2. Innovation for ASEAN 2040

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Innovation for ASEAN 2040

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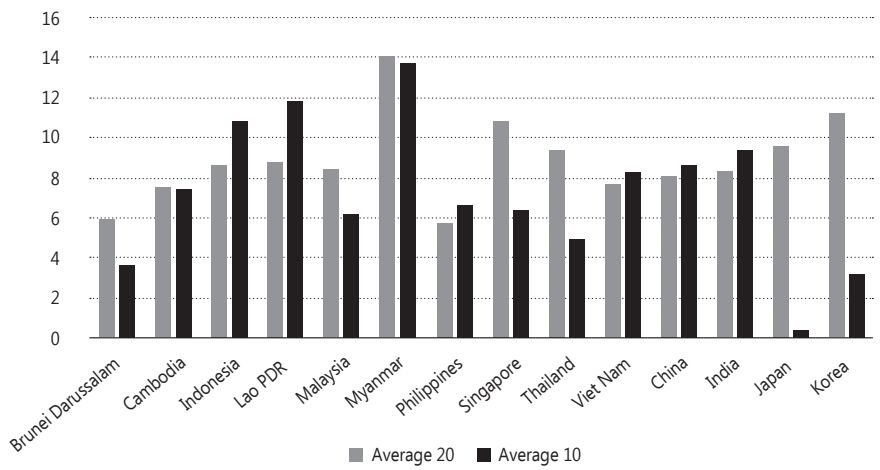
Discussion Points

- How will the Association of Southeast Asian Nations (ASEAN) and ASEAN Member States (AMS) be able to have economic prosperity up to 2040 through a drive towards an innovative ASEAN?
- Given that most AMS fall far below Northeast Asian countries and even India, how can they markedly strengthen their innovation capability and innovation ecosystems?
- What is the nexus of policies, institutions, firms and clusters, linkages and collaborations, multinational companies, foreign direct investment and trade, finance, incentives, human capital, entrepreneurship, intellectual property rights, etc. in furthering innovation in ASEAN for the global and regional markets?
- How would the drive for an innovative AMS and ASEAN benefit everybody in the region (i.e. be inclusive)?

1. Background

In considering the development of the Association of Southeast Asian Nations (ASEAN) towards 2040, concern is growing that ASEAN Member States (AMS), particularly Malaysia and Thailand, will fall into the so-called 'middle-income trap', where their growth in gross domestic product (GDP) per capita stagnates at the upper middle-income level[1] for a prolonged period after achieving a certain level of economic development (Griffith, 2011). Figure 1 shows the comparison of the highest average real GDP growth rates achieved over a 20-year period before 2005 versus the 10-year average growth rate during 2005–2014. Several AMS – Brunei Darussalam (hereafter, Brunei), Malaysia, Singapore, and Thailand – finished their high-speed growth periods more than a decade ago, while Cambodia, Indonesia, the Lao People's Democratic Republic (Lao PDR), Myanmar, the Philippines, and Viet Nam still enjoy rapid take-off growth.

Figure 1: Comparison of Real GDP Growth Rates (%)



GDP = gross domestic product, Korea = Republic of Korea, Lao PDR = Lao People's Democratic Republic.

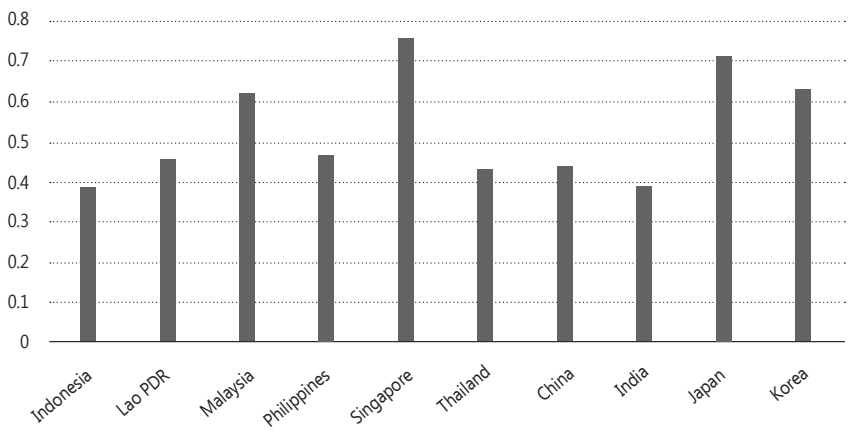
Note: The table compares the average growth rate between the 'highest growth rate for 20 years' (Average 20) and 'recent 10-year growth rate between 2005 and 2014' (Average 10). The 20-year period is as follows for each country: Brunei Darussalam, 1989–2008; Cambodia, 1994–2013; Indonesia, 1972–1991; Lao PDR, 1995–2014; Malaysia, 1965–1984; Myanmar, 1965–1985; the Philippines, 1952–1971; Singapore, 1965–1985; Thailand, 1959–1978; Viet Nam, 1995–2014; China, 1992–2011; India, 1992–2012; Japan, 1951–1970; Republic of Korea, 1969–1988.

Source: University of Groningen, Groningen Growth and Development Centre, The Database, Penn World Table version 9.0. https://www.rug.nl/ggdc/productivity/pwt/ (accessed 30 November 2018).

[1] Cabinet Office of Japan (2013) argues that less developed economies (LDEs) in Asia and Central and South America have tended to stagnate at $10,000 of GDP per capita since 1960.

The decline in the growth rates of Singapore and Brunei occurred after they had already achieved high-income status. For Malaysia and Thailand, however, it seems to have occurred while they are still at the upper middle-income stage and could be partly because of insufficient diversification and upgrading of their traditional industrial and export structures (Felipe, 2012). Indeed, although these two countries have achieved some degree of diversification and upgrading from primary to manufacturing products (e.g. automobiles and automotive parts in Thailand; electrics and electronics in Malaysia) during industrialisation, their productivity levels as represented by their total factor productivity (TFP) have never been sterling relative to Japan, the Republic of Korea (hereafter, Korea), and Singapore (Figure 2). They have also experienced lower TFP growth rates than China, and even India, in most periods of the 21st century (Figure 3). This should provide a compelling reason for Malaysia and Thailand to climb much higher on the 'technology ladder' to improve industrial productivity through enhancing their innovative capability.

Figure 2: TFP Level at Current PPPs (United States = 1, 2014)

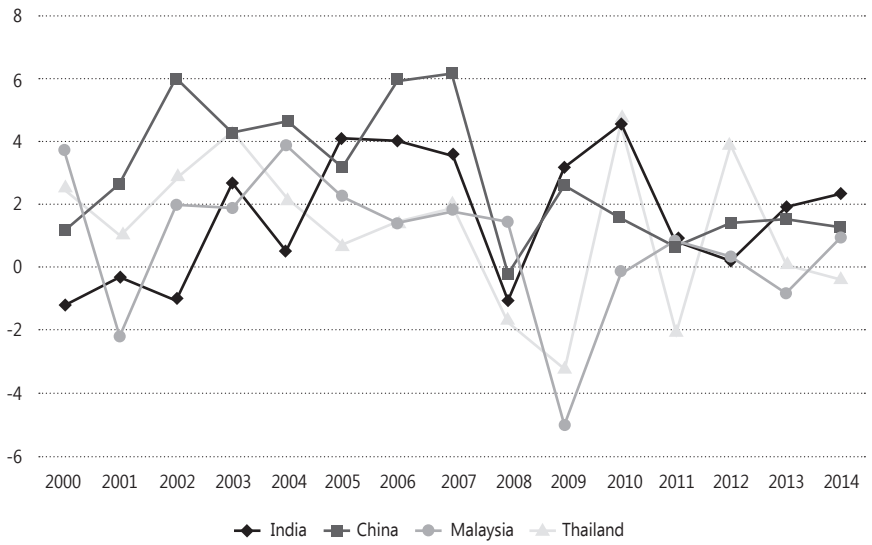


Korea = Republic of Korea, Lao PDR = Lao People's Democratic Republic, PPP = power purchasing parity, TFP = total factor productivity.

Note: Cambodia, Myanmar, and Viet Nam are omitted because of unavailability of data.

Source: University of Groningen, Groningen Growth and Development Centre, The Database, Penn World Table version 9.0. https://www.rug.nl/ggdc/productivity/pwt/ (accessed 30 November 2018).

Figure 3: Growth Rates of TFP at Constant National Prices (2011 = 1, %)



TFP = total factor productivity.

Source: University of Groningen, Groningen Growth and Development Centre, The Database, Penn World Table version 9.0. https://www.rug.nl/ggdc/productivity/pwt/ (accessed 30 November 2018).

Among the other AMS, Brunei and Indonesia continue to rely on primary products. For example, Indonesia's exports still include a significant share of crude materials and fuels (28%), such as coal (10%), gas (5%), petroleum (4%), and other crude materials (9%) in comparison with manufacturing (43%) as of 2016. In addition, Cambodia, the Lao PDR, Myanmar, and Viet Nam (the CLMV countries) utilise abundant low-wage labour forces in initial industrialisation and have just launched their basic manufacturing industries, such as garments and other labour-intensive products, taking advantage of production networks in East Asia (ASEAN–Japan Centre, 2017).

In terms of innovation, the overall progress of the AMS does not appear satisfactory.[2] Data on research and development (R&D) intensity as a percentage of GDP reveal that all AMS except Singapore have maintained substantially lower investments in R&D than Japan and Korea, which have an R&D intensity in excess of 3%. While Malaysia's R&D expenditure

[2] We later argue that these kinds of data do not necessarily represent real innovative activities in LDEs.

has been rising rapidly and reached 1.3% in 2016, Thailand's has been low even during the 2000s and was 0.6% in 2016 (Table 1). Worse still, the CLMV countries have made minuscule investments in R&D. Patent applications show the same pattern. Although the number of direct patent applications per million population has increased in all AMS, it is still considerably lower than in Asia's developed economies (Table 2). Further, although Malaysia (2,030 per million population) had the highest number of researchers among the AMS except Singapore (6,730) in 2014, the number is small relative to that of Japan (5,329) and Korea (6,856) (Table 3).

Table 1: Gross Domestic Expenditure on R&D per GDP (%)

Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Brunei Darussalam												
Cambodia											0.12	
Indonesia					0.08				0.08			
Lao PDR												
Malaysia		0.61		0.70	1.01	1.04	1.03	1.09		1.26	1.30	
Myanmar												
Philippines	0.11		0.11		0.11		0.12		0.14			
Singapore	2.16	2.13	2.34	2.62	2.16	2.01	2.15	2.00	2.00	2.18		
Thailand	0.22	0.23	0.20	0.20	0.23		0.46		0.44	0.48	0.62	
Viet Nam							0.19		0.37		0.44	
Asia (Southeast)	0.64	0.66	0.68	0.73	0.74	0.75	0.78	0.78	0.80	0.83	0.85	
China	1.31	1.37	1.37	1.44	1.66	1.71	1.78	1.91	1.99	2.02	2.06	2.11
India	0.84	0.82	0.82	0.87	0.84	0.82	0.83				0.62	
Japan	3.18	3.28	3.34	3.34	3.23	3.14	3.24	3.21	3.31	3.40	3.29	3.15
Korea	2.63	2.83	3.00	3.12	3.29	3.47	3.74	4.03	4.15	4.29	4.22	4.24

GDP = gross domestic product, Korea = Republic of Korea, Lao PDR = Lao People's Democratic Republic, R&D = research and development.

Source: UNESCO Institute for Statistics, Data for the Sustainable Development Goals. http://uis.unesco.org/ (accessed 30 November 2018)

Table 2: Total Patent Applications per Million Population

Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Brunei Darussalam	712	110.7	170.7	197.8	109.4			77.5	86.3	284.2		
Cambodia	19.0		1.0	2.8	2.0	1.8	3.0	3.6	5.0	4.4	4.2	
Indonesia		20.1	22.0	21.7	18.9	23.2	23.7		29.6	31.4	35.5	36.9
Lao PDR												
Malaysia	245.0	183.6	89.1	195.6	207.8	227.1	225.3	237.9	242.5	252.1	251.5	232.0
Myanmar												
Philippines	34.4	37.1	38.9	36.5	32.5	36.2	33.5	30.9	33.4	35.9	36.7	33.1
Singapore	2,017.2	2,0819	2,168.6	2,00.7	1,751.6	1,925.1	1,889.4	1,823.1	1,800.6	1,885.3	1,953.7	1,958.2
Thailand	96.9	95.1	103.0	101.3	87.6	28.8	58.1	99.4	108.7	115.9	119.0	113.6
Viet Nam	23.1	25.5	33.3	36.9	33.0	40.5	39.8	42.1	43.7	48.1	53.8	55.3
China	132.9	160.6	186.0	218.8	236.3	292.4	391.6	483.3	607.9	680.3	803.6	970.9
India	21.3	24.9	29.9	30.7	28.2	32.3	33.9	34.8	33.7	33.1	34.9	34.0
Japan	3,342.5	3,196.4	3,096.0	3,053.2	2,722.4	2,690.7	2,680.1	2,685.9	2,77.1	2,5613	2,506.8	2,507.0
Korea	3,339,7	3,430.9	3,542.6	3,478.4	3,316.4	3,432.6	,583.0	3,763.3	4,144.0	4,144.0	4,188.9	4,075.1

Korea = Republic of Korea, Lao PDR = Lao People's Democratic Republic.

Note: Direct and Patent Cooperation Treaty national phase entries.

Sources: World Intellectual Property Organization, Intellectual Property Statistics. https://www.wipo.int/ipstats/en/ (accessed day month year); World Bank, World Development Indicators. http://datatopics.worldbank.org/world-development-indicators/ (accessed 30 November 2018).

Table 3: Researchers per Million Inhabitants

Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Brunei Darussalam												
Cambodia											30.4	
Indonesia					89.2							
Lao PDR												
Malaysia		370.8		602.9	1,072.6	1,467.4	1,649.8	1,784.4		2,029.6	2,274.0	
Myanmar												
Philippines	79.9		77.9		81.4		84.4		187.7			
Singapore	5,297.1	5,428.0	5,739.1	5,739.1	6,148.5	6,312.4	6,514.4	6,477.2	6,720.1	,729.7		
Thailand	313.4		323.2		328.9		538.4		790.9	964.2	865.4	
Viet Nam									673.9		672.1	
Asia (Southeastern)	328.9	344.3	373.2	395.7	441.6	491.3	527.5	573.0	613.2	637,8	642.6	
China	846.5	920.7	1,064.8	1,184.5	852.3	890.5	963.9	1,021.0	1,073.2	1,096.5	1,158.9	1,205.7
India	135.3					156.6					216.2	
Japan	5,303.5	5,332.6	5,325.2	5,108.3	5,098.8	5,103.2	5,109.9	5,032.8	5,147.5	5,328.6	5,173.4	5,210.0
Korea	3,691.6	4,090.1	4,523.4	4,942.9	4,942.9	5,330.0	5,807.7	6,317.8	6,415.1	6,856.4	7,045.3	7,113.2

Korea = Republic of Korea, Lao PDR = Lao People's Democratic Republic.

Note: Full-time employment.

Source: UNESCO Institute for Statistics, Data for the Sustainable Development Goals. http://uis.unesco.org/ (accessed 30 November 2018).

The experience of the Northeast Asian economies thus strongly suggests that ASEAN needs to significantly increase its investment in innovation if it wants to achieve strong economic development towards 2040.[3] The point we should notice is that AMS has achieved different development levels in terms of innovations (Tables 4 and 5 exhibit the Global Innovation Index and Competitiveness Index, respectively).[4] Investment

[3] ASEAN Secretariat (2017) declares that ASEAN recognises 'the importance of Science, Technology, and innovation (STI) to foster sustainable economic growth, job creation, and enhanced well-being and science and innovation systems, to spur creativity and innovation that will serve as a foundation in driving the growth and competitiveness of industries in the region'

[4] The large discrepancy in the levels of innovative activities among AMS means that innovation policies for individual AMS may also vary in detail. In drawing up innovation policies for each AMS, a typology of technology and innovation is useful to guide individual AMS. Considering AMS at very different stages of innovation, Ambashi (2017) and Intal et al. (2014) roughly categorise AMS into (1) frontier (Singapore); (2) catch-up (Malaysia and Thailand), (3) learning (Indonesia, the Philippines, and Viet Nam); and (4) initial condition (Cambodia, the Lao PDR, and Myanmar). This categorisation suggests that it is important to understand which innovation stages AMS have reached and to move up the technology ladder accordingly based on effective strategic and systemic economic policies.

in innovation will be critical for Malaysia and Thailand to escape the 'middle-income trap' and attain the status of developed economies, while for the CLMV countries, their ability to adopt technologies will be critical to help them adapt to the newly changing global environment driven by rapid technological advancement. Nevertheless, the presumption that innovation would only help advanced developed economies like Singapore is no longer valid. The potential of innovation should be brought into all AMS at various levels of development on the technology ladder. From this perspective, we argue how ASEAN and AMS will only be able to realise economic prosperity in 2040 through strong involvement with innovation.

Table 4: Ranking of Global Innovation Index

Country	2013	2014	2015	2016	2017	2018
Brunei Darussalam	74	88			71	67
Cambodia	110	106	91	95	101	98
Indonesia	85	87	97	88	87	85
Lao PDR						
Malaysia	32	33	32	35	37	35
Myanmar		140	138			
Philippines	90	100	83	74	73	73
Singapore	8	7	7	6	7	5
Thailand	57	48	55	52	51	44
Viet Nam	76	71	52	59	47	45
China	35	29	29	25	22	17
India	66	76	81	66	60	57
Japan	22	21	19	16	14	13
Korea	18	16	14	11	11	12

Korea = Republic of Korea, Lao PDR = Lao People's Democratic Republic.

Sources: Cornell University, INSEAD, and the World Intellectual Property Organization. https://www.globalinnovationindex.org/Home (accessed 30 November 2018).

Table 5: Ranking of Global Competitiveness Index

Country	2010	2011	2012	2013	2014	2015	2016	2017
Brunei Darussalam	28	28	28	26			58	46
Cambodia	109	97	85	88	95	90	89	94
Indonesia	44	46	50	38	34	37	41	36
Lao PDR				81	93	83	93	98
Malaysia	26	21	25	24	20	18	25	23
Myanmar				139	134	131		
Philippines	85	75	65	59	52	47	57	56
Singapore	3	2	2	2	2	2	2	3
Thailand	38	39	38	37	31	32	34	32
Viet Nam	59	65	75	70	68	56	60	55
China	27	26	29	29	28	28	28	27
India	51	56	59	60	71	55	39	40
Japan	6	9	10	9	6	6	8	9
Korea	22	24	19	25	26	26	26	26

Korea = Republic of Korea, Lao PDR = Lao People's Democratic Republic.

Source: World Economic Forum, The Global Competitiveness Report 2017–2018. http://reports.weforum.org/global-competitiveness-index-2017-2018/ (accessed 30 November 2018).

The rest of this paper is organised as follows. Section 2 presents conventional policy options for an innovative ASEAN from the viewpoint of 'national innovation systems' (NIS). Section 3 makes a detailed explanation of the new trends of innovation, that is, globalisation in innovation and the shift in conceptual framing of innovation. It also presents plausible directions that AMS should pursue. Section 4 briefly touches on the challenges of 'no one left behind by innovation', i.e. 'inclusive innovation'. Section 5 concludes with policy goals and priorities.

2. Conventional Policy Options for an Innovative ASEAN

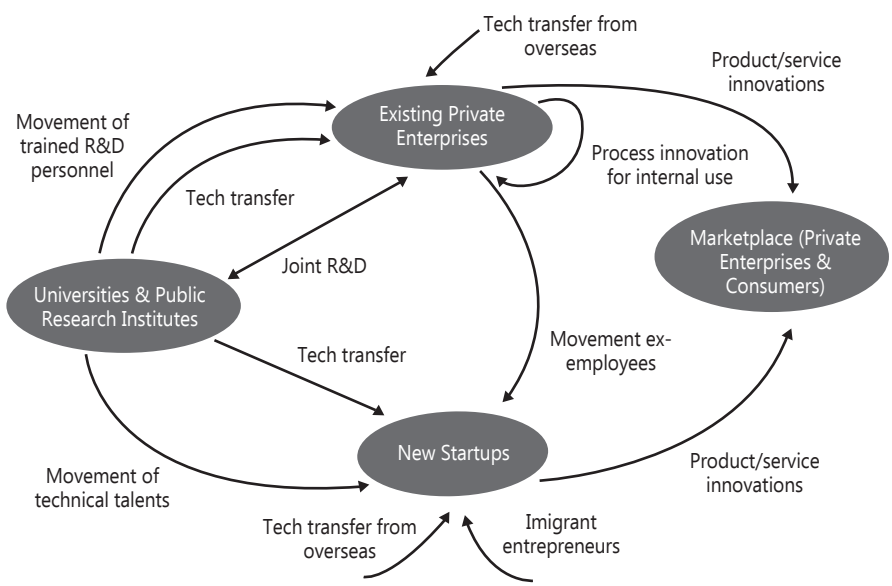
2.1. What is a National Innovation System?

How can AMS and ASEAN build the foundation for innovation (i.e. innovation capability)? In response to this question, one reference is that many developed economies, including leading Asian countries such

as Japan, Korea, and Singapore, have successfully formulated effective and functional NIS, and their governments function as active agents in coordinating systematic innovation policies to make them work well. More generally, NIS can be defined as a continuous process of systemic change facilitated by government policies (at central and local levels), where institutions, learning processes, and networks play a central role in generating technological advancement and innovation via the intentional, systemic interactions between various components such as universities, institutions, the private sector, and investors (Soete, et al., 2010).

Figure 4 illustrates that the systematic innovation framework involving all actors is likely to transform individual small steps into great achievements, which is a strategy of implementing NIS for AMS that seeks to create innovation dynamics. In short, given that AMS must embrace and generate new innovations, the role of governments, universities, public research institutes, and the private sector (particularly new start-ups) and consumers in the marketplace, is becoming much more important.

Figure 4: Stylised Flow of National Innovation System



R&D = research and development.

Source: Wong (forthcoming).

2.2. Conventional Policy Options

This section discusses in more depth the conventional innovation policy options for ASEAN to achieve its development goals.

The fundamental strategy of innovation policy for individual AMS has been to continuously attract foreign direct investment (FDI) from multinational companies so as to receive the benefits of knowledge spillovers from them. AMS have attracted FDI by encouraging multinational companies headquartered in developed economies to locate their factories in industrial zones – usually special economic zones – in the hope of receiving significant technology transfers from them. This FDI strategy is still valid for AMS to enhance 'process innovation'. However, as discussed previously, some AMS need to significantly upgrade their industrial structures and competitiveness in the marketplace through their own 'product innovation' achievements. Hence, they need to implement forward-looking innovation policies and create product innovation based on well-crafted NIS development policies.

From this viewpoint, Ambashi (2018) presents three conventional policy options that individual AMS are encouraged to consider.

(1) Establish their own NIS: drive and implement harmonised innovation policies; set priorities over measures, plans, and programmes; and monitor and evaluate them.
The biggest problem most AMS face is the absence or functional failure of government organisation in promoting innovation policies. In principle, they need to control and coordinate innovation policies that are formulated and implemented across various government departments. It is also important to give responsibility for the establishment and/or reinforcement of a member state's NIS framework in a government organisation.

(2) Encourage the private sector, including both domestic and foreign firms, to invest more in R&D and innovation-related activities.

AMS should orient their innovation policies more towards encouraging the innovative activities of the private sector. In NIS, governments are responsible for proactively addressing market failure that hinders innovation creation. One conspicuous area of market failure is the way innovation achievements are commercialised. To promote the commercialisation of innovation, governments need to consider creating specialised public research institutes whose primary mission is to conduct R&D and technical support related to commercialising various types of innovation achievements (e.g. the Industrial Technology Research Institute (ITRI) in Taiwan, Fraunhofer-Gesellschaft in Germany).

(3) Further develop a conducive 'innovation ecosystem' in their NIS involving universities, public research institutes, and the private sector.

University–industry collaboration (UIC) is an integral part of innovation ecosystems which are conducive to technology diffusion and knowledge spillovers. Therefore, AMS need to formulate policies and measures to expedite UIC like the Basic Law for Science and Technology, 1995 and the Technology Licensing Organization Law, 1998 in Japan and the Bayh–Dole Act, 1980 in the United States. AMS could also aim to create local public technology centres, which function as innovation intermediaries and foster the development of local manufacturing industries, particularly small and medium-sized enterprises.

3. New Trends Surrounding Innovation

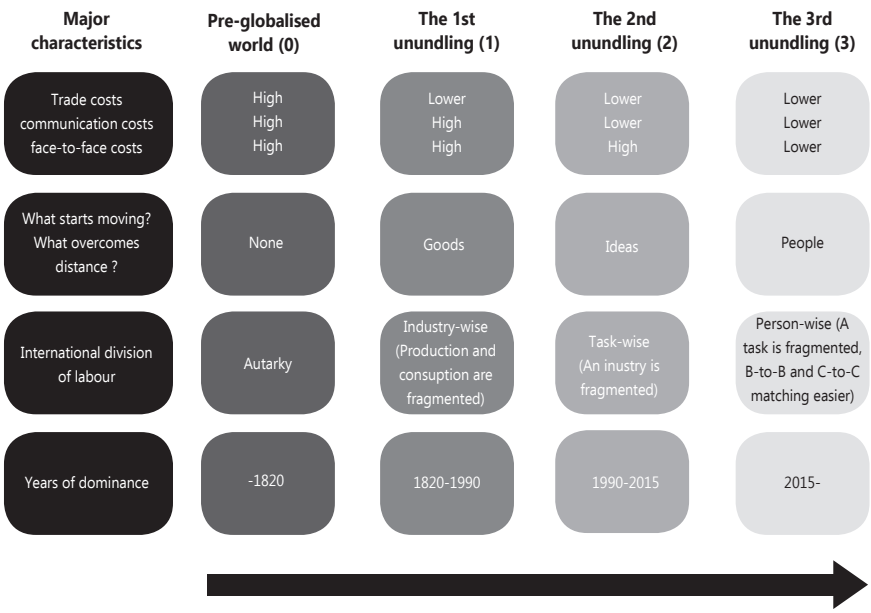
This section sheds light on new trends surrounding innovation: (1) globalisation in innovation and (2) a shift in the conceptual framing of innovation. These new trends stem from the rapid advancement in information and communication technology (ICT), which alters the dynamics of innovation diffusion.

3.1. Globalisation in Innovation

Paradigmatic shifts have occurred in innovation policy because of the rapid development of ICT in recent decades. The situation that ASEAN and AMS face now is totally different from what Japan and Korea experienced decades ago. The successful experiences of Japan and Korea were based on strategic innovation policies to catch up with Western developed countries. That is, their strategy emphasised using domestic industrial resources for innovation (e.g. importing technologies via licensing agreements and alliances with Western companies, inventing through reverse engineering, and restrictive industrial and trade policies to promote home-grown innovation), which was efficient because the globalisation of trade and investment was limited at that time compared with what it is today. The World Trade Organization agreement regarding trade and investment restrictions, subsidies, and intellectual property rights also makes it difficult for AMS to adopt the same industrial policies as the developed Asian countries did in the 1970s–1980s.

To understand most recent globalisation, the concept of the '3rd unbundling' advocated by Baldwin (2016) is helpful for us to shape the development strategies of AMS based on innovation. His unbundling framework is illustrated in Figure 5. Notably, in the 3rd unbundling, advanced ICT (especially communication technology) reduces face-to-face costs and accelerates the international division of labour in terms of human tasks. Kimura (2018) points out that the 3rd unbundling will encourage a sharing economy as a result of easier matching between individuals on internet platforms, make complex tasks managed by persons in different locations possible, increase the international data flow that is available for businesses, and connect individuals with each other more tightly all over the world. Such an impact is anticipated to generate three unique aspects of globalisation in innovation.

Figure 5: Overcoming Distance and the Evolution of 'Unbundlings'



B to B = business to business, C to C = consumer to customer.

Source: Kimura (2018).

First, the reduction in face-to-face costs and globalisation presently operates to benefit front-runner internet firms, particularly large firms ('unicorns') in Silicon Valley, in generating dominant innovations as internet platforms, (e.g. Apple, Google, Facebook, and Amazon).[5] There is concern that frontier innovation based on advanced ICT seems to be increasingly dominated and monopolised by the existing big platform firms, which can afford to continue to invest in huge amounts of R&D and take over innovative start-ups in related spaces (Taplin, 2017). This may widen the gap in innovation capabilities between developed economies and LDEs.

Second, many innovative activities still require human inputs, especially in the form of services trade (e.g. not only engineers, programmers, and scientists, but also professional managers, accountants, lawyers, and university professors). This is why developed economies aim to import significant amounts of skilled human capital as immigrants from LDEs

[5] Chinese platform firms such as Alipay, Alibaba, and Tencent have emerged and established market positions in China.

to promote domestic innovation. Baldwin (2016) indicates that with a reduction in face-to-face communication costs because of progress in communication technology, a new phase of globalisation is beginning in which the international division of labour in units will be realised in the 3rd unbundling. According to his vision, a 'virtual immigration' will be achieved, leading to 'telepresence', which will enable the above-mentioned 'brainworkers' to provide their services across borders from LDEs to developed economies. Thus, future workers may find job opportunities while residing in LDEs if individual innovative activities are globally fragmented despite the concentration of large firms.[6]

Finally, local applications of technology and business model innovation in each LDE demand physical interactions between engineers/scientists and entrepreneurs across the world. In particular, new technologies provided by firms of developed economies are indispensable for business model innovations in LDEs. It is notable that ASEAN home-grown internet platform providers like GO−JEK, Grab, and Lazada supply new relevant services (e.g. e-payment systems) to their core business models in combination with the technological professionals of ICT, finance, and others, offered initially by foreign professionals (e.g. technology alliance) or those who have received a science and engineering education in developed economies. This case not only demonstrates a good example of the interaction between the technologies of developed economies and business model innovations of LDEs, but also suggests the importance of arranging effective innovation ecosystems with a particular emphasis on human capital that has updated knowledge about technology.

Innovation in the 3rd unbundling would be a big challenge for the AMS. The NIS that AMS have established were tailored basically for manufacturing sectors in the 2nd unbundling; consequently, they may not automatically provide the innovation bases, especially human capital, for the 3rd one. Hence, the way to connect their existing advantages with the 3rd unbundling is a critical issue. Although it may be difficult for them to establish strong innovation bases in the short run, specific

[6] Baldwin (2016) also predicts the emergence of 'telerobotics', which will enable workers in LDEs to provide physical labour services in developed economies by, for example, controlling cleaning robots.

policies to maximise the exploitation of opportunities created by ICT and globalisation should be prioritised.

In particular, we may need to adopt more forward-looking, "futuristic" innovation policies in addition to, or somewhat away from, those derived from the traditional NIS frameworks that focus only on challenges to be addressed in the short term. To achieve innovation in the globalised period, the NIS of AMS must put more emphasis on (1) inviting innovation service outsourcing in connection with developed economies; (2) implementing local applications of technologies for innovative business models; and (3) attracting both indigenous and foreign human capital. The last point (3) is the most important in addressing the challenges of (1) and (2). Therefore, AMS may need to start competing for attracting well-educated people, and prepare comfortable urban amenities for them, which can be improved relatively easily if good infrastructure in the 2nd unbundling has already been established.[7]

3.2. Shift in the Conceptual Framing of Innovation

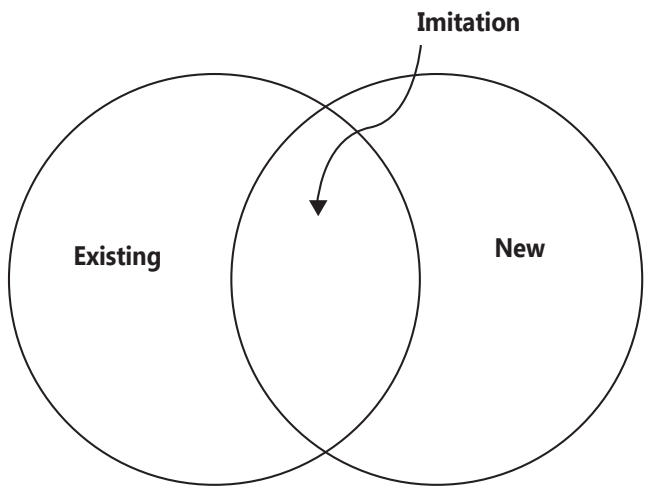
We have also experienced a shift in the conceptual framing of innovation to a greater extent than in the past. In particular, two conspicuous shifts must be highlighted.

First and foremost, 'imitative innovation' is increasing in importance for LDEs (Wong, 2018). Despite the seemingly strong evidence of less innovative AMS shown in Tables 1–3, we may need to go beyond R&D and patenting outputs in measuring their actual innovative activities. Many innovation efforts made by latecomer economies frequently takes the form of what we call 'creative imitation' (Figure 6), whereby latecomers seek to part-imitate and part-adapt new products and services from overseas to meet local market needs or produce lower cost versions to compete in more price-sensitive lower-end markets. This creative

[7] Glaeser, Kolko, and Saiz (2001) list the elements of urban amenities as (1) the presence of a rich variety of services and consumer goods, (2) aesthetics and physical setting, (3) good public services, and (4) speed.

imitation is what China (and Korea earlier) did in much of their catch-up phase, although observers from developed economies have sometimes called these indigenous products copycats or intellectual property (IP) piracy. However, they are not always complete copies, and some degree of innovation is included.[8] These part-imitative, part-creative activities involve little R&D or patent granting. In a nutshell, we can argue that the innovative part compared with the imitative part would increase as LDEs move up the technology ladder. Figure 7 depicts the comparison between path-following and path-breaking learning. AMS should reinforce path-breaking learning since it has broader potential for innovation.

Figure 6: Continuum Between Imitation and Innovation



Source: Wong (2018).

[8] Baidu in China did not just copy Google by providing better search engines in the Chinese language; it adapted them to search Chinese chat sites instead of just web pages. GO-JEK in Indonesia is not a mere copy of Uber for since GO-JEK introduced ride-hailing motorcycles with women drivers for women passengers (important in Islamic culture) and delivery services 2 years before Uber.

Figure 7: Pass-Following and Pass-Breaking Learning

Learning type	Pass following	Pass breaking
Learning to innvate	Incremental Continuous Sustaining Explorative	Radical Discontinuous Disruptive Explorative
Learning to replicate	Duplicative imitation	Creative imitation6
Learning to use	Imitative use	Creative Use
		A broader definition of innovation

Source: Wong (2018).

The second shift is found in the growing role of technology entrepreneurship in the NIS of LDEs. Table 6 shows that a growing number of people have engaged in entrepreneurship and start-up businesses in many AMS. According to recent entrepreneurship and innovation literature (Sahut and Peris-Ortiz, 2014), the importance of young technology start-ups, not large established firms, has been the main driver for spurring innovations, especially those associated with digital technologies and business model innovations which are enabled by digitalisation and mobile internet (e.g. e-commerce mobile apps, Fintech, internet of things). Such entrepreneurial exploitation of the latest technologies is not confined to developed economies but can often allow LDEs to leapfrog existing technology ladders.[9] As such, public policies that affect the development of the entrepreneurship ecosystem may be just as significant as traditional policies in encouraging technology transfer from public research institutes. In addition, recent research has shown that injecting entrepreneurship education into university curricula can increase the supply of entrepreneurs in AMS (Low, Ho, and Wong, 2014; Wong, forthcoming). In conclusion, many AMS, such as Indonesia, the Philippines, and Viet Nam, which are still reaping the demographic bonus of relatively young populations, have the potential to supply a large amount of young IT talent and entrepreneurs,[10] provided that the education systems in these countries can scale up quickly in both quality and quantity.

[9] Mobile payment penetration in China is now the highest in the world, and it has been quite high even in many ASEAN developed economies partly because traditional banking services do not exist in many rural areas.

[10] In the case of the National University of Singapore (NUS), where one of the authors oversees the university's tech start-up support system, digital technology start-ups established by alumni and students do not draw on patent inventions granted from the NUS lab.

Table 6: Entrepreneurship in ASEAN economies

Country	Total early-stage entrepreneurial activity	New business density
Cambodia		0.217
Indonesia	7.5% (2017) 14.1% (2016)	0.333
Lao PDR		0.100
Malaysia	21.6% (2017) 4.7% (2016)	2.262
Philippines	17.2% (2015)	0.331
Singapore	11.0% (2014)	8.623
Thailand	21.6% (2017) 3.5% (2016)	0.991
Viet Nam	23.3% (2017) 13.7% (2016)	

Lao PDR = Lao People's Democratic Republic.

Note: Total early-stage entrepreneurial activity represents the percentage of the population aged 15–64 who are either nascent entrepreneurs or owner-managers of new businesses less than 42 months old. New business density includes new registrations per 1,000 people aged 15–64.

Source: Global Entrepreneurship Monitor. https://www.gemconsortium.org/ (accessed day month year); World Bank Entrepreneurship Surveys. http://www.enterprisesurveys.org/ (accessed 30 November 2018).

The above-mentioned innovation ecosystem seems to be reinforced by advantages of ASEAN, i.e. emerging global middle classes which demand common product categories but differentiated local ones, and more opportunities to meet indigenous social needs and fit local cultural contexts – implying more inclusiveness in its impact. Not only does ASEAN have a rising number of upper classes which are connected globally, but also a diversity of cultural, physical, and social contexts simply because the region is more diverse than a single country. In short, the ecosystem associated with these advantages can serve as a good foundation for innovation in AMS that involves creative imitation. The successful experience of creative imitation and facilitating innovation policies in Asia's newly industrialised economies and China should be more broadly recognised among policymakers of AMS.

4. Leave No One Behind from Innovation

So far, we have discussed the need for human capital that can adapt to globalisation, creative imitation, and technology entrepreneurship. In this sense, education systems are critically important in the long run to fill knowledge and technology gaps between latecomers and the front-runners, and a sufficient number of people who receive higher education is necessary. With respect to formal school education, elementary education should be reformed to be consistent with the knowledge economy. For example, since quality online courses (EdTech) are widely available via the internet, AMS can implement labour policies that improve workers' abilities even at the initial stage of education and learning. On-the-job training, the other pillar of the education system, should also be enhanced in AMS to facilitate flexible labour movement from declining to growing industries.

Conceptual framing of innovation has also shifted in recent years to highlight the importance of inclusive innovation in supporting growth with political stability. We should note that the outcomes of innovations do not always increase social benefits for all people. Since innovation has frequently shifted towards labour-saving or extremely skill-biased technologies, the impact of such innovation is generally quite adverse for the low-skilled labour force. Likewise, Stiglitz and Greenwald (2014) argue that financial innovations that are driven purely for short-term financial returns are likely to benefit the rich at the expense of the poor. In this way, unfettered capitalist market forces may lead to significantly increased inequality, which may result in social and political instability.

Technological innovations that widen income inequality and regional disparities could contribute to a backlash against globalisation, leading to growing industrial and trade protectionism in recent years. Stiglitz and Greenwald (2014) also argue that societies with a large domestic income or wealth inequality gap tend to perpetuate the use of innovation to maintain or even widen the gap, which suggests the importance of social protection. By contrast, creating new jobs by leveraging technologies and innovations could resolve the problem of unemployment caused by them, which has been demonstrated by history since the past Industrial Revolution (Acemoglu and Restrepo, 2018). For AMS that still depend

on labour-intensive industries, innovations should be used to enhance existing industrial structures at least in a shorter time span. Accordingly, a public policy role is needed in promoting social innovation (e.g. innovation in public transport, urban environment, healthcare, and educational services) as well as inclusive innovation that can create jobs for the lower population pyramid, including frugal innovation that raises the productivity of rural farmers and urban small and medium-sized enterprises.

5. Concluding Remarks

New technologies and innovations are critical for the future development of ASEAN. Innovation activities could be enhanced in all countries regardless of their level of development, but the diversified mix of innovation policies needs to be adapted to AMS at different levels of technological development. It should be therefore noted that details of innovation policies could be varied in individual countries.

Having said that, ASEAN innovation policies should reflect the new trends surrounding innovation. First, in a globalised world accelerated by the 3rd unbundling, advanced ICT that reduces face-to-face costs generates various business innovation opportunities. However, the exploitation of such opportunities still not only requires human capital especially in terms of professional services, but also demands interactions between engineers/scientists and entrepreneurs at the global level to develop apt innovative business models in domestic LDEs. From this perspective, we need to put more emphasis on inviting innovation service outsourcing in connection with developed economies, implementing local applications of technologies for local business models, and attracting both indigenous and foreign human capital to AMS.

In addition, we have experienced a shift in the conceptual framing of innovation. Imitative innovation will remain important for LDEs, as many of the innovation efforts made by latecomer economies take the form of creative imitation. On the other hand, the role of technology entrepreneurship is growing in the NIS of LDEs. As such, public policies may be significant to affect the development of the technology

entrepreneurship ecosystem. The most important thing is that, with rapidly growing middle classes and social/cultural diversity, ASEAN will benefit particularly from innovation of the creative imitation type, driven by indigenous technology entrepreneurs who can best understand and decode the market opportunities of their own societies and cultures.

Based on these discussions, we should focus on expediting ASEAN market integration from the viewpoint of spurring pan-ASEAN regional innovation. The innovation induced by advanced ICT can be facilitated by a large market, which means that current innovation and its outcomes tend to be subject to economies of scale and positive network externalities. ASEAN therefore needs to recognise the importance of pan-ASEAN market integration to promote the rapid diffusion of innovation from individual ASEAN economies to the whole of ASEAN to reap economies of scale and scope.

Accordingly, we highlight the following policy goals and priorities to drive innovation towards ASEAN 2040.

First, AMS need to introduce policies responding positively to globalisation and to facilitate both services outsourcing and free movement of natural persons, especially of highly skilled human capital. More service provision and freer movement of human capital are usually desirable because innovation is still often spurred through person-to-person contacts physically and virtually, especially by professionals like engineers, scientists, and entrepreneurs who can contribute to R&D and innovative activities. The free movement of engineering service providers, assured in mutual recognition agreements, is particularly important given that the engineering workforce is a foundation for science, technology, and innovation. Further improvements in domestic laws and regulations on engineering services are needed to make it easier for certified engineers to work overseas.

Second, governments' aggressive support for the innovation ecosystem, especially technology entrepreneurship, is also critically important. It is necessary to provide policy incentives for young entrepreneurs to

establish technology start-ups that are keen to create imitative innovation leading to economic viability through, for example, R&D investment tax credits, the formation of industrial clusters promoting knowledge spillovers, and facilitated institutions such as incubators and technology license offices, for university start-ups and spin-offs. AMS also need to focus governments' efforts on entrepreneurship education not only for aspiring young entrepreneurs but also students even at the basic education level. Granting a prestigious entrepreneurship award to conspicuous entrepreneurs may encourage young people to follow them. Finally, ASEAN could consider the establishment of an ASEAN-wide innovation performance benchmarking and innovation policy best practice sharing platform. ASEAN seems to need an innovation performance benchmarking system, similar in spirit to what the European Union (EU) has established among its member states – EU Innobarometer or Innovation Scorecard – but adapted to ASEAN (e.g. including indicators for the creative-imitation type of innovation, pace of adoption of the Fourth Industrial Revolution technologies, and measures of inclusiveness of innovation). Such a benchmarking system is likely to motivate each AMS to accelerate the development of their respective NIS and promote the diffusion of best innovation policy practice across ASEAN.

Table 7: Goals and Policy Recommendations

Goals	Policy recommendations
• Exploit opportunities of globalisation through the effective use of human capital in professional service at the global level. • Promote 'imitative innovation' or 'creative innovation' through pass-breaking learning to meet local markets and to produce lower cost versions of products and services. • Develop the technology entrepreneurship ecosystem and nurture young technology start-ups as a main driver for innovations. • Reinforce the innovation ecosystem of ASEAN by taking advantages of emerging global middle classes and diversified local needs	• Introduce policies facilitating services outsourcing and free movement of natural persons, especially of highly skilled human capitals, e.g. MRAs for professional workers, improvement in domestic laws and regulations on engineering services. • Provide policy incentives for young entrepreneurs to establish technology start-ups, e.g. R&D investment tax credits, promotion of incubators and technology license offices of universities. • Inject entrepreneurship education into university curricula, e.g. granting a prestigious entrepreneurship award. • Establish an ASEAN-wide innovation performance benchmark and innovation policy best practice sharing platform like EU Innovarometer and Innovation Scorecard to promote the diffusion of best innovation policy practices across ASEAN

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