Executive Summary

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Innovation Policy in ASEAN is an outcome of the new ERIA research project conducted during fiscal year 2017. As is well known, innovation is a primary source of sustainable economic development and inclusive growth, not only through improving productivity in firms, industries, and macroeconomies but also through stimulating consumption, investment, and exports. It is also widely recognised that innovation, in addition to capital investments and skilled human resources development, is indispensable for propelling modern economies.

Economic growth in most member states of the Association of Southeast Asian Nations (ASEAN) has been driven by manufacturing industries in conjunction with a low-wage labour force, and labour-intensive manufacturing remains the basis for economic development in ASEAN. However, the economic management of ASEAN Member States (AMS) will run into obstacles if AMS remain dependent on this model in the long term. Wage levels in some AMS, such as Malaysia and Thailand, have been rising sharply, and other AMS will witness wage increases before long. This will harm the competitiveness of ASEAN's manufacturing industries compared with those of other emerging countries. In the face of this challenge, innovation can help ASEAN improve the sophistication of its economies as it enhances the attractiveness of its single market and production base. Although it may not be easy for AMS to quickly achieve a significant level of innovation capability, they have much potential for improvement in future years.

The objective of the study is to (i) review the past and present innovation policies of the more developed countries of ASEAN and East Asia – China, Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Viet Nam – and present them with reasonable future innovation policies; (ii) analyse successful and failed national innovation systems (NIS) using country case studies and empirical data, and derive policy implications for AMS; and (iii) examine the ASEAN-wide innovation policies needed to promote regional innovation and provide suggestions for carrying out the ASEAN Economic Community Blueprint 2025.

Chapter 1: Introduction to Innovation Policy in ASEAN (by Masahito Ambashi) provides a general introduction to the book by describing the innovation policies that should be introduced in each AMS and for ASEAN as a whole. While existing studies have highlighted the importance of enhancing each country's innovation capability, the limited development of innovation to date has heightened concerns that some AMS, such as Malaysia and Thailand, have succumbed to the middle-income trap. It is important for AMS to steadily accelerate innovation development by formulating and implementing appropriate policies in accordance with the typology of innovation development stage. To this end, NIS, which organise innovation policy in a systematic manner and emphasise active coordination by governments, could be effective policy tools for home-made innovation. It is also important to examine ASEAN-wide innovation policies formulated to enhance the region's presence and competitiveness in the global economy.

Chapter 2: Theoretical Framework for Innovation Policy in ASEAN (by Nobuya Fukugawa) presents a theoretical framework for the design of innovation policy in ASEAN. AMS are diverse in their economic and industrial structures as well as their ethnic and political aspects. For this reason, Chapter 2 pays particular attention to devising a theoretically desirable approach to innovation policy according to the development phase and industrial characteristics. The chapter emphasises that innovation creation should first be considered from the viewpoint of how knowledge diffusion works among private firms, public institutes, and universities. A review of the theories and facts on economic growth also indicates that innovation policy matters at any stage of development. The chapter next identifies the determining factors of innovation from a theoretical perspective. These include appropriability conditions (i.e. private ownership), technological opportunities (i.e. public access), and knowledge spillovers, all of which need to be integrated appropriately into the framework of sectoral, national, and regional innovation systems. The policy implication is that multi-frameworks encompassing innovation intermediaries, entrepreneurship, and a whole-of-government approach should be built to produce knowledge spillovers and innovation diffusion in and across ASEAN.

Chapters 3 to 9 are devoted to detailed country studies. **Chapter 3: Innovation Policy in China** (by Yanfei Li and Dayong Zhang) comprehensively reviews China's past, current, and possible future innovation policy and technological catch-up strategy to provide a valuable reference for AMS that intend to accelerate economic growth by taking advantage of innovation as China has done. China remains a developing economy, and most of its industries are still in the technological catch-up phase.

However, since the 2000s, innovation, especially incremental innovation, has become more prevalent in the Chinese economy. Government innovation policies have shifted from focusing on catching up to strengthening innovation in all sectors and recognising that innovation should be seen as essential for raising productivity and avoiding the middle-income trap. Supported by empirical analysis and case studies, new theoretical frameworks, such as the life-cycle theory and the S or inverted-S curve theories, explain the dynamism of the phenomenal catching up – and even lead taking – of technologies and innovations by Chinese industries in recent decades. The chapter identifies several key factors, including risk, financing, entrepreneurship, and supply chain and component technologies. It also analyses the cases of China General Nuclear and Huawei to show how these factors work together to create the pathways for catching up.

Chapter 4: Innovation Policy in Indonesia (by Yose Rizal Damuri, Haryo Aswicahyono, and David Christian) takes stock of past and present innovation policies implemented in Indonesia. The chapter begins by revealing the absence of a formal, integrated NIS until recently and the corresponding lack of significant innovations in Indonesia compared with its regional peers. It then draws lessons for frameworks of governance with respect to the government's innovation initiatives, programmes, and platforms that are intended to stimulate knowledge diffusion, by exploring the interactions between the innovation actors. The discussion finds that Indonesia's approach to innovation has been generally too government-centric and has lacked good coordination, continuity, and implementation and, consequently, has failed to produce the desired knowledge diffusion. The chapter concludes with suggestions for the future Indonesian innovation system. It proposes that the government should assume the role of an innovation facilitator by creating a conducive environment at the macro level. Improving the investment climate, establishing basic innovation enablers, and encouraging local-level initiatives must also be prioritised in the short run to promote knowledge diffusion. On the other hand, adopting the more explicit and advanced innovation policies commonly observed in developed countries is unlikely to succeed at the current stage of development unless they are accompanied by significantly greater foreign direct investment, which has been the major channel of knowledge diffusion in Indonesia.

Chapter 5: Innovation Policy in Malaysia (by Suresh Narayanan and Lai Yew-Wah) states that despite a late start in formulating its policies to nurture innovation, there is encouraging evidence that firm-level innovation in Malaysian manufacturing has been growing and that macro indicators of research inputs and outputs have been increasing. However, despite this evidence of innovation development, Malaysia's rankings in key global innovation indices fell during 2014–2016. The chapter sets out to account for

this poor performance by considering the nature of innovation. First, whereas most of the innovation undertaken by large firms and small and medium-sized enterprises (SMEs) occurred in relatively low-tech sectors, little or none was reported from SMEs in the more sophisticated electrical and electronics sectors despite their long links with multinational corporations (MNCs). Second, most firms were engaged in adaptation rather than patent-generating creation. Third, collaborative research with publicly created entities and technology gained from parent plants produced most of the innovation, but the technology gained through supplier links with MNCs contributed little to firm-level innovation. Fourth, while foreign firms appear to have generated horizontal and vertical spillovers, principally including forward and backward spillovers, the vertical spillovers were limited to backward ones. Weaknesses in the implementation, monitoring, and application procedures of well-intentioned innovation policies and schemes compounded the problem. The chapter, therefore, concludes that no new policy initiatives are required to increase the momentum of innovation; rather, a fine-tuning of existing innovation policies and delivery systems is urgently needed to increase their efficiency.

Chapter 6: Innovation Policy in the Philippines (by Francis Mark A. Quimba, Jose Ramon G. Albert, and Gilberto M. Llanto) recognises that now, more than ever, Philippine industries are facing new demands that require more innovations if firms are to remain competitive across the rapidly changing global marketplace. The 2015 Philippine Institute of Development Studies Survey on Innovation Activities suggests that about 43% of establishments in the Philippines were innovation-active, and, strikingly, the business process outsourcing sector spent the most on innovation activities. Intellectual property applications have been very low across all industries and all types of intellectual property, which implies that firms tend to view their product innovations as trade secrets to maintain their competitive edge against rivals. The chapter finds that knowledge management activities are positively correlated with firm size and that larger firms tend to rely on internal sources for their information and innovation, as is the case with the food processing and automotive sectors. The 2015 survey found that firm size and the practice of knowledge management were adequate determinants of innovation. Considering the survey results, the chapter argues that innovation policy should veer away from a linear innovation model focusing only on research and development (R&D) and move towards one that is grounded on consultations with all stakeholders in the innovation ecosystem. In addition, it maintains that stronger intellectual property rights would provide a more enabling business environment to encourage larger numbers of firms to innovate, especially among wary MNCs.

Chapter 7: Innovation Policy in Singapore (by Hank Lim) conducts an elaborate analysis of knowledge diffusion over successive phases of economic restructuring and technological development in Singapore. The diffusion process can be observed not only through the change in and upgrading of existing industrial clusters, such as the offshore marine engineering cluster, but also in the establishment of a biomedical science cluster. Throughout the process, the Government of Singapore has played an instrumental and crucial role in strategic planning, infrastructure building, and human resources development. The chapter stresses that the remarkable success of Singapore's innovation policy has been characterised by and is attributable to both its strategic and long-term planning and the meticulous coordination and execution of different innovation components and teamwork with various stakeholders in a single, seamless process. Such success in implementing cohesive and integrated innovation policies and measures has been made possible by effective and efficient public officials, necessary institutions, and competitive market environments. The chapter points to three core elements for the process of innovation policy: research, innovation, and enterprises. It asserts that in the next phase of innovation progress, Singapore will be increasingly dependent not only on its own research intensity and deeper pools of world-class research but also on attracting scientific and entrepreneurial talent that can translate the innovations produced into value creation and marketable services. The two case studies of the offshore marine engineering and biomedical science clusters illustrate the complexities, characteristics, and processes of Singapore's innovation policy experience as well as the resultant policy outcomes.

Chapter 8: Innovation Policy in Thailand (by Saowaruj Rattanakhamfu and Somkiat Tangkitvanich) takes note of Thailand's remarkable economic development. An average gross domestic product (GDP) growth rate of more than 6% per year from the 1960s to the mid-1990s and the diversification of export products and markets reflect Thailand's success in transforming itself from a traditional agricultural economy into modern one based on manufacturing and services. But despite these accomplishments, Thailand has been unable to regain the high growth rates achieved before the 1997 Asian financial crisis. This shows that without upgrading its R&D and innovation capabilities, the country will be unable to escape the middle-income trap. This chapter makes it clear that Thailand needs to increase its investment in R&D, produce more R&D personnel, and, more importantly, manage its total R&D system to achieve greater economic efficiency. To improve the Thai R&D system, the chapter suggests that the government should (i) increase public investment in R&D, especially applied R&D, to the target of 2% of GDP; allocate the R&D budget through capable research granting agencies; and use public money to encourage

private investment; (ii) create accountability in publicly funded research; (iii) establish a specialised government research institute with the sole mission of conducting R&D for commercialisation; (iv) improve R&D human resources policies by reforming the current government scholarship systems; and (v) make technology transfer an explicit objective of government procurement for megaprojects, such as railway and water management projects.

Chapter 9: Innovation Policy in Viet Nam (by Tri Thanh Vo, Anh Duong Nguyen, and Thu Hang Dinh) provides a comprehensive review of innovation policy in Viet Nam since 1986. In tandem with economic reforms and integration, Viet Nam has gradually expanded and amended its innovation policy. The chapter demonstrates that science and technology (S&T) achievements have contributed to economic development in Viet Nam through their impacts on labour productivity and economic structure. However, there are obstacles to more effective S&T innovation-led growth. Viet Nam's innovation capability and policy environments, namely the NIS, are insufficiently pro-innovation in both the public and private sectors due to overlapping and inconsistent policy design and implementation, and inadequate financing and human resources for S&T. It is also notable that the policy space for supporting S&T development and innovation has become narrower due to an array of international economic commitments associated with membership of the World Trade Organization and economic partnership agreements. To bring about more sustainable economic development, the chapter insists that Viet Nam's innovation policy should be amended towards (i) improving the institutional and policy framework for S&T and innovation, (ii) strengthening human resources development for S&T, (iii) enlarging the engagement and role of the private sector in innovation, (iv) enhancing the contribution of public research organisations to innovation, and (v) reinforcing links between S&T and innovation.

Chapter 10: Innovation Policy, Inputs, and Outputs in ASEAN (by Rajah Rasiah) provides an overview of innovation policy by the governments of Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Viet Nam and their impacts on innovation inputs and outputs. The evidence shows that Singapore is by far the most innovation-intensive of the six AMS, followed by Malaysia and Thailand, and there is little difference between Indonesia, the Philippines, and Viet Nam, which are by far the least innovation-intensive countries. While Singapore has led the other countries on both innovation inputs and outputs and has reduced its dependency on foreign intellectual property, despite aggressive promotion, the country still lacks strong research-based universities and the human capital to support the kind of radical,

global-scale innovation that can stimulate technological leapfrogging. Malaysia and Thailand have implemented innovation policies since the 1990s and 2000s, respectively, by increasing R&D expenditure and focusing on augmenting R&D personnel to stimulate patent filing and intellectual property exports. In contrast, Indonesia, the Philippines, and Viet Nam have invested little in R&D, and, as a result, their innovation inputs and outputs have remained relatively low. The chapter also argues that ASEAN regional innovation policies, such as ASEAN initiatives for promoting innovation, should be seriously considered; collaborative sharing of and access to knowledge should be promoted to stimulate innovation synergies; and R&D grants and efforts to upgrade vocational and technical training programmes should be coordinated across AMS.

Finally, **Chapter 11: Conclusion and Policy Recommendations** (by Masahito Ambashi) summarises the discussions developed in individual chapters and provides policy recommendations for innovation policy in ASEAN. The chapter's key message is that it is important for ASEAN not only to increase investment in R&D and innovative activities but also to enhance the region's innovation capabilities and improve the environment in which innovation tends to take place. The chapter goes on to present innovation policy for individual AMS and for ASEAN as a whole. With respect to AMS innovation policy, it argues that the fundamental strategy should be reaffirmed; that is, AMS need to continuously attract foreign direct investment from MNCs to benefit from the knowledge spillovers of process innovation in the use of production networks or the 'second unbundling'. The region's economic integration should be further strengthened to realise an efficient and effective division of labour through measures such as infrastructure enhancement, the removal of non-tariff barriers, and economic partnership agreements, such as the Regional Comprehensive Economic Partnership Agreement. In doing so, it is important to (i) strategically drive and implement harmonised innovation policies; set priorities over measures, plans, and programmes; and monitor and evaluate them; (ii) encourage the private sector, including both domestic and foreign firms, to invest more in R&D and innovative activities; and (iii) elaborate on a conducive innovation ecosystem for the NIS. The chapter goes on to consider policies for ASEAN, recommending that it should (i) formulate initiatives for promoting innovation with more cross-regional synergies and positive feedbacks across AMS; (ii) accelerate goods, investment, and service trade liberalisation and deregulation; and (iii) promote the freer movement of natural persons, especially of highly skilled immigrants.

SUMMARY OF POLICY RECOMMENDATIONS

The following policy recommendations aim to provide possible directions for the innovation policies of ASEAN Member States and ASEAN to promote their own innovation creation.

I. Innovation Policy for Individual ASEAN Member States

Fundamental strategy: Continuously attract foreign direct investment from multinational companies and receive the benefits of knowledge spillovers from them to promote process innovation, particularly in the use of production networks or the 'second unbundling'.

Strengthen economic integration to realise efficient and effective production networks (e.g. infrastructure enhancement, the removal of non-tariff barriers, and economic partnership agreements, such as the ASEAN-plus-one free trade agreements).

1. Strategically drive and implement harmonised innovation policies; set priorities over measures, plans, and programmes; and monitor and evaluate them.
   - Establish or reinforce a government organisation responsible for holding unified authority with strong leadership under government control to lead and coordinate innovation policies across various departments.
2. Encourage the private sector, including both domestic and foreign firms, to invest more in research and development (R&D) and innovative activities.
   - Provide subsidy and tax credits for R&D and human resources development, grants for targeted innovative activities, and patent grants.
   - Create specialised public research institutes with the primary mission of conducting R&D and providing technical support related to the commercialisation of innovation achievements modelled after other countries (e.g. Exploit Technologies Pte Limited of A*STARS in Singapore).
3. Elaborate on a conducive innovation ecosystem for the national innovation system.
   - Nurture university–industry collaboration to enhance university-launched innovations and to disseminate and commercialise them for private industrial sectors (e.g. by introducing laws analogous to the 'Basic Act on Science and Technology' in Japan and the 'Technology License Organization Law' and 'Bayh–Dole Act' in the United States).
   - Organise public institutes or programmes, such as local public technology centres, as innovation intermediaries to help private manufacturing firms, particularly small and medium-sized enterprises, innovate.

II. Innovation Policy for ASEAN as a Whole

1. Formulate initiatives for promoting innovation with more cross-regional synergies and positive feedback across ASEAN Member States.
   - Innovation surveys and censuses for innovation infrastructures; databases and platforms for R&D findings and innovation for collaborative knowledge; and optimised coordination of R&D grants and subsidies, and education programmes.
   - Compare ASEAN Member States' innovation policies by introducing peer reviews.
2. Accelerate goods, investment, and services trade liberalisation.
   - Consider, in particular, further eliminating services trade restrictions in the ASEAN Framework Agreement on Services and the ASEAN Trade in Services Agreement.
3. Promote the freer movement of natural persons, especially of highly skilled immigrants.
   - Enhance the free movement of engineering service providers and make it easier for certified engineers in the mutual recognition agreement to work overseas.
   - Strengthen collaboration among ASEAN universities through harmonising their curricula and degrees to create new, university-based innovation.