

# Digital Transformation and Industry 4.0 in Southeast Asia

*Raja Mikael Mitra*

## 1. THE SWEEPING DIGITAL TRANSFORMATION

The sweeping change enabled by advanced information and communication technologies (ICTs), the fourth industrial revolution (Industry 4.0 and the like) or more broadly the transformation towards a digital and knowledge-based new economy are major drivers of economic as well as cultural, social and political change. And yet there are fundamental gaps in the knowledge and awareness of the implications of these changes and in the understanding of how to respond to them. Those who respond effectively can benefit greatly while those who falter risk losing out. The velocity, scale and scope of change imply that past models and strategies for social, economic and technological development are becoming increasingly obsolete or ineffective. Southeast Asian economies have common as well as unique features in ICT development and more broadly digital society transformation.<sup>1</sup>

The next 5-10 years and beyond will see technology and other innovative developments ranging from new materials to nanotechnology, new ways to produce, distribute and store electric power, biotechnology, genomics and medical science advancement and manifold other technological, business processes and other innovative developments are poised to imply major transformations in technology, economic, social and political ecosystems. The latter is illustrated by ICT developments: artificial intelligence (AI), Internet of Things (IoT), 3D printing, data analytics, cloud computing, blockchain (finance and other sector-specific applications), autonomous vehicles (e.g., drones, ships, trains, cars, trucks, kiwi-robots) and other “new” technologies are driving continuous creative disruption in socio-economic

---

<sup>1</sup> This chapter draws on various publications by the author, including research covering data and other evidences validating findings outlined here. This presentation is part of a larger research project which the author is working on currently.

ecosystems. Amongst other things this is reflected in worldwide transformational trends in trade, investment and employment. It has major impact not only on manufacturing, construction, mining, agriculture and other natural resource-based sectors but also in terms of service sectors. Furthermore a large number of jobs will be reshaped or disappear in both goods producing and service sectors, the latter especially impacting routine functions relating to clerical jobs, accounting, banking and financial services, transport and logistics services, retail, hotel and restaurants and social services such as education and health care. At the same time, as demand for certain type of manpower declines, it is equally important to note that new technologies and other forms of innovation result in new or boosted demand for certain products and services, some of which result in higher productivity, income and new jobs (World Bank 2018a).

The conceptual framework applied in this chapter centers around 12 pillars that drive and constrain digital transformation, namely: historical legacy, geography and timing, demand and supply settings in local and external markets, human and social capital, financing, technology and innovation, infrastructure, urban and rural development and institutional and stakeholder eco-systems: government, legal and regulatory-frameworks, the private sector, the Diaspora and the leadership context (Mitra 2012 and 2019a).

## **2. DIGITAL TRANSFORMATION IN SOUTHEAST ASIA**

### **2.1 Asian diversity and catch up trajectories**

The degree of maturity and phases of digital development differs significantly within and between countries. Common to all societies in Asia and elsewhere is, however, the increasing importance of digital economy transformation, a development which typically is spearheaded by larger cities with the most effective interfaces with international innovation, finance and access to human talent.

Most of the East Asian economies (that is, costal mainland China, Hong Kong SAR, Taipei, China, the Republic of Korea and Japan) are well ahead of the South and Southeast Asian economies (with the exception of Singapore and a few major urban ICT industry centres in other countries) in digital economy developments. This is reflected in the fact that higher GDP per capita levels is also associated with greater use of ICTs in the local economy. Economies which are particularly lagging behind include Cambodia, Laos, and Myanmar as well as backward areas in other countries. It should, however, be noted that all countries (including lagging ones) have launched multiple government vision and planning initiatives relating to ICT

development and more recently also digital economy and Industry 4.0 inspired and other broad transformational initiatives. Moreover, it should be noted that ICT industry and application development in ASEAN to a large extent has been driven by foreign and local private companies, the latter including ICT and ICT-enabled micro, small and medium-sized enterprises (MSMEs) as well as startups which have seen a surge in recent years.

Over the past decades ASEAN and other Asian economies have experienced a major surge in the diffusion and use of a wide range of ICTs but the adoption of new technologies has been uneven within and between countries. While the digital divide has been narrowing in many countries if measured in terms of number of TVs, PCs, mobile phones and use of basic ICT services, most countries are significantly behind high-income economies in the application of new sophisticated technologies such as high-end AI, IoT and big data analytics.

Also, it should be noted that internal and cross border migration have played a major role in the development of ICT and other sectors in Asia, prime examples of this being large-scale migration within China and India; and the fact that the Chinese, Indians and other Asians play prominent roles in the ICT-related developments in Singapore and other ASEAN economies.

The international dimension of many new technology developments is further illustrated by close linkages between several Asian economies and the United States. Asia is not only a major market for selling ICT products and services but is also a prominent centre for international sourcing of ICT hardware (especially East and Southeast Asian countries) and since the 1990s also IT and Business Process Management (BPM) services (India being a prime example in IT software and services and BPM and the Philippines in terms of BPM). Much of the ICT industry in Silicon Valley is staffed (and more recently also owned and managed) by diaspora originating from China, India, the Republic of Korea, the Philippines and other parts of Asia. While this has implied so-called brain drain it has also resulted in brain circulation and other benefits for Asian countries. This and other facts have contributed to inspire Asian nations to develop their own "Silicon Valley" type of industry clustering (Saxenian 2005).

**Table 1. ICT Development Index (IDI): Global and Asia region, 2017**

...Economy	Asia Region Ranking 2017	Global Ranking 2017	IDI Value 2017
<b>High-ranking</b>			
Korea (Rep.)	1	2	8.85
Hong Kong, China	2	6	8.61
Japan	3	10	8.43
New Zealand	4	13	8.33
Australia	5	14	8.24
Singapore	6	18	8.05
Macao, China	7	26	7.80
Brunei Darussalam	8	53	6.75
Malaysia	9	63	6.38
<b>Middle-ranking</b>			
Thailand	10	78	5.67
China	11	80	5.60
Mongolia	14	91	4.96
Philippines	15	101	4.67
Viet Nam	17	108	4.43
Indonesia	19	111	4.33
Sri Lanka	20	117	3.91
<b>Low-ranking</b>			
Bhutan	21	121	3.69
Timor-Leste	22	122	3.57
Cambodia	24	128	3.28
India	25	134	3.03
Myanmar	26	135	3.00
Lao PDR	27	139	2.91
Nepal	28	140	2.88
Bangladesh	30	147	2.53
Pakistan	31	148	2.42
Afghanistan	34	159	1.95

Note: The IDI comprises of three sub-indices, namely, the access sub-index, the use sub-index and the skills sub-index.

Source: ITU 2017. *Measuring the Information Society*. Geneva, ITU.

## 2.2 ASEAN regional developments

Among the members of ASEAN, Indonesia, Malaysia, the Philippines, Thailand and Viet Nam are well ahead of South Asia in most economic development indicators but lag behind most of East Asia in terms of socio-economic indicators for per capita income; education and health; ICT spending per capita; adoption of ICT and the development of the domestic market for services; and international rankings in competitiveness, ease of doing business, e-readiness and so on. Moreover, the

region's colonial legacy differs from that of East Asia and is only partly in line with that of South Asia. Malaysia, Myanmar, and Singapore were under British colonial rule and hence are familiar with British culture and legal and business practices. The Philippines was a Spanish colony that came under American rule; Indonesia was a Dutch colony; Cambodia, Laos, and Viet Nam were French colonies; and Thailand was never a colony. These facts have had a significant impact on their legal and education systems and subsequently the scope for developing IT-BPM and other export industries.

Growth opportunities are outlined in two recent reports: According to a report by Bain & Company in 2018 the digital economy<sup>2</sup> currently accounts for 7 percent of GDP (around USD 50 million) in ASEAN compared to 16 percent in China and 35 percent for the US. Moreover, the report estimates that capitalising on new digital economy growth opportunities could create an additional USD 0.8-1.1 trillion revenue in 2025, that is, close to one-fifth of ASEAN's projected GDP of USD 5.25 trillion in the year 2025. The increased digital economy potential is calculated by considering three factors, namely: i) productivity improvements in offline sectors enabled by digital adoption, such as productivity improvements in the manufacturing sector from adoption of Industry 4.0; ii) expansion of digital markets enabled by digital integration, such as access to new markets through e-commerce or financial inclusion through digital financial services; and iii) growth of enabling sectors that lay the foundation for digital integration, such as growth in ICT or logistics sectors that will support digital integration (Bain & Company 2017 and 2018).

According to a McKinsey report released in 2018, Industry 4.0 is expected to drive productivity increases comparable to those generated by the introduction of the steam engine in the first industrial revolution. Globally, it is expected to deliver between USD 1.2 trillion and USD 3.7 trillion in gains by 2025. Of this, ASEAN, whose member economies have significant manufacturing components, has the potential to capture productivity gains worth USD 216 billion to USD 627 billion by 2025 (McKinsey 2018a).

The increased attention being given to digital economy and Industry 4.0-related developments in ASEAN is illustrated by Singapore's Smart Nation and Committee for the Future Economy initiatives, Malaysia's launch of the world's first digital free trade zone (partnering with Alibaba) and the unveiling of a vision for Industry 4.0

---

<sup>2</sup> *Digital Economy:* A collective term that includes digital infrastructure sub-sectors (such as telecommunications, hardware and software), Internet and platform sub-sectors (such as e-commerce and sharing platforms), and the proportion of traditionally offline sectors and sub-sectors enhanced by digitalisation such as manufacturing adoption of Industry 4.0 (Bain & Company 2018).

transformation, Indonesia's "2020 Go Digital Vision", the "Thailand 4.0" initiative, the Viet Nam government's Industry 4.0 initiatives and numerous other digital/ICT development initiatives in the region.

While progressing it should be recognised that achieving rapid and sustainable economic transformation is a complex task and that is so especially in countries that are weak in terms of infrastructure, human capital and institutions, the later including "soft states" such as Cambodia, Laos and Myanmar. Furthermore, it should be noted that most politicians tend to focus on short-term objectives while they have limited incentive to give high priority to implementing long-term national economic and technological transformation development.

At the regional level, digital developments manifest in the blueprint for the ASEAN Economic Community (AEC) 2025 and in more detail in the ASEAN ICT Master Plan 2020 as well as the Master Plan on ASEAN Connectivity 2025 and other reports released by the ASEAN Secretariat in Jakarta. Developments in diffusion of ICT technologies and expanded use of broadband connectivity are fostering rapid expansion of logistics, e-commerce, banking, finance and payment systems and other ICT-related developments, and are poised to be major factors driving digital economy transformation within and between ASEAN countries (Mitra 2019b).

While progressing, the Southeast Asian region is characterised by weakness in legal and other aspects of harmonisation needed to boost regional integration in ICT and other areas. Also, it should be noted that multinational corporations (MNCs) and local business interests are key forces in driving or constraining national and regional developments. Effective regional integration implies a strong need for efforts in designing and implementing specific schemes relating to the legal and regulatory system, trade and foreign investment, connectivity and logistics, migration, education and research and specific applications such as payment systems and e-commerce (Severino 2006). Also, it is important to continuously update national and regional plans relating to digital and Industry 4.0 related transformation.

Much of IT and BPM industry development in several ASEAN economies have for some time been directed towards exports (and imports). This reflects the scope for major growth of exports to high income economies coupled with rapid expansion of foreign investment from these countries. The local markets in ASEAN have also expanded but ICT spending for the domestic market is small on a per capita basis compared to higher income countries.

The Philippines and even more so Malaysia, Thailand and Viet Nam, have made major strides in developing their ICT hardware export industry while the Philippines has emerged as a major centre for export of BPM services as well. Moreover, most ASEAN members have made significant progress in the development of ICT startups

and national plans for ICT-related development. Inspired by the Republic of Korea, Singapore and other countries, Malaysia, Thailand and Viet Nam have made major progress in terms of broadband connectivity while the Philippines, Laos PDR, Cambodia, Indonesia and Myanmar lag behind other ASEAN countries.

Finally, it should be noted that China and the Chinese diaspora have for centuries had major cultural and economic influence in the region and that fact has re-emerged as increasingly important in recent times. China has become a principal trade partner for ASEAN and many other economies. Indonesia, Malaysia, Thailand and Viet Nam and other countries in the region have attracted more direct investment from China but also from North American, European and Japanese investors (not only in electronics and automobiles but also other sectors); one reason for the latter being interests in diversifying investment in order to avoid singular reliance on China as a production centre and market. As of today, Chinese large enterprises such as Alibaba, Huawei, Lenovo and Tencent are principal competitors to Japanese, South Korean, North American and European firms in spearheading the ICT industry and thereby related digital transformation especially in East and Southeast Asia. Also, it should be noted that Chinese firms have emerged as major investors in the region, e.g., Huawei in ICT infrastructure; Alibaba in e-commerce and ICT local startups. The potential for further developing the scale and scope of China's relations with ASEAN and other countries is clearly manifest in the Chinese government's Belt and Road Initiative (BRI) and other regional cooperation and integration initiatives which also have implications on ICT development, including ICT infrastructure and the development of industry centres.

## 2.3 Country experiences

- **Singapore.** This highly internationalised city economy has outperformed other ASEAN members in ICT as well as other aspects of economic development. It has given high priority to ICT development since the 1980s with the government acting as a direct and indirect catalyst. It has also focused on developing partnerships between government, private industry (both foreign and local), and academia. Early on, the government placed strong emphasis on investing in advanced telecommunication infrastructure and in ICT education, training and research, and institutional capacity building. An examination of all 12 pillars driving digital and more broadly knowledge economy transformation shows that Singapore has been and continues to be a front-runner in responding to new technology, innovation and market developments. Singapore has emerged as a world-class centre in ICT

development, logistics, finance, management consulting, education, research, and other knowledge economy services.

Recent government initiatives include the Committee on the Future Economy (CFE), the SkillsFuture and Smart Nation and other visionary initiatives relating to innovation, skill and infrastructure requirements for continued socio-economic transformation. The CFE's vision covers seven mutually-reinforcing strategies:

- Deepen and diversify international connections
- Acquire and utilise deep skills
- Strengthen enterprise capabilities to innovate and scale up
- Build strong digital capabilities
- Develop a vibrant and connected city of opportunity
- Develop and implement Industry Transformation Maps (ITMs)
- Partner each other to enable innovation and growth (Government of Singapore 2017).

Furthermore, the government launched a Services and Digital Economy Technology Roadmap (SDE TRM) in November 2018. This initiative was envisaged to be an important part of Singapore's "Digital Economy Framework for Action". It provides a scan of the digital technology landscape in the next 3 to 5 years, identifying the impact of key shifts and technology trends. "Services 4.0" is identified as a key engine of growth for Singapore's digital economy as the services industry accounts for 72 percent of the nation's GDP. "The SDE-TRM aims at enabling business across sectors to harness technology and innovate, equipping their workers with new skills and capturing opportunities in the digital marketplace to deliver customer-centric experiences." (IMDA 2019).

This and other reforms spearheaded by the Singapore government and its corporate partners will have major direct and indirect implications not only for the transformation of Singapore but also for other countries and the international business community in particular. Also, Singapore has been spearheading various regional initiatives, including the ASEAN Smart Cities Network, the development of industrial parks and promoting education. Nonetheless, the role of Singapore in the region does not merely stem from official government schemes but from the fact that it is a forerunner in ICT development and also a major hub for major corporations, financial, consulting, education and research developments in the region. Also, it is a socio-economic ecosystem especially geared to respond to "new" innovative challenges such as transformations of service sectors (fintech, healthcare,

higher education and research, communication and transportation services, etc.) and smart industry/Industry 4.0 developments (Tan Teck Boon et al. 2017).

From the time Singapore became an independent nation (1965) the Singapore government has consistently been committed to learning from its own and others' experiences in designing, and also to ensure effective implementation of, policies and specific technology, infrastructure and other development plans. The government continues to design and implement new policies to tackle a wide range of future socio-economic challenges such as the need to re-orient and upgrade the legal and regulatory, infrastructure, education, training, entrepreneurial and innovation ecosystems, the latter including digital technologies, Industry 4.0, biotechnology and other areas.

### **Box 1 - Singapore: Smart Nation Visionary Initiative**

The Smart Nation initiative envisions a Smart Nation that is a leading economy powered by digital innovation, and a world-class city with a Government that gives our citizens the best home possible and responds to their different and changing needs. Singapore's plans to drive transformation across the economy are detailed in the Digital Economy Framework for Action, the Digital Government Blueprint and the Digital Readiness Blueprint. The Digital Economy Framework for Action and the Digital Readiness Blueprint has been released by the Ministry of Communications and Information (MCI). These three plans are key pillars which work together to support Singapore's Smart Nation goals, namely:

I. Strategic National Projects: To drive pervasive adoption of digital and smart technologies throughout key Strategic National Projects:

- National Digital Identity – for citizens and businesses to transact digitally in a convenient and secure manner;
- e-Payments – to allow everyone to make simple, swift, seamless, and safe payments;
- Smart Nation Sensor Platform – deployment of sensors and other IoT devices that will make our city more liveable and secure;
- Smart Urban Mobility – leveraging data and digital technologies, including AI and autonomous vehicles, to enhance public transport;
- Moments of Life – bundling government services, across different agencies, to the citizen at different moments of his life.

II. Enabling a Culture of Innovation & Experimentation: The government will put in place appropriate policies and legislations to facilitate innovations by the public and the private sector, and encourage adoption of new ideas.

III. Computational Capabilities and Digital Inclusion. Smart Nation efforts are underscored by re-skilling and promoting the learning of coding and computational thinking skills, to ensure that all segments of the population benefit regardless of age or digital literacy. Resources are also to be put in place to assist larger as well as smaller enterprises as they seek opportunities in the digital economy.

*Source: Abstracted from Government of Singapore 2018a. <https://www.smartnation.sg/about/Smart-Nation#sthash.LsvEf1oW.dpuf>.*

■ **Malaysia.** This multi-cultural and natural resource rich country has made major strides in developing its ICT industry and is ahead of most ASEAN countries (except for Singapore) in the diffusion of ICT in the local economy. Malaysia developed an electronics industry early on based on multinational corporations' offshoring assembly component manufacturing to serve regional and global markets.

Much of the IT and BPM service industry has been concentrated in Kuala Lumpur and the Klang Valley and Penang areas. The government has made major efforts to attract investment into Cyberjaya, located between the Kuala Lumpur city centre and the international airport, and efforts have also been made to develop the industry in other parts of the country. One example is the Iskandar Malaysia project, a major high-technology industry township close to the Singapore border, with the potential to attract investors and professionals who would have otherwise operated out of Singapore.

Malaysia differs from the Philippines (and many other Southeast Asian countries) in the scale and scope of government interventions to promote and invest large sums to promulgate the use of e-government and other applications in the local economy as well as to foster electronics and ICT hardware and subsequently also ICT service industries. The latter applies also to investment in basic and higher levels of vocational training education.

The Malaysian experience indicates that both the government and the private sector have principal roles in fostering ICT development but the efficacy of government intervention is key. This is illustrated not only in terms of attracting foreign investment but also in establishing industrial parks but the record has been mixed in terms of the ability to solve problems resulting from fragmentation and the poor implementation of government initiatives, some of which have been characterised by ineffective subsidy regimes and corrupt practices. Malaysia's varied results in ICT development suggest that focusing exclusively on government and public-private partnerships for investing in infrastructure and providing generous tax and other incentives may not be enough to enable major IT-BPM industry development, especially if the investments and policies are ineffective. The importance of early and sound investments in human resources and ensuring that such efforts are carefully monitored and managed is paramount. Also, it should be noted that a large number of skilled and educated Malaysians have opted to leave their country with Singapore being the major beneficiary.

Also, it is imperative to compete for foreign investment and to establish more effective programmes to strengthen local entrepreneurship and innovation. Nevertheless, Malaysia has been an example of bold leadership, as illustrated by its Vision 2020 of a technologically advanced society and a technologically enabled

government. The government's 8th, 9th, and 10th plans (2010-2015) along with the Knowledge-Based Economy Master Plan, the Digital Transformation Program and several other government initiatives aim to transform the economy through innovation, knowledgeable and skilled human capital, and the widespread use of technology. By 2020, the Digital Transformation Program is expected to increase the contribution of the digital economy from the current 12.5 percent to 17 percent of gross national income (MOSTI and PIKOM 2012). Furthermore, Malaysia's National Policy on Industry 4.0 or Industry4WRD was launched in 2018. Industry4WRD focuses mainly on digitally transforming the manufacturing sector and its related services to embrace Industry 4.0.

■ **The Philippines.** This island economy has until recently trailed behind most other major Asia economies in GDP, foreign trade and investment growth. But it continues to lag behind not only Singapore and Malaysia but also Indonesia, Thailand and Viet Nam in per capita income, industrial, infrastructure and social development indicators.

The country has developed a major BPM export industry and seen a rapid expansion of social media and some other ICT applications, especially from the 2000s onwards. Manila has emerged as the world's largest centre for offshoring of call centre operations and has also progressed in developing increasingly wide ranges of non-voice BPM services for international markets, the latter including knowledge process management. In addition, it should be noted that the Philippines has a sizeable electronics industry focusing on assembly and more recently also higher value added work. Moreover, in recent years the country has experienced a rapid expansion in the number of ICT-enabled MSMEs, startups and micro-businesses.

The Philippine experience with BPM since the 2000s demonstrates the scope for rapid growth in outsourcing services to developing countries. Most of the growth has so far been at the lower end of service provision such as basic call centres and low-end, BPM non-voice services plus some knowledge process outsourcing and legal service outsourcing, IT services and software, and engineering services. The country has, however, considerable potential to expand the scale and scope of service delivery at the lower as well as the higher end of the value chain, although recent years' advancement in technology (automation etc.) has begun to have significant impact on the growth and structure of the IT-BPM services as well as prospects for developing ICT hardware and other industries.

The success in developing the BPM export sector can largely be attributed to access to a large pool of service-minded people with English language and other skills coupled with the limited scope for full employment in other sectors. The

development of industrial parks in Metro Manila and in other parts of the country have helped due to costing and productivity advantages and increased interest among multinational corporations in expanding the scale and scope of their offshoring and outsourcing operations to a wider range of countries. Much of the ICT-related industries are likely to continue to be located in the Greater Metro Manila area or in Cebu, but significant growth is also expected in the so-called “next wave” cities.

The government has generally been favourable to ICT development. This is reflected in planning documents and the significant expansion of special economic zones and industry parks. Nevertheless, financially and institutionally the scale and scope of the effort to support the ICT industry and more broadly speaking the digital economy transformation, and more recently Industry 4.0, has been moderate if compared to Malaysia, Thailand, Viet Nam and several other Asian countries.

The Philippines lags behind many other countries in improving its education system, investments in science and technology as well as diffusion of quality broadband services. Moreover, it faces general challenges in developing hard and soft infrastructure, the latter including weaknesses in the legal and regulatory system, governance and in educating and retaining technical and managerial talent. More than 10 million Filipinos have opted to work abroad. This includes a large number of unskilled, skilled and well-educated Filipinos working and living in the United States (including in Silicon Valley), Canada, Europe, the Middle East, Singapore, Hong Kong SAR, Thailand and elsewhere.

■ **Thailand.** The country’s economic progress since the 1960s is clearly manifest in major investments in infrastructure and education coupled with rapid development of tourism and the manufacturing industry, the latter illustrated by successful development of the eastern seaboard (the “Eastern Economic Corridor”) and other special economic zones or industry clusters. While Thailand has become a major centre for offshoring electronics, automobiles and other manufacturing, it has only achieved limited success in developing a major IT-BPM service industry, leaving aside recent years’ boom in terms of startups. Several factors impede the development of a competitive ICT services export industry, notably shortages of skilled and experienced technical, managerial, and entrepreneurial human resources and persons with strong English-language skills.

The government is increasingly committed to visions for a digital-economy related transformation. This is manifest in Thailand’s 12th Social and Economic Development Plan (2017-2021) and the ICT2020, the latter aiming at developing the country’s ICT industry so that it can be a leader in the Southeast Asia region

(Wongwuttiwat et al. 2018). The government's Third ICT Master Plan (2014 to 2018) focuses on four key strategies, namely: building optimal infrastructure, nurturing vibrant businesses, be a smart government and capitalising on ICT human resources. Also, ageing people are among the prioritised community to pay attention to; thus there is focus in the form of e-Ageing development (Research Gate 2018).

Moreover, a Digital Thailand Plan outlines strategies to expand the use of digital technologies in all socio-economic activities over a 20-year period. Other recent initiatives in support of this goal include the five-year Digital Government Development Plan, which is an operational plan to foster digital economy transformation. From 2016 onward the Thai government has promoted a vision for smart or Industry 4.0 related development in collaboration with Germany. Under "Thailand 4.0" there is perceived to be limited room for labour intensive manual processes in the future. The main areas of focus are, as per Thailand 4.0, in the food, agriculture, biotechnology, healthcare, biomedicine, smart devices, robotics, automation, digital industry, Internet of Things, better technology, culture and creative industries, as well as a high-value services sector (Jones et al. 2017).

While progressing in adopting modern technologies, the country faces major issues such as limitations in English language, technical and other capabilities, the need to respond to disruptive technology (automation in electronics, automobiles and other), and weaknesses in the investment climate and challenges in implementing stated policy objectives.

■ **Viet Nam.** As in the case of Thailand, Viet Nam has made major progress in developing infrastructure and has become a major centre for electronics and other manufacturing.

Viet Nam is the world's third largest producer of mobile handsets (2017) after China and India (ICA 2018). While the country has made major progress in IT-related development, including penetration of computers, smart phones and access to broadband and entrepreneurial developments (including a boom in terms of number of startups), rapid ICT-related development is constrained due to shortages of skilled and experienced technical, managerial, and entrepreneurial human resources and persons with strong English-language skills and multinational corporations' concerns about intellectual property rights and e-security. In addition, concerns about the overall quality of the regulatory and business environment have hampered development (WEF 2013).

The government has nonetheless declared plans to develop a sizeable ICT industry along with major investments in ICT infrastructure, training and education, and e-government. Viet Nam is expected to have a complete, stable 4G network in

2018 and aims to introduce 5G networks by 2020 (Oxford Business Group 2017). By 2020, the country's goal is to be well above the average ASEAN member (leaving aside the more advanced Singapore) in terms of ranking as an information society. It aims to change its socioeconomic structure so that it will have an advanced, networked, knowledge-based economy that will contribute significantly to successful industrialisation and modernisation. Achieving continuous growth and upgrading of the manufacturing industry does, however, entail major challenges including responding to the expanding scale and scope of additive technology (3D printing) and automation resulting from the fourth industrial revolution development currently sweeping advanced industrial economies. In 2017 Prime Minister Nguyen Xuan Phuc issued a directive to strengthen the country's ability to access the fourth industrial revolution (Cameron et al. 2018).

Though advancing rapidly in ICT industry and application developments the country faces major economic catch-up issues such as the need to upgrade technical and other capabilities and more broadly to respond to disruptive technology and challenges in implementing stated policy objectives.

■ **Indonesia.** Unlike several East and Southeast Asian countries, Indonesia has not been able to establish a large internationally competitive ICT hardware manufacturing (leaving aside some low end assembly), BPM and software service industry. Also economic growth has slowed down in recent years reflecting demographic development and feeble productivity performance (Felipe 2019). Nevertheless, there is a need to serve the sizeable local market for both ICT services and hardware. Major advancements in broadband connectivity in all parts of the country are critical for integrating and developing the domestic economy as well as its international interface.

The country's major scope of digital economy-related development is highlighted in the McKinsey report "Unlocking Indonesia's digital opportunity" published in 2016. According to this report, if Indonesia embraces digitisation, it can realise an estimated USD 150 billion in growth – 10 percent of GDP – by 2025. "Digital technologies offer ways to boost productivity across sectors and expand participation in the economy to all segments of the population. But accelerating Indonesia's digital progress will require businesses to step up to the challenge and fundamentally transform themselves. To win in a digital age, Indonesian businesses should pursue five strategic imperatives that will spearhead growth and efficiency: i) define customer-centric experiences to differentiate on design and agility; ii) develop omnichannel engagement to link the online and offline worlds; iii) leverage big data to drive real-time decisions across the value chain; iv) double down on cyber security

to protect information capital in a connected world and v) build digital capabilities to develop the organisation of the digital age." (McKinsey 2016b) Further, according to the report "The digital archipelago: How online commerce is driving Indonesia's economic development" released by McKinsey in 2018, the size of Indonesia's online commerce market (a sector comprising about USD 5 billion of formal e-tailing and more than USD 3 billion of informal commerce) is estimated to be about 30 million online shoppers in 2017 in a total population of about 260 million. Moreover the report points to the socio-economic impact of online commerce in Indonesia, today and five years from now, through an evaluation of financial benefits, job creation, buyer benefits, and social equality. It forecasts that online commerce sales will grow substantially, reaching up to USD 65 billion by 2022, out of which 30 percent will be consumption that otherwise would not have occurred. The report claims that in addition to increasing revenue, online commerce can unlock broader positive social impacts (McKinsey 2018b).

In 2015 the Indonesian government launched the "2020 Go Digital Vision" campaign to boost the country's digital economy. Among key targets are helping one million farmers and fishermen to go digital, and creating 1,000 local tech startups valued at a total of USD 10 billion by 2020. The campaign vision is that the country will become the largest digital economy in Southeast Asia by 2020, a vision which is not astounding given the size of its population and economy (McKinsey 2016b). Furthermore, the government has launched a multi-sector Industry 4.0 related development initiative.

While lagging behind Malaysia, Singapore, Thailand and Viet Nam in composite ICT development indexes (ITU 2017) and Internet readiness indexes (EIU 2018) the country has a fast-growing market for related ICT services. Internet traffic, revenue from cloud services, and connected devices (Internet of Things) are growing fast. The scale and scope of local ICT-empowered entrepreneurs is developing rapidly. This is illustrated by e-commerce major PT Tokopedia and unicorn firms such as Go-Jek, Tokopedia and Traveloka (all founded by indigenous entrepreneurs and subsequently also having major foreign shareholders as well) which have created jobs and often also provide better wages and benefits, such as health insurance and access to bank accounts, compared to more traditional jobs. However, while disruptive technologies are perceived as offering benefits, it is also said to pose risks such as loss of job opportunities in certain sectors and increase in inequality. These facts are reflected in the national e-commerce roadmap released in 2016 aimed at supporting the development of the local e-commerce ecosystem, to fund e-commerce startups, to protect consumers, and to double down on cyber security. The e-commerce roadmap has eight major components: funding, taxation, consumer

protection, education and human resources, communication infrastructure, logistics, cyber security and the implementing organisation. Also, the government has also started targeted measures and programmes to promote fintech and other technologies as part of its strategy to reduce poverty and inequality in urban as well as rural and remote areas.

Much ICT and other modern economy development is concentrated to few areas, that is, Java in particular, while other areas lag behind. With a large and heterogeneous population spread over a vast archipelago Indonesia faces major challenges in tackling income, education and other socio-economic disparities and developing hard and soft infrastructure, entrepreneurship and governance.

■ **Cambodia, Laos and Myanmar.** Other countries in the region, that is Cambodia, Lao PDR and Myanmar, have for the most part lagged behind other ASEAN members in ICT diffusion and industry development. Especially from the 2000s onward all of these countries have, nevertheless, experienced rapid use of ICT with mobile telephones being the prime example. Given the inadequate infrastructure, the poor education system and other socio-economic weaknesses, it is, however, apparent that these countries (as well as Timor Leste and Papua New Guinea) face major challenges in catching up in ICT-related development, which in turn implies major handicaps in responding to challenges in digital economic transformation and more broadly the fourth industrial revolution.

### **3. COMPARATIVE PERSPECTIVE LESSONS**

#### **Twelve key strategic imperatives**

In conclusion, digital transformation experiences from Southeast Asia illuminates varied sets of feasible development strategies and best practices. Added together, the lessons from country experiences point to the need for multidimensional understanding of digital economy and Industry 4.0 developments. Moreover, the record highlights the fact that there is little room for complacency in responding to numerous opportunities and challenges relating to technology and other forms of innovation.

The digital transformation strategic lessons from ASEAN (and other countries) need to cover all 12 pillars of digital and Industry 4.0 transformation as noted earlier (Mitra 2019a and 2019b).

## **A. Legacy, supply, demand, investment climate, factor markets and agglomeration**

- 1. Historical legacy, geography and timing.** The colonial past and different periods in the post-independence era including the political economy, cultural and geopolitical settings, matters significantly in terms of the opportunities and challenges in technology, industry and entrepreneurship development.
- 2. Swift response to change in demand and supply.** Timely and effective responses to new demand and competitiveness conditions are essential as illustrated by local IT-BPM industry growth opportunities in a wide range of vertical and horizontal market segments and local and international geographies. The investment climate needs to be perceived as sound and stable by both indigenous and foreign firms. Business models grounded in local and international competition as well as cooperation and partnerships are beneficial.
- 3. Human and social capital.** Early, continuous, and quality efforts in education and training must be a core and principal priority to all stakeholders concerned. Educating and training, and attracting and retaining of technical, managerial and entrepreneurial talent is key. It is essential to tackle issues related to mismatch and weak quality in terms of output and demand in education, training and labour market mobility and overall weaknesses in ICT awareness and digital literacy. There is little room for complacency in responding to overall changes in human resource needs and labour markets.
- 4. Financing.** Access to local and foreign capital and the existence of established financial institutions is essential. It is essential to tap into multiple effective avenues for financing, including angel investors and venture capital firms with capacity not only to provide finance but also advice and mentoring. While well-established entities typically have better access to funding it is acknowledged that long-term growth hinges on greater emphasis on R&D and financing smaller firms and startups.
- 5. Technology and innovation.** Adoption of technology developed in advanced industrial economies has been a fundamental driver of ICT industry and diffusion development. This is reflected in the role of foreign and indigenous firms, the government, the academe, diaspora, consulting firms and various other networks and their interfacing. Also, there has been a notable potential to adapt technology to local market conditions, e.g., software and content. The increasingly short life cycle of technologies and skills competency constitutes a major concern especially in areas where there is major international competition.

**6. Infrastructure.** New and more efficient telecommunication technology and the growth in computer and broadband as well as other infrastructure is a basic need. The government and subsequently also major private and public private partnership investments in infrastructure have been central to the development of industry, especially due to the fact that many areas lack basic physical and soft infrastructure. The track record in terms of ICT and other infrastructure initiatives available has thus been mixed, pointing both to major successes as well as failures. Continuous upgrading of ICT and other local, regional and international infrastructure is vital, e.g., high-quality and reliable electricity, telecommunications, Internet, airports and local transport systems.

**7. Agglomeration, urban and rural development.** Agglomeration or "clustering" of industry in major cities and sustaining development in major cities or industry centres is key. Coherent and consistent efforts are needed to develop industrial parks, economic zones and corridors through partnerships. Also, the international experience points to the fact that development of rural areas not only offers major markets for ICT products and services in the long term but also leads to sources of attracting talent and in some cases locations for the BPM industry. Furthermore, the "death of distance" can empower not only on international and domestic trade but also, souring and telecommuting within cities also more broadly peri-urban and rural areas. Past experiences and prospects for further development point to the need for coherent and effective efforts to tackle weaknesses in city planning, infrastructure, the environment and other requirements for the development of competitive and liveable cities and to promote the development of smart villages and cities.

## B. Institutions and role of key stakeholders

**8. Government policy and investment.** National and sub-national governments should take on multiple roles in education, e-government, telecom and other infrastructure, urban planning and other public sector development initiatives. In addition policymakers can play a special role as general facilitators of private sector development by providing a generally sound investment environment including appropriate legal and regulatory frameworks, and fiscal and other incentives. The government continues to have key roles not only in terms of procurement, research and leadership in promoting industry development and diffusion of technology, but also in minimising unwarranted implications of digital transformation. This applies to the fact that the digital revolution is associated with a wide range of disruptions in the overall socio-economic fabric; it creates new manifestations of cultural,

economic, political and social development empowerment opportunities as well as risks such as marginalisation, and digital divides or gaps; it results in a complex set of issues that can be a consequence of poor design and ill-managed dependency on technology and weaknesses in the overall public administration and governance ecosystem. More generally, government policies need to be coherent in serving both short- and long-term national and sub-national development goals while being stable and predictable and yet bold and flexible.

**9. Legal and regulatory ecosystems.** The digital and other innovative developments imply multiple challenges in creating or augmenting the legal and regulatory ecosystem so that it can respond to general as well as sector- and issue-specific local as well as international developments. This imposes needs for swift, effective and resilient responses to legal and regulatory and other policy challenges in terms of labour and migration, industrial development and competition, finance services and ecommerce, intellectual property, harmonisation of technical standards, cyber security, data protection including privacy, consumer protection, data ethics, conflict resolution, environmental and technology risk disasters adaptation and other unwarranted implications of ICT development. The digital transformation thus requires that the judiciary system is efficient and effective in enforcing existing and new laws and regulations and warrants a need for trust among key stakeholders.

**10. Multi-faceted large firms, micro, small and medium-sized enterprises and startups; the technology, business services and industry association ecosystems.** Indigenous firms and other institutions as well as foreign firms, consulting firms and other entities typically have key roles in the development of IT-BPM industries. Attracting foreign investment and developing strategic alliances or other forms of international collaboration are vital as is dynamic and multi-faceted entrepreneurship of large firms, MSMEs and ICT industry as well as other startups. A swift response to existing business opportunities is central. In addition, it is central to develop research and other capabilities to move up the value chain and responding to new path-breaking technology and business model development issues, or else businesses risk stagnating or failing to avail to opportunities to become major internationally competitive firms. Conventional forms of local and foreign investment, strategic alliances and partnerships coupled with the use of new technologies, business models, management skills and connections among local and international value chains, knowledge and other networks are all essential in the new networked economy development.

**11. Diaspora** can have an especially pivotal role as investors and in serving as mentors and inspiring role models.

**12. Leadership and collaboration.** Political, corporate and civil society leadership with a strong commitment to understanding and implementing what is doable in the short term as well as providing an early response to new technology and other societal transformational development challenges is central. Sound government, corporate, academic and civil society leadership and collaboration capabilities to respond to technological, market and other change requirements are key. It is imperative to fully acknowledge country and project track records in terms of quality of leadership and collaboration which has resulted in major successes as well as examples of poor performance.

All of the above illuminates the potential of collaboration and learning from different individual and collective experiences within countries and internationally.

Finally, it points to the need for continuous re-orientation of both corporate strategies and public policies coupled with a strong commitment to sound prioritisation of investments and effective implementation of programmes and projects.

**Raja Mikael Mitra** has served with the World Bank in Washington DC for twenty years. Recent assignments include, among others, work on high-tech industry, human talent and higher education, innovation and entrepreneurship, digital and knowledge economy transformation, infrastructure development, urbanisation and smart cities, in Asia and globally. He graduated from the University of Stockholm and Harvard University.

## References

- Arora, Ashishand and Alfonso Gambardella (eds). 2005. *From Underdogs to Tigers: The Rise and Growth of the Software Industry in Brazil, China, India, Ireland, and Israel*. New York. Oxford University Press.
- Asian Development Bank Institute (ADBI). 2014a. *ASEAN 2030: Towards a Borderless Economic Community*. Tokyo. ADBI.
- . *ASEAN, the PRC, and India: The Great Transformation?* Tokyo, ADBI.
- Asian Development Bank (ADB) and Asian Development Bank Institute (ADBI). 2012. Masahiro Kawai, Rajat Nag and Biswa N. Bhattacharyay (eds). *Infrastructure for Asian Connectivity*. Tokyo and Manila. ADB, ADBI and Edward Elgar.
- Association of Southeast Asian Nations (ASEAN). 2009. ASEAN Economic Community Blueprint. Jakarta. ASEAN Secretariat.
- . 2010 and 2017. "Master Plan on ASEAN Connectivity". Jakarta: ASEAN Secretariat.
- . 2013. "ASEAN Integration Monitoring Report". Jakarta and Washington DC. A Joint Report by the ASEAN Secretariat and the World Bank ASEAN Integration Monitoring Office. ASEAN and Office of the Chief Economist, East Asia and Pacific Region and the World Bank.
- AT Kearney. 2018. *Industrial Transformation Asia-Pacific Region*. AT Kearney.
- Bain & Company. 2017. *Advancing Towards ASEAN Digital Transformation: Empowering SMEs to Build ASEAN's Digital Future*.
- . 2018. *Digital Acceleration in Southeast Asia: Navigating Tectonic Shifts*.
- Baldwin, Richard. 2016. *The Great Convergence: Information Technology and the New Globalization*. London. Belknap Press of Harvard University Press.
- Beschorner Natasa and James Neumann. 2018. *Benefiting From The Digital Economy Cambodia Policy Note*. Washington DC. World Bank.
- Boon Tan Tech and Wu Shang-Su. 2017. *Public Policy Implications of the Fourth Industrial Revolution for Singapore*. Singapore. RIIS, Nanyang Technical University.
- Boston Consulting Group (BCG). 2018a. The report titled *The Internet's New Billion: Digital Consumers in Brazil, Russia, India, China, and Indonesia*.
- Breznitz, Dan. 2006. *Innovation and the State—Development Strategies for High Technology Industries in a World of Fragmented Production: Israel, Ireland, and Taiwan [Taipei, China]*. Published by Oxford University Press on behalf of the Business History Conference.
- Brynjolfsson, Erik and Andrew McAfee. 2017. "The Business of Artificial Intelligence: What it Can—and Cannot—Do for Your Organization." Harvard Business Review, July 2017.

- Brynjolfsson, Erik and Tom Mitchell. 2017. "What Can Machine Learning Do? Workforce Implications." *Science* 358(6370): 1530-1534.
- Cameron A., Pham T., and Atherton J. 2018. *Vietnam Today—first report of the Vietnam's Future Digital Economy Project*. Brisbane. Australia. Commonwealth Scientific and Industrial Research Organization.
- Carmel, Erran. 2003. "Taxonomy of New Software Exporting Nations". *Electronic Journal on Information Systems in Developing Countries*. 13(2).
- Castells, Manuel. 2000. *The Rise of Network Society*. Oxford: Blackwell.
- Felipe Jesus. 2019. *Policies to Support the Development of Indonesia's Manufacturing Sector During 2020-2024*. Manila. Asian Development Bank.
- Government of Singapore. 2017a. <https://www.gov.sg/microsites/future-economy/thecfe-report/7-strategies>.
- . 2018a. <https://www.smartnation.sg/about/Smart-Nation#sthash.LsvEf1oW.dpuf>.
- Hallward-Driemeier, Mary and Gaurav Nayyar. 2018. *Trouble in the Making? The Future of Manufacturing-Led Developments*. Washington DC. The World Bank.
- Hew, D. (ed). 2007. *Brick by Brick: The Building of an ASEAN Economic Community*. Singapore. Institute of Southeast Asian Studies.
- Infocom Media Development Authority (IMDA). 2019. Singapore. <https://www.imda.gov.sg/sgdigital/tech-roadmap> Accessed January 21, 2019.
- International Telecommunication Union (ITU). 2018. *Measuring the Information Society 2018* (and earlier issues). Geneva. ITU.
- Mazzucato, M. 2013. *The Entrepreneurial State: Debunking Public vs Private Sector Myths*. London. Anthem Press.
- McKinsey Global Institute. 2014. "Southeast Asia at the Crossroads: Three Paths to Prosperity". McKinsey Global Institute.
- McKinsey. 2016a. *Indonesia in the Digital Age – an Anthology of Digital Perspective*. McKinsey & Co.
- . 2016b. *Unlocking Indonesia's Digital Opportunity*. McKinsey & Co.
- . 2018a. *Industry 4.0: Reinvigorating ASEAN Manufacturing For the Future*. McKinsey & Co.
- . 2018b. *The Digital Archipelago: How Online Commerce is Driving Indonesia; Economic Development*. McKinsey & Co.
- Mitra, Raja M. 2009. "IT Industry in Transformation: Opportunities and Challenges for India". *Asia Research Centre Working Paper* 29. London: London School of Economics.

- . 2013a. *The Information Technology and Business Process Outsourcing Industry: Diversity and Challenges in Developing Asia*. Chapter 3 in "Developing the Service Sector as an Engine of Growth for Asia". Manila and Washington DC. Asian Development Bank and the Peterson Institute of International Economics.
- . 2018. *Digital Economy and Industry 4.0 Transformation: Opportunities and Challenges for Asia*. Research submitted to State University of Michigan, London School of Economics, Singapore Management University and others.
- . 2019a. *Digital and Knowledge Economy Transformation: Disruptive Opportunities and Challenges for Asia and its Partners* (Forthcoming).
- . 2019b. *Leveraging Digital and Knowledge Economy Transformation: Opportunities and Challenges for India and its Partners* (Forthcoming).
- Organisation for Economic Co-operation and Development (OECD). 2018. *Economic Outlook for Southeast Asia, China and India: Fostering Growth through Digitalisation*. Paris. OECD Development Centre.
- Oxford Business Group. 2017. *The Report: Vietnam 2017*.UK. Oxford Business Group.
- Preen, Mark. 2018. "China's Mega City Clusters: Jing-Jin-Ji, Yangzte River Delta, Pearl River Delta". Hong Kong. China Briefing. Dezan Shira & Associates, Hong Kong.
- Research Gate. 2018. [https://www.researchgate.net/publication/270762593\\_Thailand\\_NewICT\\_Master\\_Plan\\_to\\_PromoteICT\\_Innovations\\_and\\_Services\\_for\\_e-Ageing](https://www.researchgate.net/publication/270762593_Thailand_NewICT_Master_Plan_to_PromoteICT_Innovations_and_Services_for_e-Ageing).
- Santoso, S. 2017. *How can ASEAN nations unlock the benefits of the Fourth Industrial Revolution?* Davos. World Economic Forum.
- Saxenian, A. L. 2005. *From Brain Drain to Brain Circulation: Transnational Communities and Regional Upgrading in India and China. Studies in Comparative International Development*, June 2005, Volume 40, Issue 2, pp 35-61.
- Schumpeter, Joseph. 1942. *Capitalism, Socialism and Democracy*. New York. Taylor & Francis Group.
- Schwab, Klaus. 2016. *The Fourth Industrial Revolution: what it means, how to respond*. Davos: World Economic Forum.
- . 2018. *Shaping the Fourth Industrial Revolution*. Geneva. World Economic Forum.
- Severino, R. 2006. *Southeast Asia in Search of an ASEAN Community*. Singapore. Institute of Southeast Asian Studies.
- United Nations Conference for Trade and Development (UNCTAD). 2012 and onwards. *Information Economy Report*. <http://unctad.org/en/Pages/Publications>.
- Wongwuttiwat Jittima and Adtha Lawana. 2018. *The Digital Thailand Strategy and the ASEAN Community*", The Electronic Journal of Information Systems in Developing Countries.
- World Bank. 2016. *Digital Dividends. World Development Report*. Washington DC.

- . 2018a. *World Development Report*. World Bank. Washington DC.
- . 2018b. *Ease of Doing Business Reports*. Washington DC.
- . 2018c. *Information and Communications for Development: Data-Driven Development*. Washington, DC.
- . 2018d. *Malaysia's Digital Economy: A New Driver of Development*. Kuala Lumpur.
- . 2018e. *Preparing ICT Skills for Digital Economy: Indonesia within the ASEAN context*. Jakarta.
- . 2019. *World Development Indicators Online Database*. Washington DC.
- World Economic Forum (WEF). Geneva. 2018a. *The Global Information Technology Report 2018* (and earlier issues).
- . 2018b. *The Global Competitiveness Report 2018* (and earlier issues).
- . 2018c. *Readiness for the Future of Production*.