human capital children born today can expect to achieve when they are 18 years old, relative to the ideal scenario of full education and health. For Southeast Asia, the index ranges from 0.45 for Lao PDR to 0.88 for Singapore. This means that, given the current provision of health and education, the productivity of a child born today in Lao PDR will be 45% of the ideal condition. ASEAN Member States are keenly interested in expanding their human capital base to sustain their economic growth and modernise their economies. Expansion of education and training has been highlighted as a policy imperative.

The objective of this project is to expand the perspective on human capital development by analysing factors that impact each component of human capital. The project will bring together researchers to conduct empirical research. Each researcher will develop an original research proposal and conduct rigorous empirical research. During FY2020, this project produced nine Discussion Papers from project members.

5. The Current Status and The Future Prospect of xEV in ASEAN

This project seeks to clarify the impacts of electric vehicles (xEV) on the automobile industry and our society by explaining the current xEV status and the future global automobile production network in the ASEAN region. Highly sophisticated cross-border production networks characterise the automotive and electronic industries in the ASEAN region, i.e. specific production factors are highly fragmented across countries. Although still limited to a few cases, automotive suppliers have started to locate certain xEV production processes in ASEAN countries. The automotive component industry is a representative example because it already operates a complex division of labour in ASEAN and has been designated as a key industry of the ASEAN Economic Community. Studying the workforce and the actual content of work in the xEV production network is important to understanding similarities and differences amongst production sites in the Cambodia–Lao PDR– Myanmar–Viet Nam region and older ASEAN member countries. The project also seeks to understand the research and development activities of automotive industries, particularly those related to the development of xEV in the ASEAN region, where developing countries have different levels of production complexities. The project aims to conduct research through firm surveys and case studies that could analyse factories producing identical or at least similar xEV components.

POLICY IMPLICATIONS: From the results of the project's objectives, recommendations regarding xEV strategies of automotive and electronic firms in ASEAN could be formulated. The proposed research could help small and medium-sized enterprises in ASEAN and transnational enterprises identify xEV strategies they could adopt. Regarding the gaps between local capabilities and the xEV technology

that transnational enterprises demand, the research could formulate policy recommendations for ASEAN countries. But as xEV progress in ASEAN countries depends on the social infrastructure in each member country and the xEV progress in China, recommendations would focus on formulating an xEV development strategy for these particular countries.

Sustainable Development



1. Financing Infrastructure for Climate-Change Adaptation

Threats from climate change are real and cannot be ignored. Scientists are increasingly recording rising sea levels, sea and air temperatures, weather

anomalies, etc. The frequency and magnitude of climate-related disasters have been increasing globally. The Food and Agriculture Organization estimated, in 2015, that the world suffered economic cost up to US\$1.5 trillion from 2003 to 2013 because of climate-related disasters,

apart from their impacts on human health. The International Panel on Climate Change estimated, in 2018, that the world would need \$1.6 trillion–\$3.8 trillion of investment in energy system to maintain the rising temperature within 1.5 degrees C. The major events pushing global awareness on climate change risks are (i) the Paris Agreement within the United Nations Framework Convention on Climate Change, dealing with greenhouse gas emissions mitigation, adaptation, and finance signed in 2016; (ii) the 2030 Agenda for Sustainable Development, widely cited as Sustainable Development Goals (SDGs); and (iii) the Sendai Framework for Disaster Risk Reduction in 2015. The awareness and commitment to reduce the effect of climate change have been supported by a majority of countries. To date, 75% of country commitments, represented by nationally determined contributions, have adaptation targets, although many are difficult to measure (only 18% of adaptation goals are quantified). Commitment to the SDGs also partially contains elements of supporting resilient infrastructure finance.

Governments can be better fiscally prepared for climate change if they (i) include climate change as part of their long-term objectives in public budget and expenditure framework, (ii) improve financial tracking and performance accountability at the spending units, and (iii) strengthen public financial management systems to tap external climate finance.

This study aims to review the implementation of infrastructure financing for climate change adaptation in selected East Asia developing economies. It will look at regulatory aspects, budgeting, institutional frameworks, and

implementation. The study will also present several case studies from selected economies. The study reviews government strategies and actions for climate change adaptation, especially in the infrastructure sector. The study suggests ways to fill the gaps in data availability and quality and to maximise resource mobilisation, including access to climate funds and green financing. The study briefly discusses infrastructure policy responses to COVID-19.

2. Applying Extended Producer Responsibility Towards Plastic Waste in Asian Developing Countries to Reduce Marine Plastic Debris

The extended producer responsibility (EPR) mechanism is adopted in many countries to give producers responsibility for managing their products up to the post-consumer stage. In developing countries, EPR is mostly implemented for electronic waste. However, with the rising concern about marine plastic, developing countries, including those in Asia, have started to apply EPR for package and container waste. In practice, developing countries significantly differ in their implementation of EPR compared with developed ones due to contrasting social, economic, technology, and other factors.

This paper aims to explore the challenges of developing countries in applying EPR and to determine possible measures to overcome the challenges. Results show that applying EPR for plastic waste in developing countries faces many challenges, such as the existence of a market-based collection system of recyclables, high transport cost, lack of waste collection services in rural areas, limited number of facilities to manage certain types

of plastic waste, insufficient pollution control, and free riding and orphan products. The challenges can be minimised by differentiating the responsibility of producers, focusing on rural and remote areas, involving informal sectors, creating joint facilities in recycling parks, expanding waste management collection services, increasing the use of EPR, and minimising free riding. Aside from optimising the implementation of EPR, other related measures ensure the circularity of plastic waste in Asian developing countries. For instance, governments or private companies facilitate investment to reduce transport cost of collected recyclables, enhance recycling design, develop industrial standards for recycled products, and stimulate green public procurement. The study presents typical challenges in EPR implementation and possible measures to address them. They can have valuable lessons for other Asian developing countries that are considering or even preparing related policy to implement EPR. Most Asian developing countries can benefit from other countries' experience, not only in adopting EPR but also in enhancing the circular economy model in dealing with marine plastic debris.

3. Technology and Jobs in East Asia

The world today is witnessing an unprecedented pace of technological progress. The fourth industrial revolution, a concept encompassing the application of smart technology to economic activities, is predicted to exert a profound impact on the global economy by enhancing productivity and efficiency, as well as encouraging the exchange of ideas and improving life's conveniences. Despite such benefits, there has been growing concern

about the disappearance of some occupations and jobs. Displacement of workers increases income disparity and threatens social stability, thus posing a challenge for inclusive growth. The question then is how to take advantage of this new wave of development and at the same time to prepare workers for unfavourable changes, if any, in the labour market. Theoretically, technological progress can either complement or substitute workers and skills. In addition, production expansion as a result of technological improvements could lead to rising labour demand. The net effect of technology on employment is thus not clear-cut with the answer remaining an empirical matter. Against this backdrop, this project aims to deepen the understanding about the relationship between technology and jobs by providing further empirical evidence in the case of East Asian countries.

Policy Implications:

- Policies to support workers to adjust to the changing landscape, for example through education and training, financial aid, job seek support.
- Policies to encourage the development of labour-intensive technology.
- Policies related to the informal sector, which can absorb laid-off workers from formal sectors.
- Policies to accommodate the development of new industries and new jobs.

The report of this project resulted in the publication of five ERIA Discussion Papers in FY2020.

4. Assessing the Readiness of Industry 4.0 for Circular Economy

Industry plays a central role in the economies of the East Asia Summit (EAS) countries. It serves as a key driver of research, innovation, productivity, job creation, and exports. Looking at its effect on services alone, industry can be considered a social and economic engine of Asia. But industry in the EAS countries is fundamentally diverse – while many countries' emerging industrial sectors are gaining productivity and market share, some advanced economies like Japan, Republic of Korea, and Singapore have been losing ground in the past 2 decades. Most of the traditional industrialised countries in Europe have also been experiencing a decline in manufacturing competitiveness and resource efficiency due to several factors. Imitating the successful industrial models of Europe, Japan, or the US may not be a viable solution for developing countries of Asia. A successful approach to reindustrialisation needs to be much more than simply rebuilding structures of old-fashioned manufacturing. The concepts of Industry 4.0 and a circular economy have recently gained traction in EAS policymaking as a positive, solution-based perspective for achieving resource-efficient industrial development using the next generation of technologies. Current academic, industrial, and policy debates set out a large number of initiatives to be included under the action plan to maximise the use of resources available within the economy. They also indicate that the transition to Industry 4.0 and a circular economy requires fundamental changes in many different areas of the economic system. Although it is a difficult and complex process, several crucial areas of change can be identified in the technology,

engineering, economic, and social domains. This study addresses the interface between Industry 4.0 and a circular economy, and whether the integration of both would unleash new gains in productivity and efficiency. It also looks at whether the experiences gained in other parts of the world could be transferred to the ASEAN region, providing respective recommendations and conclusions. The main objective is to prepare a manual consisting of a fairly robust framework for measuring the readiness of EAS economies for Industry 4.0 and a circular economy.

Policy Implications:

1. The ERIA Assessment Framework for Industry 4.0 Readiness shall be applied at macro (national), meso (sector), and micro (local) levels and utilised to recognise the driving factors and enabling environments;
2. As with all transitions, the benefits of Industry 4.0 are not going to be evenly distributed. Some industries, businesses, regions and worker groups are likely to be disadvantaged, while other sectors will benefit; and
3. Efforts to realise the benefits of Industry 4.0 and a circular economy will also depend on the quality and speed at which adequate education and skills training are developed and rolled out.

The report of this project was published as an ERIA book titled: *Assessing the Readiness of Industry 4.0 and the Circular Economy* on 26 November 2020.

5. Innovations and Experiences in Financing Disaster Risk Reduction

The Association of Southeast Asian Nations (ASEAN) and East Asian Region is more vulnerable to natural disasters than any other part of the world. Recent disasters such as the Great East Japan Earthquake or the Thailand floods have made us understand our vulnerabilities to the forces of natural disasters and their wider consequences for energy security, which stretch far beyond the directly affected areas. The Fukushima disaster, in particular, showed how the impact of natural disasters can be hugely amplified by technological hazards such as nuclear power plant shutdowns. This report reviews the key disaster management strategies and energy security actions being adopted in Japan, Europe, and the US from the perspective of nuclear power plant operations. Based on a barrier analysis of ASEAN countries, this study proposes an integrated policy framework that could enhance appropriation of resources – technology, finance, and decision-making capacity – for improved resilience of future nuclear infrastructure investments.

Policy Implications:

- It is appropriate to build a country-specific model for each country based on the activities and histories of the advanced countries and incorporate applicable lessons based on their own predictions of the future.
- Enhancing nuclear resilience by preparing an academic field to conduct discussions about nuclear resilience amongst advanced countries and ASEAN countries is strongly recommended for all countries that are considering the introduction of nuclear power or where experimental nuclear facilities are already in operation.

6. Study on Potential for promotion of CCUS in ASEAN

Carbon Capture Utilisation and Storage (CCUS) surely contributes to reducing CO₂ emissions from thermal power plants and energy intensive factories such as iron and steel. Thus CCUS will be indispensable to accomplish decarbonisation. As part of this project the 3rd East Asia Energy Forum was organised to discuss CCUS from the angles of technology, business model, regulation, F/S and financing. In addition, the importance of the CCUS network to realise a CO₂ value chain, which consists of capture, transport, and storage, is highlighted. Policy Implications: Initiate establishment of an Asia CCUS Network.

The report of the study 'Study on the Potential for the Promotion of Carbon Dioxide Capture, Utilisation, and Storage in ASEAN' was published on 19 March 2021. It uses a multi-aspect survey approach and includes findings on recent trends in policies, technologies, and business development from countries with experience of Carbon Dioxide Capture, Utilisation, and Storage (CCUS). It also looks into the potential for CCUS development in the Association of Southeast Asian Nations (ASEAN) and the East Asia Region. Based on discussions held at the 3rd East Asia Energy Forum, the report reiterates the important role CCUS can play in the region to achieve both energy transition and decarbonisation objectives. It also explores the potential and benefits of a regional collaborative approach, which is proposed as the Asia CCUS Network to create an enabling environment for business cases of CCUS.