Chapter 2

Reallocating resources for digitalisation in response to COVID-19: Health, education and Industry 4.0

The COVID-19 pandemic spurred rapid digitalisation worldwide, especially in the delivery of health and education services. This chapter explores the digitalisation of the health and education sectors in Emerging Asia. Country-level responses are examined, as are the challenges countries still face in this process, which will likely not be met for some time. Such challenges include poor infrastructure and affordability of access to digital services, which can exacerbate existing inequalities, or skill deficiencies in medical and educational staff that prevent the full potential of these technologies from being realised. The chapter explores possible solutions to these challenges, including the positive contribution of TVET to lifelong learning. The chapter also stresses the need for regional co-operation on cybersecurity and data privacy regulations to foster trust in digital systems. Finally, the chapter reviews each country’s state of play regarding Industry 4.0 and provides policy recommendations for completing the implementation process.
Introduction

Digitalisation is transforming the world economy into a more integrated, complex and dynamic system. This presents both challenges and opportunities. During the COVID-19 crisis, digitalisation has proved critical for ensuring the continuity of essential services. The use of e-commerce, telemedicine and online education all accelerated sharply during the pandemic in Emerging Asia – the ASEAN-10, China and India.

Digitalisation of health and education requires the most urgent attention in the region. With a surge in demand for health care and a shortage of physicians in Southeast Asian countries, the digital health revolution has provided innovative solutions during the pandemic, but incorporating digital tools into health care systems requires a radical shift from the traditional clinical approach. Health care workers also need to be retrained to strengthen their digital skills. Likewise, the use of online education has allowed teaching and learning to continue despite restrictions on movement, but digital education requires efforts to ensure that students continually receive quality instruction that does not jeopardise their well-being and career prospects. Lifelong learning programmes and technical and vocational education and training (TVET) can contribute to strengthening digital skills, but these initiatives also face similar challenges.

The pandemic has also accelerated the digital transformation of firms, which are adopting new technologies to survive during this difficult period. Insights from countries in the region show how the adoption of Industry 4.0 solutions can increase agility and flexibility, boosting business resilience amid restrictions on movement. However, Industry 4.0 – the automation of industrial practices – is inhibited by country-specific challenges in the region given differences in economic structure and Industry 4.0 readiness.

This chapter begins with a discussion on digital transformation in the health and education sectors, particularly in the context of the COVID-19 crisis. It concludes with a review of the impact of the pandemic on the progress of Industry 4.0 in the region.

Digital health tools are helping the response to the pandemic

Technology continues to play a major role in providing innovative solutions to the health care industry. Even before COVID-19, digital health was an emerging policy priority, and the pandemic has intensified its importance. With a surge in demand for health care and a shortage of physicians in Emerging Asian countries, innovative digital health solutions reduce hospital attendance, enable rapid delivery of diagnoses and treatments, and provide equality of access to health care. According to the World Bank, in six out of ten ASEAN countries, more than 50% of the population live in rural areas with limited access to health facilities, doctors and health care workers (Word Bank, 2018). Digital health allows patients with only mild symptoms or who live in remote areas to avoid travel to hospitals, such that, for instance, emergency rooms and hospital beds can be reserved for more urgent patients. Beyond its convenience, digital health also reduces the risk of spread of the virus in hospitals.

Digital health tools have helped health care professionals to increase productivity and optimise resource management during the pandemic, and the digital health services have turned out to be more robust and safer for the people using them, as they minimise physical contact (Fagherazzi et al., 2020). These services also reduce costs through improvements such as patient self-management and digital health records. In Australia, medication misadventure costs AUD 1.2 billion (Australian dollars) each year and digital health records were able to reduce duplicate pathology tests by 18% per week (Biggs et al., 2019).

Digital health tools could also reshape the distribution of health workers in rural and urban areas. Health workers' preference to work in an urban environment and a lack of training opportunities in rural regions are two well-documented reasons for imbalances in the distribution of the health care workforce. Among efforts to reduce inequality of
access to health workers, digital health has been increasingly explored as a mechanism to improve conditions in underserved regions (WHO, 2010). Through telehealth platforms, doctors can collaborate with their colleagues regardless of their physical location.

Furthermore, digital health helps to increase productivity by gathering large amounts of data on patients to build personal health profiles and even predict their probability of acquiring certain diseases and the evolution of existing conditions. It can therefore be argued that digital health could foster a shift from treatment to prevention. Indeed, health professionals can use this vast knowledge base to offer preventive care, increase the precision of diagnoses and design targeted treatment. The saved time and reduced cost allow health professionals to divert focus to more urgent issues.

Digital health solutions protect patients and improve access to health care

The COVID-19 pandemic has caused shortages of both human and physical capital in health care. At the same time, strict quarantines and physical distancing measures have made it difficult for patients to access health facilities. Long waits for diagnosis and treatment and limited availability of hospital beds pose health risks, while public transportation and onsite appointments increase the risk of exposure to the virus. Measures aimed at enhancing digital health solutions have helped to address these challenges. In Australia, for example, health professionals were encouraged to shift to a digital workspace to protect patients and health care providers from the risk of exposure to the virus. Digital tools facilitated this arrangement, which has proven to be both popular and efficient (Box 2.1).

Box 2.1. Adapting to telemedicine: The case of Australia

Digital health tools can help people with minor medical needs to avoid medical facilities and preserve resources for more severely ill patients. Australia granted access to telehealth services to all Australians with a Medicare card to help reduce the risk of community transmission of COVID-19 and to protect patients and health care providers. The year-long initiative commenced on 13 March 2020 under the government’s Medicare Benefits Schedule (Australian Department of Health, 2020). As a result of this measure, face-to-face visits to general practitioners (GPs) decreased by more than two million from March to April 2020, with more than four million telehealth GP consultations conducted in April. Some access to telehealth services should be maintained after the pandemic, especially as a means of maintaining health care access for otherwise underserved communities. (Figure 2.1).

Figure 2.1. Number of requested Medicare items processed for GP attendances in Australia

Source: Australian Department of Health and Australia Medicare Benefit Schedule. https://doi.org/10.1787/888934229331
Rural communities are heavily disadvantaged by limited medical resources despite having a greater need for health care and services. In many Asian countries, younger people often choose to work in metropolitan areas, leading to a higher proportion of older people with chronic conditions in rural regions.

Reducing pressure on intensive care units (ICUs) has been a primary public health concern during the pandemic. To improve timely health care access in rural and remote areas and bridge the demand-supply gap, remotely monitored intensive care units (electronic ICUs, or eICUs) were established in several countries even before the pandemic. An example of an eICU is a seven-bed critical care unit in Dehradun, India that is remotely controlled from a command centre in New Delhi. The eICU facility delivered tangible benefits in terms of reducing mortality: the 30-day mortality rate of 16.4% among 134 patients with cardiovascular diseases in the pre-eICU period was reduced to 4.8% among 145 patients admitted during the eICU phase (Gupta et al., 2014). In Thailand, the state-owned Nopparat Rajathanee Hospital has partnered with a communication conglomerate holding the country’s largest Internet provider, and the country’s largest mobile operator. Together, they aim to offer 5G-powered medical services through the initiative “ER new normal”. This service will use a range of aids, such as MedTech ambulance equipment that will facilitate communication with doctors, so that incoming patients can be more effectively treated. Temi Connect and CareBot will also be launched in order to facilitate remote physician consultation and to smooth the delivery of medical treatment and documents (OpenGovAsia, 2020).

During the COVID-19 pandemic, artificial intelligence (AI) has also been used in some OECD countries to carry out specific tasks, such as pre-hospital triage for COVID-19. The Boston-based hospital Mass General Brigham (formerly Partners HealthCare) implemented an automated pre-hospital triage solution to direct patients with mild symptoms of COVID-19 to the appropriate care setting instead of the emergency department (Lai et al., 2020). Duke University in North Carolina has developed Innovations in Healthcare which aims to highlight and promote promising innovations from diverse global organisations, including corporations and foundations committed to strengthening and increasing the scale of health care innovations (IHC, 2020).

From a patient perspective, digital health platforms can support the entire cycle from pre-treatment diagnosis to post-care management. Digital platforms allow patients to book appointments online, go through a faster triage process and receive electronic prescriptions. This mode of service can improve patients’ experiences by providing convenient and easily accessible care, just like online shopping and online banking. It also reduces direct contacts between health workers and patients, thus decreasing the risk of hospital contagion and preserving personal protective equipment (PPE) for health workers. A market study of the European Economic Area (EEA) countries (i.e. EU 27, the United Kingdom, Iceland, Norway and Liechtenstein) conducted by the European Commission found there are societal and economic benefits to reap from telemedicine. With an average patient consultation taking approximately 14 minutes among the investigated countries, it usually costs the patient one third to one half of a day in productivity to undergo the consultation from start to finish, including travel and waiting. This in turn results in economic activity losses for society. With telemedicine solutions, these economic activity losses can be reduced down to only 30 minutes’ worth, which would alleviate a large burden on societies (European Commission, 2018).

Many digital health apps have integrated a special channel to educate the public on COVID-19 symptoms and precautionary measures. In care for COVID-19 patients, digital health tools could, for instance:

- monitor health conditions, provide consultation to quarantined patients and provide follow-up mental health support if needed;
- detect and track confirmed and suspected cases for building epidemiological models to guide policy interventions;
- analyse big data from COVID-19 cases to speed the development of effective treatments.
Most importantly, digital health can help to overcome care disparities in rural areas with inadequate health care resources, and thus potentially contribute to achieving universal health coverage (Box 2.2). No longer constrained by geographical inaccessibility and a limited choice of hospitals and doctors, patients can acquire professional advice through videoconferencing.

Box 2.2. Universal health coverage in Emerging Asia

Most ASEAN countries have implemented some sort of universal health coverage (UHC) initiative, but with varied degrees of success (Figure 2.2). According to the World Health Organization (WHO), achieving UHC includes financial risk protection in terms of health care; access to quality essential health care services; and access to safe, effective, quality and affordable essential medicines and vaccines for all citizens (WHO, 2020b). Joint measures have been initiated in the region to achieve UHC. In August 2019, health ministers from all ASEAN countries met and reiterated their commitments to attain the UHC goal by 2030 (ASEAN, 2020). The ability of health care systems to cope with the pandemic and the progress in implementing UHC varies by country.

Figure 2.2. UHC service coverage index, 2017

Among ASEAN countries, Viet Nam has one of the best track records in terms of health coverage and has also taken effective action in tackling and curbing the spread of the virus. The country launched its first national social health scheme in 1992. Between 2000 and 2017, the proportion of covered citizens rose from 13% to 87% (WHO, 2020b). Thailand is another country that can boast a well-developed social health care system. The country launched a UHC policy in 2002, which currently covers 75% of the population. The system is funded by general taxes and is administered by the National Health Security Office (NHSO). Still today, the country adheres well to the UHC standards and according to WHO, the proportion of health costs requiring out-of-pocket expenditure has declined from 34% in 2001 to 11% in 2017 (ADB, 2020b). In Lao PDR, the government is working towards reaching the UHC goal by 2025 through a gradual extension of its current National Health Insurance (NHI) scheme. However, the country is battling widespread social protection gaps which leave many households particularly vulnerable to the impacts of health issues and accidents (ILO, 2020b).
Countries in Emerging Asia increase use of digital tools as part of their pandemic responses

Emerging Asian countries quickly recognised the benefits of introducing digital health tools to improve access to health care during the COVID-19 pandemic. Governments across the region have endorsed initiatives to develop telemedicine services, such as the promotion of telemedicine providers and the development of self-assessment tools to lighten the burden on hospitals and clinics. Health care facilities have benefited from digital platforms that provide a more thorough patient classification system, allowing medical practitioners to prioritise patients who are most in need of direct attention.

Although digital health tools have been used for a while in some countries, their wide adoption did not start until the pandemic began. For instance, in China, the booming telehealth market connects doctors and patients effectively and offers a unique method for patient screening, triage and treatment. Ping An Good Doctor offers hospital referrals, doctor appointments and online consultations. As of June 2020, there were 346 million registered users, and the number of monthly active users reached 16 million. Other popular platforms include haodf, WeiMai, WeDoctor, Chunyu Doctor, Dingxiang Doctor and Careate Medical.

Telehealth is also transforming the way people interact with health care workers in Indonesia, Singapore and Malaysia. The Indonesian government has directed its citizens to telehealth firms, such as Alodokter, Halodoc and KlikDokter, for a wide array of services including verified medical guidance and prescriptions. Alodokter reports that it has approximately 27 million monthly users. Singapore’s telemedicine start-up Doctor Anywhere is a well-established player in the market and has expanded to Viet Nam, Thailand and Malaysia. In addition to standard telehealth services, Doctor Anywhere launched an online mental health consultation service in October 2020. Malaysia’s first and largest digital health care platform, DoctorOnCall, partnered with the Ministry of Health to develop a customised channel to address public concerns about COVID-19.

These digital health initiatives are progressively evolving as technology improves in the wake of the pandemic. Indeed, the use of digital health tools in the region is booming (Figure 2.3).

**Figure 2.3. Daily active users of telemedicine platforms in Indonesia and Singapore**

March 2020 percentage increase versus 2019 average

<table>
<thead>
<tr>
<th>Platform</th>
<th>Percentage Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halodoc</td>
<td>101</td>
</tr>
<tr>
<td>Alodokter</td>
<td>39</td>
</tr>
<tr>
<td>Doctor Anywhere</td>
<td>156</td>
</tr>
<tr>
<td>Singapore</td>
<td>147</td>
</tr>
<tr>
<td>MyDoc</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: Kapur and Boulton (2020).
Digital health tools provide remarkable ways to overcome barriers to care, especially in archipelagic countries such as Indonesia, the Philippines and Malaysia. In all these countries, plus Thailand, the rise of interest in telehealth followed the rise of cumulative confirmed cases of COVID-19 (Figure 2.4). The COVID-19 pandemic has also brought a rise in online pharmacies. In India, the popularity of e-pharmacies has soar during the pandemic (FICCI, 2020), as residents stockpiled medicines for emergencies in response to lockdowns.

![Figure 2.4. Interest in telehealth and cumulative confirmed cases of COVID-19 in selected ASEAN economies, February-November 2020](image)

Source: OECD Development Centre based on data from Johns Hopkins University and Google Trends (accessed on 8 December 2020).

What follows is a review of digital health initiatives taken by various countries to combat the pandemic, while Table 2.1 summarises some of the key initiatives undertaken in Emerging Asian countries to enhance the telemedicine sector, with a focus on government-led initiatives.
In Indonesia, the pandemic has triggered an increase in telemedicine usage over a wide array of pre-existing platforms and companies. (UNDP, 2020a). In April 2020, the Indonesian Medical Council issued KKI Regulation 74 on the use of medical treatment through telemedicine during the crisis, while the Ministry of Communication and Information Technology published a COVID-19 tracing application, Peduli Lindungi, which warns users in real time when they enter into contact with a patient under surveillance or observation. The Ministry of Health also partnered with the ride-hailing firm Gojek and the telemedicine provider Halodoc for the provision of quick COVID-19 diagnostics in rural areas (see Table 2.1).

In Malaysia, the government launched an “e-COVID19” strategy through co-operation between the Ministry of Health, the National Security Council and the Communications and Multimedia Commission. The e-COVID19 application was created to ensure that data are reliable and accurate, and to improve reporting and resource allocation (MAMPU, 2020a). In February 2020, the Ministry of Health (MOH) and the telemedicine platform DoctorOnCall have established a Virtual Health Advisory portal to provide free public access to consultations with MOH family medicine specialists or medical officers and address any uncertainties regarding COVID-19 (DoctorOnCall, 2020). The government also published the MySejahtera self-assessment application and a contact-tracing application, MyTrace Malaysia, which uses Bluetooth technology to inform users when they have been in contact with an infected person (MAMPU, 2020b, 2020c). Further efforts may be needed to ensure willingness to use the tools (Box 2.3).

**Box 2.3. Attitudes towards digital health in Malaysia**

Malaysia is one of the most technology savvy countries in ASEAN, and is therefore expected to benefit from m-health services. The country’s Internet and broadband penetration rates over 100% signal that many Malaysians have more than one way of accessing the Internet. It also lays a good foundation for the country to reap the benefits of a well-developed digital health care structure. Digitalisation also continues to be a top priority for the Malaysian Government. In the recently announced Federal 2021 Budget, a total of USD 242.5 million is to be distributed among Cybersecurity, Connectivity, Internet of Things, Digital talents, and Digital Transformation of Malaysian SMEs (International Trade Administration, 2020). Even before the COVID-19 pandemic, the country had also established the National Fibreisation and Connectivity Plan (NFPC) with the aim to “put in place robust, pervasive, high quality and affordable digital connectivity throughout the country” (Malaysian Communications and Multimedia Commission, n.d).

The success and implementation of any m-health programme depends upon the acceptance of users and health care professionals. A survey conducted before the COVID-19 pandemic showed that 62.7% of respondents disagreed or strongly disagreed with the idea of using mobile devices to manage their health, and that 37.6% of respondents felt uncomfortable with the idea of health care professionals monitoring their health using mobile health devices (Figure 2.5). In addition, the MAera platform (Malaysian Alliance for Embedding Rapid Reviews in Health Systems Decision Making) has been developed in order to promote the utilisation of rapid review outcomes in health system decision making. The goal of the platform is to document policy responses of the Ministry of Health (MOH) and how the government generally handles the COVID-19 pandemic. This is done by keeping an up-to-date record of the government’s actions and in order to promote transparency (Maera, 2018).
Box 2.3. Attitudes towards digital health in Malaysia (cont.)

Figure 2.5. Malaysian residents are wary of digital health tools

A. Agree to use mobile health devices/m-health for managing their health

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.5%</td>
<td>14.9%</td>
<td>17%</td>
<td>17.7%</td>
<td>45%</td>
<td>13.1%</td>
</tr>
</tbody>
</table>

B. Comfortable with health care professionals to monitor my health using mobile health device

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.2%</td>
<td>13.1%</td>
<td>9.2%</td>
<td>26.9%</td>
<td>37.6%</td>
<td>13.2%</td>
</tr>
</tbody>
</table>

Note: Survey based on a total of 4,504 respondents who were randomly sampled in public areas, parks, government hospitals, primary care clinics and public and private universities in the Klang and Petaling district in the state of Selangor from November 2015 to January 2017.


StatLink © https://doi.org/10.1787/888934229369

In a survey conducted in the Malaysian state of Selangor, digital health care was more accepted among younger individuals, aged 39 and below. People with higher education and who owned two or more mobile devices were also more inclined to adopt and use m-health and health associated applications in their daily lives. Among the most common applications used were the medication reminder, tele monitoring and the teleconsulting services. Despite the more accepting attitude towards m-health and mobile health services among millennials and younger generations, the results still indicated that only half of the millennials were willing to use digital health services. Since this generation is younger and healthier than baby boomers, it could help explain the rather slow adoption of m-health services among Malaysians. For the baby boomer generation, the low tendency to use m-health was more expected as respondents considered digital health tools to be unable to improve their health compared to traditional methods.

Among respondents, there was a general tendency to consider lack of ICT skills as an obstacle to use digital health tools. Many respondents reported that they would be more inclined to use a mobile health device if education was provided, or if the health device was easy to using. Almost half of the respondents answered they were comfortable to share their health information with their health care professional or family members. In general, respondents were somewhat optimistic about mobile technology, such as receiving doctor’s instructions and consultations. However, concerns were raised among participants regarding the accuracy of the data as well as data privacy.

The Philippines was promoting the use of digital health tools long before the current crisis, and the pandemic led to increased government efforts to further digitalise health care and government services. As early as 2014, the Department of Health (DOH) instituted an eHealth Strategic Framework and Plan (DOH, 2014). When the number of COVID-19 cases soared, the DOH asked telehealth companies and providers to give free primary case teleconsultation (DOH, 2020). Furthermore, the government released an open-data COVID-19 tracker, and certain telecommunication service providers began giving free access to official websites with information about the pandemic. The DOH also published COVIDKAYA, an app to collect data and provide information about the virus that was developed by the World Health Organization in co-ordination with the Department of Information and Communications Technology (PIA, 2020a). The DOH also partnered with Quezon City to deploy the country’s first end-to-end telemedicine project. In October 2020, the DOH announced a partnership with Smart Clinic to provide telemedicine consultation in the COVID-19 response (PIA, 2020b).

The Ministry of Public Health in Thailand announced its first “eHealth Strategy” in 2017 under the country’s 4.0 policies (MPH, 2017). Since then the government has launched multiple eHealth applications, such as H4U, Smart Health ID and Primary Care Cluster App. Moreover, the Ministry of Public Health has partnered with the Thailand Tech Startup Association and private telemedicine providers, such as Doctor Raksa to make telehealth services available to the general public and health care professionals during the COVID-19 pandemic (TCDC, 2020). As regards the implementation of track-and-trace systems, the tracing app, Thai Chana, uses QR codes that the user must scan when entering public places. Its usage is widely promoted and people entering the country may be forced to download it. Thailand also developed a “new normal” medical services model to help health care facilities and personnel strengthen their response to COVID-19.

Viet Nam is in a good position to adapt to digital health platforms. While the latest National Health Programme is general in its nature and does not include digital health tools, the government has taken notable steps to build necessary digital infrastructure in the past couple of years. The main costs and challenges are attributed to the process of digitalising hospital systems and digitising patient records (Austrade, 2019). To combat the pandemic, the Ministry of Information and Communications and the Steering Committee for COVID-19 Prevention and Control published an app, NCOVI, which allows citizens to update their daily health status and receive government health updates (MIC, 2020). Furthermore, the Ministry of Health (MOH) in co-ordination with the Ministry of Information and Communications (MIC) launched a telehealth programme. The programme has been developed by Viettel Group, Viet Nam’s largest telecommunications service company, and it provides remote health care services by connecting patients and doctors through a virtual platform, called Viettel Telehealth (Viettel, 2020).
2. REALLOCATING RESOURCES FOR DIGITALISATION IN RESPONSE TO COVID-19: HEALTH, EDUCATION AND INDUSTRY 4.0

Table 2.1. Examples of government-led initiatives in Emerging Asia to develop digital health tools during COVID-19

<table>
<thead>
<tr>
<th>Country</th>
<th>Endorsement of private initiatives/partnerships with private telemedicine providers</th>
<th>Development of COVID-19 self-assessment tools/track-and-trace systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>The Ministry of Health partnered with the ride-hailing firm Gojek and the telemedicine provider Halodoc for the provision of quick COVID-19 diagnostics in rural areas.</td>
<td>The Ministry of Communication and Information Technology published Peduli Lindungi, a COVID-19 tracking application that warns users in real time when they enter into contact with a patient under surveillance or observation.</td>
</tr>
<tr>
<td>Malaysia</td>
<td>In February 2020, the Ministry of Health (MOH) and the telemedicine platform DoctorOnCall have established a Virtual Health Advisory portal to provide free public access to consultations with MOH family medicine specialists or medical officers and address any uncertainties regarding COVID-19.</td>
<td>The government published the MySejahtera self-assessment application and a contact-tracing application, MyTrace Malaysia, which uses Bluetooth technology to inform users when they have been in contact with an infected person. MySejahtera also provides users with a Virtual Health Advisory, which contains links to the telemedicine platform DoctorOnCall.</td>
</tr>
<tr>
<td>Philippines</td>
<td>In October 2020, the Department of Health (DOH) announced a partnership with Smart Clinic to provide telemedicine consultation in the COVID-19 response.</td>
<td>The government released an open-data COVID-19 tracker, and certain telecommunication service providers began giving free access to official websites with information about the pandemic. The DOH also published COVIDKAYA, an app to collect data and provide information about COVID-19.</td>
</tr>
<tr>
<td>Thailand</td>
<td>The Ministry of Public Health has partnered with the Thailand Tech Startup Association and private telemedicine providers, such as Doctor Raksa to make telehealth services available to the general public and health care professionals during the COVID-19 pandemic.</td>
<td>The Medical Council developed a tracing app, Thai Chana, which uses QR codes that the user must scan when entering public places. Its usage is widely promoted and may also be mandatory for people entering the country.</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>The government collaborated with Viettel Group, the largest telecommunications service company in Viet Nam, to develop the Viettel Telehealth platform. The platform enables remote medical consultation, surgery consultation, training and technology transfer.</td>
<td>The Ministry of Information and Communications and the Steering Committee for COVID-19 Prevention and Control published an app, NCOVI that allows citizens to update their daily health status and receive government health updates.</td>
</tr>
<tr>
<td>Singapore</td>
<td>The Infocomm Media Development Authority (IMDA) and Enterprise Singapore (ESG) expanded a range of pre-approved digital solutions to help health care SMEs deal with the COVID-19 pandemic by providing virtual health consultations to serve the rise in demand. These solutions include significant subsidies and grants.</td>
<td>The government of Singapore launched an app called TraceTogether, which uses Bluetooth signals to alert people who have been near a person known to be infected with COVID-19. Stay-home notices (SHN) in Singapore are enforced using phones. People who were issued an SHN receive text messages several times during a day and are then required to update their location within an hour through their phone’s GPS location.</td>
</tr>
<tr>
<td>China</td>
<td>According to a study conducted by the National Centre for Biotechnology Information (NCBI), 29.2% of Internet hospitals were initiated by the government, while 70.8% were initiated by the private sector.</td>
<td>China is using a national QR code developed by technology firms Alibaba and Tencent to quickly collect data on a person’s movements and generate decisions on whether the respective individual should be quarantined. The QR code can be scanned at entries to various places, with entry being granted only if the code is green.</td>
</tr>
<tr>
<td>India</td>
<td>N/A</td>
<td>The Ministry of Electronics and Information Technology launched the Aarogya Setu tracing app, which uses Bluetooth technology for contact tracing, mapping of likely hotspots and dissemination of relevant information about COVID-19.</td>
</tr>
</tbody>
</table>

Source: OECD Development Centre based on various national sources.

**Singapore** is experiencing rapid growth in start-up companies developing digital health tools. In January 2020, the Ministry of Health (MOH) announced that the telemedicine sector would officially be licensed before the end of 2022. The Infocomm Media Development Authority (IMDA) and Enterprise Singapore (ESG) expanded a range of pre-approved digital solutions to help health care SMEs deal with the COVID-19 pandemic by providing virtual health consultations to serve increased demand. These solutions include significant subsidies and grants. It is widely believed in Singapore that the push to improve digital health capabilities will continue in the wake of the pandemic, with more benefits to come in the future (IMDA, 2020).

In **Myanmar**, the private sector has taken substantial steps to promote digital health tools to help the population. In January 2020, a partnership between Prudential Corporation Asia and MyanCare, a telemedicine company, sought to improve health care access by initially allowing 5,000 families to set up appointments and consult general
practitioners listed on the MyanCare app, with fees covered by Prudential (Mobile Health News, 2020). Prudential Myanmar intends to expand this project by including more families. More digital health initiatives could help boost the inadequate supply of health care throughout the country and ease financial and other barriers to medical care. The COVID-19 pandemic highlighted the need for greater access to health care, and more initiatives from the private sector are likely to be unveiled as a result.

In May 2020, China encouraged provincial governments to establish their own online regulatory platforms to oversee and regulate individual online medical providers and to accelerate the market access of Internet-based hospitals (Han et al., 2020). China also strengthened an information service system which aims to aid county-level hospitals that are located in high-poverty areas to provide telemedicine services. China increased fibre optic coverage in the country’s rural poor areas from less than 70% in 2016 to 98% in November 2020 (China SCIO, 2020). In addition to government-led initiatives, the private sector has developed many telemedicine offerings. While 29.2% of Internet hospitals were initiated by the government, 70.8% were initiated by the private sector (Han et al., 2020). Although the initiatives come from two different sources, the dominant platform entails an integration of the private sector-led hospital initiatives into the public health system (Han et al., 2020). E-health innovations are often developed and tested first by private sector health care providers before implementing them wider to more financially constrained public hospitals and health care centres (JASEHN, 2018).

India launched a National Digital Health Mission in August, the country’s National Health Portal (NHP) reported. The mission’s core building blocks will be monitored by the government. The mission aims to provide Digital Health cards to each citizen, which would entail a paradigm shift to the country’s health administration in the wake of the COVID-19 pandemic. The digital cards will initially contain details of doctors, including their qualifications and availability. Doctors will be able to easily access their patients’ entire medical histories (Ministry of Special Services and Features, 2020). During the same month, the National Health Mission instated an Electronic Vaccine Intelligence Network (eVIN), which is an innovative solution for strengthening existing immunisation supply chain systems across India. The network will provide real-time information on vaccine stocks and flows, while also providing information on storage temperatures and other conditions. This platform will be particularly useful during the upcoming COVID-19 vaccine rollout (Ministry of Health and Family Welfare, 2020a).

**Figure 2.6. Openness to telehealth services increases in India**

Willingness to book telehealth visits in India by age group, September 2020

![Openness to telehealth services increases in India](https://doi.org/10.1787/888934229388)
India's new platform is intended to foster development in the digital health field, particularly with linkages to e-pharmacies and telemedicine (NHP, 2020). Willingness to use telehealth services increased considerably among all age groups (Figure 2.6); and the number of Indian households using online pharmacy services reached 9 million in May 2020, compared to 3.5 million in fiscal year 2020. Owing to the increased availability of these services, the number of new households onboarded from non-metropolitan cities increased by 50% during the lockdown (FICCI, 2020).

**Box 2.4. India's eSanjeevani initiative takes off during the pandemic**

The Indian digital health platform eSanjeevani was launched in November 2019 and conducted more than 300 000 teleconsultations within six months, with the majority of demand coming from the states of Tamil Nadu, Uttar Pradesh and Kerala. Today, the platform has been implemented by 23 states and approximately 75% of the Indian population. It offers two types of telemedicine services: doctor-to-doctor consultation (eSanjeevani), and a patient-to-doctor service (eSanjeevani OPD), which was launched as a response to the COVID-19 pandemic and has been successful in curbing the spread of the virus by providing care while maintaining physical distance (Press Information Bureau India, 2020a).

Almost 5 000 doctors have been trained on eSanjeevani OPD and approximately 6 000 consultations are conducted daily. The region of Tamil Nadu, which was severely affected by the pandemic, accounts for most completed consultations, with more than 319 000 consultations as of 14 December 2020 (Ministry of Health and Family Welfare, 2020b). The promotion of digital health is especially encouraging in the rural parts of the country where access to health care has often been very limited. With eSanjeevani OPD, residents can contact a doctor using their smartphone or computer and Internet connection (Press Information Bureau India, 2020b).

The promotion of eSanjeevani is part of the government’s Digital India campaign, which was introduced in July 2015. The campaign aims to ensure that digital access to government services is available to all citizens by improving Internet connectivity and online infrastructure.

**Policy makers need to ensure regulations governing telemedicine are fit for purpose**

The COVID-19 pandemic has shown the importance of technology and digital infrastructure for providing access to health care services. It is primordial for governments to encourage the sector by removing any regulatory uncertainties. As the digital health industry rushes to expand during the pandemic, rules and regulations are necessary to ensure that the population receives reliable quality care. Medical licensing authorities at various levels of government should collaborate to provide guidelines that support innovation without compromising safety. Telemedicine frameworks are currently at different levels of development in Emerging Asian countries, and various amendments have been implemented in response to the pandemic. While India, Indonesia, Malaysia, the Philippines and Viet Nam have specific regulations governing the telemedicine sector, the provision of telemedicine services in the other Emerging Asian countries is primarily regulated through general codes or guidelines (Table 2.2).

Several initiatives have been undertaken since the onset of the pandemic to either address the legal vacuum or implement COVID-19-specific amendments in cases where telemedicine regulations already existed prior to the pandemic. In March 2020, the Department of Health (DOH) and the National Privacy Commission (NPC) of the Philippines issued a joint memorandum on the use of telemedicine in the COVID-19 response, with the objectives of alleviating surges in confirmed cases and minimising risks posed by
unnecessary patient traffic in health care facilities, among others (DOH-NPC, 2020). Also in March 2020, India issued guidelines for the practice of telemedicine allowing any registered medical practitioner to provide telemedicine services to patients from any part of India, while upholding the same professional and ethical norms and standards applicable to traditional in-person care (BoG-MCI, 2020). The guidelines state that in emergency cases, the patient must be advised to have an in-person interaction with a registered medical practitioner; teleconsultation is permitted if it is the only option for providing timely care. Practitioners are advised to use professional judgement to decide whether telemedicine is appropriate in a given situation or whether in-person care is needed (Kapoor et al., 2020). In April 2020, the Malaysian Medical Council published a telehealth advisory, guided by the professional code of conduct, to ensure the well-being and care of telehealth patients, while the Medical Council of Thailand issued a Telemedicine Guideline as a criterion for health care providers to ensure the safety of patients (Lexology, 2020).

Table 2.2. Status of telemedicine regulation in Emerging Asian economies

<table>
<thead>
<tr>
<th>Country</th>
<th>Existing regulation specific to telemedicine</th>
<th>Specific provisions on data privacy related to telemedicine</th>
<th>Amendments to the existing legal framework/development of COVID-19-specific guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brunei Darussalam</td>
<td>Currently there is no law or administrative regulation specific to telemedicine.</td>
<td>Currently there is no privacy/data protection law that applies specifically to the provision of telemedicine services.</td>
<td>N/A</td>
</tr>
<tr>
<td>Cambodia</td>
<td>Currently there is no law or administrative regulation specific to telemedicine.</td>
<td>Currently there is no privacy/data protection law that applies specifically to the provision of telemedicine services.</td>
<td>N/A</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Telemedicine is regulated under Regulation of Minister of Health of the Republic Indonesia Number 20 of 2019 regarding the Organisation of Telemedicine Services through Health Service Facilities.</td>
<td>Under the Regulation of Minister of Health of the Republic Indonesia Number 20 of 2019 Health Service Facilities are required to protect patients’ data.</td>
<td>In April 2020, the Indonesian Medical Council issued KKI Regulation 74 on the use of medical treatment through telemedicine during the COVID crisis.</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>Currently there is no law or administrative regulation specific to telemedicine.</td>
<td>Currently there is no privacy/data protection law that applies specifically to the provision of telemedicine services.</td>
<td>N/A</td>
</tr>
<tr>
<td>Malaysia</td>
<td>The provision of telemedicine services is regulated through the longstanding Telemedicine Blueprint issued by the Ministry of Health in 1997.</td>
<td>Currently there is no privacy/data protection law that applies specifically to the provision of telemedicine services.</td>
<td>In April 2020, the Malaysian Medical Council published a telehealth advisory, guided by the professional code of conduct, to ensure the well-being and care of telehealth patients.</td>
</tr>
<tr>
<td>Myanmar</td>
<td>Currently there is no law or administrative regulation specific to telemedicine.</td>
<td>Currently there is no privacy/data protection law that applies specifically to the provision of telemedicine services.</td>
<td>N/A</td>
</tr>
<tr>
<td>Philippines</td>
<td>Several pieces of legislation have been enacted to define the practice of telemedicine. These include the Telehealth Act of 2012, the Telehealth Act of 2014 and the Senate Bill No. 1518 (The Philippine eHealth Systems and Services Act).</td>
<td>The Department of Health (DOH) collaboration with the National Privacy Commission (NPC), enacted in March 2020, is expected to allay concerns on data privacy and confidentiality.</td>
<td>In March 2020, the Department of Health (DOH) and the National Privacy Commission (NPC) issued a joint Memorandum on the use of telemedicine in the COVID-19 response.</td>
</tr>
<tr>
<td>Singapore</td>
<td>There is no all-encompassing legislation governing telemedicine, but the upcoming Healthcare Services Act is expected to regulate the sector by 2022. Telemedicine is currently regulated through various codes, guidelines and regulations.</td>
<td>Telemedicine providers need to ensure that tighter security arrangements are put in place to protect personal data, especially where the impact to an individual would be significantly more adverse if data were inadvertently accessed.</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Table 2.2. Status of telemedicine regulation in Emerging Asian economies (cont.)

<table>
<thead>
<tr>
<th>Country</th>
<th>Pre-COVID-19 status of telemedicine regulation</th>
<th>Specific provisions on data privacy related to telemedicine</th>
<th>Amendments to the existing legal framework/development of COVID-19-specific guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thailand</td>
<td>Currently, the provision of telemedicine is only regulated through the Notification No. 54/2563 (2020) issued by the Thai Medical Council, effective from 21 July 2020.</td>
<td>Currently there is no privacy/data protection law that applies specifically to the provision of telemedicine services.</td>
<td>The Medical Council of Thailand issued a Telemedicine Guideline as a criterion for health care providers to ensure the safety of patients.</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>Circular 47/2017 issued by the Ministry of Health regulates telemedicine in Viet Nam, allowing physicians to offer telemedicine services to patients, subject to certain requirements.</td>
<td>Currently there is no privacy/data protection law that applies specifically to the provision of telemedicine services.</td>
<td>N/A</td>
</tr>
<tr>
<td>China</td>
<td>Currently there is no law or administrative regulation specific to telemedicine.</td>
<td>Currently there is no privacy/data protection law that applies specifically to the provision of telemedicine services.</td>
<td>N/A</td>
</tr>
<tr>
<td>India</td>
<td>There was no legislation prior to the guidelines for the practice of telemedicine issued in March 2020, in response to the COVID-19 pandemic.</td>
<td>The guidelines for the practice of telemedicine issued in March 2020 state that professional norms for protecting patient privacy and confidentiality must be upheld and practiced.</td>
<td>In March 2020, the government issued guidelines for the practice of telemedicine allowing any registered medical practitioner to provide telemedicine services to patients from any part of India.</td>
</tr>
</tbody>
</table>

Source: OECD Development Centre based on Bodulovic et al. (2020), WHO (2020a) and various national sources.

Privacy and data concerns can deter patients from accessing digital health. A data protection framework is a building block for the sustainability of digital health, but some ASEAN countries lack any legislation on privacy and data protection or have only draft legislation (UNCTAD, 2020). In 2019, the Global Digital Health Index assessed countries’ digital health preparedness and adoption and measured the readiness of the wider health system to adopt digital health interventions (Figure 2.7). Within ASEAN, the index shows that many countries lack a legal framework for data security; laws or regulations on privacy, confidentiality and access to health information; a protocol for regulating or certifying devices and digital services; and rules on cross-border data security and sharing. The Philippines and Lao PDR are at Phase 2, Indonesia and Thailand are at Phase 3 and Malaysia is relatively advanced at Phase 4. The measures announced in response to the pandemic (Table 2.2) should nevertheless translate into improved performance in some of these countries.
Governments should strive to protect personal health data by clarifying ambiguities within data governance frameworks. The following steps are important:

- licensing telehealth service providers;
- mandating data encryption and password protection on telehealth platforms;
- utilising insider threat monitoring;
- ensuring continuous investment in consumer data protection.

The platforms need to ensure that patients who have consented to use a digital health service are aware they can opt out of future contacts at any time. Canada is considered an early adopter of data protection legislation for telemedicine. Canada issued guidelines on the privacy and security requirements that an interoperable electronic health record (EHR) must meet in order to fully protect patient privacy and maintain the confidentiality, integrity and availability of their data (Canada Health Infoway, 2004). With the notable exception of India, Indonesia, the Philippines and Singapore, in most Emerging Asian countries there is no specific data protection or privacy law that applies to the provision of telemedicine services (Table 2.2), but rather the general rules on data protection are applicable to those services. From a technical perspective, patient privacy could be preserved through methods that use artificial intelligence (AI) and deep-fake technology to “swap” faces in order to conceal the identity of patients while still preserving facial aspects, such as movements, that may provide important medical information (Zhu et al., 2020).

Furthermore, expanding reimbursement of telemedicine is another key determinant of access to care and disease monitoring (Webster, 2020). For example, consumers in Singapore attach great importance to whether treatment is covered by insurance or not. Approximately 70% of respondents to a survey found it to be a very important or critically important factor in determining their satisfaction with health care services (Accenture, 2019). In response to the COVID-19 pandemic, the Chinese national health insurance system began reimbursing care providers for patients’ virtual visits, which...
contributed to a significant increase in their use (Ortega et al., 2020). Similarly, India eased previous restrictions on virtual care, allowing for the development of new care models (BoG-MCI, 2020). Furthermore, the financial sustainability of telemedicine requires reimbursement on par with that of in-person consultations. For instance, in the United States, 37 states have adopted telemedicine parity laws, which stipulate that telemedicine encounters are to be reimbursed at the same rate as in-person encounters (Talal et al., 2020). Either fee-based or value-based reimbursement schemes could be envisaged, depending on how telemedicine services are produced and consumed. For instance, value-based care and reimbursement is considered to provide more incentives for cost-efficient health care practices (Abbasi-Feinberg, 2020).

Health care workers need ongoing training to master the use of digital tools

An urgent need to upskill health care workers to cope with new digital health technologies has become apparent during the COVID-19 pandemic. A majority of ASEAN countries are suffering from shortages of doctors and trained medical personnel. The WHO advises a minimum of 4.45 skilled medical workers (doctors, nurses and midwives) per 1 000 population, and many of the Southeast Asian countries are below or just above that benchmark (WHO, 2019). Thorough training on operating technologies and use of digital services must be provided before health care providers face patients in this manner. Best practices involve short-term intensive training, such as workshops and seminars, or subsidised online vocational education. Certificates can be delivered to demonstrate the qualification of health workers to use digital platforms. In a Dutch study from 2017, researchers developed a methodology to improve the assessment of digital health skills of physicians, not only in terms of gathering data (so-called Health 1.0 skills) but also in terms of interactivity with patients on the web (referred to as Health 2.0 skills). The study develops the Digital Health Literacy Instrument (DHLI) that measures operational skills, navigation skills, information searching, evaluating reliability, determining relevance, adding self-generated content, and protecting privacy. The results of the study showed that the instrument proved to be efficient in measuring more interactive Health 2.0 skills in all seven mentioned aspects above (van der Vaart and Drossaert, 2017).

Additionally, it has been argued that one of the main barriers for successfully implementing technology into health care has been the lack of user-centred design. It has been found in studies that the ability for physicians to successfully integrate technology in their health care operations rests heavily upon this design principle. Often, the success rate of implementation fell as the primary purpose of the technology itself got lost in the design or implementation process (Ludwick and Doucette, 2009). Technologies should be reliable and easy to learn and use. In a study involving private clinicians in Malaysia, San and Yee (2013) show that when technology is easy to understand and use, clinicians’ intention to use it increases regardless of their burdensome daily workloads.

Another challenge is related to the complexity of implementing electronic systems for the recordkeeping of medical information and the existing habits of health care professionals in using paper documentation. An observational study carried out at a hospital in central Florida shows that nurses could devote more time to direct patient care after the implementation of an electronic recordkeeping system. Much of the increased time for direct care can be attributed to a 12% decline in the time spent on administrative tasks (Banner and Olney, 2009). It is therefore of utmost importance for health care professionals to master electronic health records and move away from traditional written medical record systems. A study based on questionnaires by Aldosari et al. (2018) shows that health practitioners’ willingness to learn how to use electronic medical record systems increases when appropriate and supportive training is provided in the respective health care organisation.
Technological barriers to digital health tools must be addressed in the region

Governments also need to overcome technological barriers to the development of digital health services, especially in rural or remote areas and among older age groups. Many developing countries do not possess sufficient infrastructure to support the functioning of digital health, with inadequate access to the Internet, mobile phones, computers and even electricity. It has been estimated that only 14% of the population in Southeast Asian countries have access to affordable high-speed Internet (OECD/WHO, 2020).

At the most fundamental level, the unreliable supply of electricity is the primary barrier to realising the promise of telehealth. In Cambodia, for example, which has relied on power imported from Thailand, Viet Nam and Lao PDR, the government should install an uninterruptible power supply (such as backup generators) to reduce exposure to the risk of power failures or shortages. In Indonesia, ICT infrastructure is weak and Internet coverage is lower than in some Southeast Asian countries. While mobile data in Indonesia are very affordable, costing roughly 50% of what consumers in other ASEAN countries pay, average connection speed and Internet bandwidth is much lower than in Singapore, Thailand or Malaysia (Das et al., 2016).

Stable Internet connectivity via broadband or mobile networks allows patients to connect with health workers through video consultations. It also allows the transfer and sharing of patients’ records, files and electronic prescriptions. Brunei Darussalam and Singapore have the best online connectivity among Emerging Asian countries. Viet Nam, the Philippines and Indonesia each had Internet penetration rates of 60% to 65% as of August 2019. In the least developed countries such as Lao PDR, Cambodia and Myanmar, a large proportion of the population still had no stable Internet access or no Internet access at all with Internet penetration rates of 50% or lower as of the same date (Datareportal, 2019). Internet coverage in rural and remote areas of some ASEAN countries remains a major concern. Governments in these countries could use other means in the short term, such as radio and megaphone, to educate local people about the symptoms of COVID-19 and protective measures, while health care providers should allow audio-only consultations when Internet speed is not fast enough. In the medium to longer term, policy makers should boost the digital transformation by removing barriers to investment in networks. Additionally, options for patients to drive to a designated location to complete a video visit in their car or at a clinic with reliable Internet are being explored in the United States (Hirko et al., 2020).

Commonly used commercial video conferencing services, such as Zoom, Microsoft Teams and FaceTime, are not specifically designed and calibrated for health consultations nor are they fully integrated with patients’ medical records or prescriptions. Health providers should notify patients that third-party applications may carry risks, and they should keep developing tools specifically for telehealth. For instance, the government of India recommends several tools for conducting telemedicine, including mobile or landline phones (connected over LAN, WAN, the Internet, etc.); chat apps like WhatsApp, Facebook Messenger, etc.; mobile applications and Internet-based digital platforms for telemedicine; and data transmission systems like Skype, e-mail or fax (Kapoor et al., 2020).

In 2016, the Malaysian Personal Data Protection Department updated the Personal Data Protection Act introduced in 2010 to align with society’s technological developments and to better protect the large amounts of data that are being shared across networks and devices (Personal Data Protection Act, 2016). In the Philippines, the Department of Information and Communication Technology initiated an independent organisation with the Data Protection Act in 2012. This was called the National Privacy Commission and aimed to monitor and guarantee compliance of the country with international standards for data protection (Data Privacy Act, 2012).
Policy makers need to ensure the benefits of telemedicine are equitably distributed

The advent of COVID-19 has shone a spotlight on digital divides. The barriers by which people are excluded can be grouped into three broad categories: lack of access, mostly on account of an inability to pay for devices and their operating costs; lack of motivation among people who do not consider that connectivity is relevant or worth the effort; and lack of digital skills and education (Milner, 2006). Education is one of the most important factors contributing to digital exclusion, as the most educated people are likely to be early adopters of newer technologies. Improvements in health technologies tend to increase disparities in health access across education groups, due to the fact that education enhances the ability to exploit technological advances. The most educated people therefore make the best initial use of this new information and adopt newer technologies first (Glied and Lleras-Muney, 2008).

Income is another factor restricting broadband adoption and use. For instance, in India, Indonesia and the Philippines, more highly educated people and those with higher incomes are more likely to be Internet users (Figure 2.8). The gap by level of educational attainment is particularly striking in these three countries. Indeed, the difference in Internet usage between people with higher versus lower education levels exceeds 40 percentage points. The wealthier and more educated groups will likely reap the full benefits of telemedicine, while the poorer and less educated fringes of the population could be deprived of these services. The elderly, who have been most severely impacted by the pandemic, are also among the least likely to be Internet users. For instance, a 2014 study of 385 elderly living in the Khon Khaen Municipality (Thailand) revealed that most elderly did not use the Internet (80.7%), while the majority of elderly who were above 70 years of age did not use the Internet at all. The study also identified some of the problems in using the Internet, namely: trouble with eye pain; lack of skills; and lack of computers at home (Loipha, 2014).

Figure 2.8. Internet usage by level of education and income in selected Emerging Asian economies, 2019

Note: Data refer to percentage of people who use the Internet at least occasionally or report owning a smartphone. Source: Pew Research Centre (2020). StatLink | https://doi.org/10.1787/888934228172
The factors discussed above greatly influence individual attitudes towards telemedicine. A cross-sectional study carried out by Lee et al. (2020), involving 4,504 residents from selected districts of the Malaysian state of Selangor, shows that education and age are important factors associated with higher levels of digital health use. More precisely, the study reveals that individuals aged 39 and below, those with higher educational attainment and those who owned two or more mobile devices were more interested in using digital health and health-related applications in their daily lives. According to the same study, the most common issues respondents needed help with were: connecting their devices to a wireless network (49.9% of respondents); searching for information on the Internet (48.6%); and checking e-mails (46.9%). Moreover, nearly half of survey participants claimed they were willing to use a mobile health device (m-health) if education were provided, while 47.5% of respondents said they would consider using an m-health device if it required fewer than five steps to set up (Lee et al., 2020).

Providing people with reliable equipment and access to it is undoubtedly the most promising avenue for bridging the digital divide in access to telemedicine. Reopening places that enable free and public access to the Internet could be prioritised, with the necessary safeguards in place (Allmann, 2020). In the meantime, digital isolation could be tackled through immediate and pragmatic solutions. For example, buses equipped with solar-powered Wi-Fi routers are being used to provide Internet access to isolated and underserved communities in the United States (Lee, 2020). In addition, the strategy to reduce digital divides should also involve the establishment of intensive and long-term support networks to help people acquire the digital know-how they lack. In the United Kingdom, for instance, the Oxfordshire Digital Inclusion Project is a research project that is looking at the role of public libraries in closing the digital divide. Under the project, library customers can request assistance from volunteer “digital helpers” for various actions, such as setting up an e-mail account or learning how to use Skype (Allmann, 2020). Finally, education campaigns are necessary to inform the public about the benefits of telemedicine as a trustworthy health management strategy.

A confluence of policy measures is necessary to spur digital health development

The COVID-19 pandemic fuelled growth for telemedicine that would have otherwise taken several decades to materialise. Various initiatives are necessary in order to ensure the continuity of telemedicine as a viable alternative to traditional health care even when COVID-19 no longer represents a public health concern, while also acknowledging that access to digital technologies is far from being universal.

- Policy makers need to overcome any regulatory barriers to ensure legal certainty for all stakeholders (patients, practitioners, insurance providers, etc.) and the highest service quality standards. Indeed, confidence that the quality of care is at least equal to that delivered in a traditional hospital plays a key role in the successful shift from conventional health care to telemedicine. In addition, Emerging Asian regulators could work towards ensuring a certain level of harmonisation of terminology and definitions employed in their respective legal frameworks to enable the cross-border provision of telemedicine services.

- Policy makers need to establish a clear legal framework for data protection, which governs the collection, storage, processing and sharing of patients’ data. The legal framework should provide for a simple and transparent patient consent procedure. The growing risk of cyberattacks targeting the sector needs to be accounted for appropriately. In order to promptly identify and trace the source of IT incidents, such as fraudulent access or misuse of patients’ personal data or to determine the origin of an IT incident compromising patients’ data, telemedicine providers should implement incident management systems.

- Furthermore, simplifying reimbursement rules could accelerate telemedicine adoption and ensure the financial sustainability of telemedicine. Policy makers
should consider expanding the scope of telemedicine by adding new activities covered by social security. The conditions under which telemedicine costs are reimbursed need to be carefully considered, taking into account the dual objective of improving the quality of health care, while at the same time ensuring a lower relative cost for society. Either fee-based or value-based reimbursements could be envisaged, with the latter option typically considered to be more cost-effective.

- Upskilling health professionals in digital technologies is paramount for the wider adoption of telemedicine. In order to tackle digital-skill barriers, practical training could be integrated into the curricula of medical schools. Governments in Emerging Asia could also fund additional courses in telemedicine and digital health records for health professionals, potentially through joint work with the TVET sector. Moreover, reward schemes could be envisaged as an incentive for health care professionals to ensure high quality standards in the provision of telemedicine services.

- In addition, policy makers in Emerging Asia need to overcome several technical barriers to the development of telemedicine. Governments should redouble their efforts to enhance the IT infrastructure and strengthen its capacity to process intensive information flows. The widespread availability of reliable devices and sound cellular and broadband networks has the potential to reduce telemedicine costs by transferring these expenses from telemedicine providers to patients who already have these devices available for use at home. Rural-urban gaps in digital development need to be reduced in order to ensure an uneven spread of telemedicine services. Alternative means for accessing telemedicine solutions should be envisaged in areas with weak IT infrastructure, such as audio-only consultations or directing patients to designated locations for completing video visits.

- Finally, as with all technological advances, the greater use of telemedicine services creates groups that gain more than others from the change. The benefits of digital health care are far from being equitably distributed. Education and access to technology are some of the most important factors contributing to digital exclusion. Policy makers need to ensure equal access to reliable, affordable and easy-to-use equipment. Innovative solutions like, for instance, using buses equipped with Wi-Fi routers to provide Internet access to underserved communities, could offer an immediate response. At the same time, long-term support networks could be envisaged to help people acquire the digital skills they lack. Public libraries, for instance, could play a key role in supporting this objective. Education campaigns are necessary to inform the public about the benefits of telemedicine and thus encourage the shift from treatment to prevention.

**Online education in Emerging Asia requires an upgrade in digital skills**

The COVID-19 pandemic and subsequent government responses have disrupted education across the globe. Billions of students have had their education interrupted or transformed through attempts to reduce transmission of the virus by limiting physical contact. In addition, at a time when the pandemic is also disrupting industries such as travel, tourism and hospitality, and causing job losses, there is a significant demand for upskilling and reskilling of adult workers, in particular to enhance digital skills ranging from basic computer or digital device operation to innovative tasks in programming.

**Emerging Asian countries seek optimal strategies as schools reopen**

Some degree of primary or secondary school closure occurred during the pandemic in China, India and every ASEAN economy. Some of these closures were localised to areas with high transmission rates of the virus, while others were nationwide. Some Emerging Asian countries started to implement school closure policies as early as February 2020, while by April entire school systems were shut across the region (Figure 2.9).
More than 1.4 billion students at all levels, including more than 140 million K-12 students in ASEAN and more than 232 million K-12 students in China alone, spent some time barred from in-person studies (UNICEF EAPRO, 2020a; UNESCO, 2020a). Figure 2.10 shows the seven-day rolling average number of learners under total closures for kindergarten to grade 12, college, TVET and university, excluding learners on scheduled academic breaks.
School reopening began in May 2020 in some areas, with the implementation of hygienic measures including regular disinfection, reporting of COVID-19 symptoms and contact tracing, temperature checks, use of masks or other protective gear by teachers and/or students, and measures to enforce physical distancing (Table 2.3). Of these strategies, symptom reporting and enforcement of physical distancing have been perhaps the most disruptive to education. Group activities may need to be limited, and ensuring some in-person class time for all students may involve rotating students between in-person and virtual learning. In the context of education, quarantine or self-isolation means possibly cancelling in-person lessons for a certain period of time and transitioning to remote learning on very short notice.

Table 2.3. Primary and secondary educational responses to COVID-19 in Emerging Asia

<table>
<thead>
<tr>
<th>Country</th>
<th>Date closed</th>
<th>Date opened</th>
<th>School environment measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>16 March (partial), 25 March (full)</td>
<td>13 September (partial)</td>
<td>Safe operating guidelines provided by Ministry of Education and Culture</td>
</tr>
<tr>
<td>Malaysia</td>
<td>18 March (full), 9 November (full)</td>
<td>24 June (partial), 3 August (full)</td>
<td>Digital learning platforms (Internet) for students and training for teachers; hygiene measures include provided meals and prohibition of most extra-curricular activities, including sports</td>
</tr>
<tr>
<td>Philippines</td>
<td>9 March (partial), 16 March (full)</td>
<td>N/A</td>
<td>Remote teaching resumed on 5 October; no return to class until vaccine is available and distributed</td>
</tr>
<tr>
<td>Thailand</td>
<td>18 March (full)</td>
<td>14 August (full)</td>
<td>Daily temperature screening for students with health status indicated by a stamp on the wrist; assemblies and gatherings cancelled (UNICEF Thailand, 2020)</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>28 February (partial), 31 March (full), 1 September (partial)</td>
<td>4 May (partial), 18 May (full), 5 September (full)</td>
<td>Schools must meet government safety standards to reopen; preschools closed indefinitely 26 July in some provinces</td>
</tr>
<tr>
<td>Brunei Darussalam</td>
<td>11 March (break), 1 April (full)</td>
<td>2 June (partial), 27 July (full)</td>
<td>Temperature and symptom screening at the start of each day; distancing aided by fixed exam-style desks; masks for students beyond kindergarten</td>
</tr>
<tr>
<td>Singapore</td>
<td>8 April (full)</td>
<td>2 June (partial), 29 June (full)</td>
<td>Students alternate between in-school and distance learning; government guidelines on school operating procedures; radio lessons in three widely spoken languages for Grades 1-3</td>
</tr>
<tr>
<td>Cambodia</td>
<td>8 March (partial), 16 March (full)</td>
<td>7 September (partial), 23 November (full)</td>
<td>Select grades in class only for the purpose of sitting key exams</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>19 March (full), 1 September (partial)</td>
<td>18 May (partial), 2 June (full), 1 November (full)</td>
<td>Gradual reopening of schools, which must comply with government regulations; distance learning to continue until further notice; in-school attendance will require parental consent</td>
</tr>
</tbody>
</table>

Note: Dates refer to the first day of closure or opening, not the dates of policy announcements. Source: Opening and closing dates from UNESCO (2020a), School environment measures from UNICEF EAPRO East Asia and Pacific Regional Office (EAPRO) (2020a), “UNICEF Education COVID-19 Response Update – September”, unless otherwise indicated.

While spikes in viral transmission have been the common justification for reclosing schools, the rationale behind reopening has been less clear. However, given that the five countries with the most academic days under some level of closure (Table 2.4) are five of the six countries with both broadband speed and coverage below the Emerging Asian average (Figure 2.13), it is unlikely that inadequate ICT infrastructure spurred reopening. The extended closure of schools in areas with poor ICT infrastructure and access risks
widening educational and economic inequities, something that should concern policy
makers as they decide on educational plans for 2021 while their countries await the
availability and distribution of COVID-19 vaccines.

The decision on whether or not to reopen schools, or to what extent, should protect
the rights of children and be based on helping them achieve the best holistic outcome
(UNESCO et al., 2020). This approach should consider the benefits and drawbacks of
attending physical classes versus staying at home, from various viewpoints: physical
health and COVID-19; learning opportunities; mental and emotional health; and risks or
costs to family members and communities.

The scope of school closures is another aspect to consider; whether they should be
adopted at the national or subnational level. Several studies have modelled the relative
benefits of different school closure strategies during pandemics, but the evidence is rather
mixed. One study concluded that a policy of “area closure” – whereby all schools within
a radius of 10 kilometres of a confirmed case closed for a fixed period – delivered similar
results to a policy in which each school closed following a case in the respective school
(Ferguson et al., 2006). In a similar vein, another academic paper found no consistent
differences between the effects of closing individual schools and closing schools at the
national level (Lee et al., 2010). Conversely, other studies suggest that closing individual
schools would be more effective than closing an entire school system (Halder et al., 2010;
Chao et al., 2011).

Another strand of analysis explores the merits of implementing blended school
opening strategies and their optimal structure, distinguishing between alternating
weeks of in-person learning rather than alternating days. For instance, Gandolfi (2021)
shows that careful planning of temporary school openings could drastically reduce the
number of extra cases of COVID-19 that would be induced by fully opening the school. As
illustrated in this study, blended models, which involve an alternation of weeks of remote
and in-class activities are optimal or near-optimal solutions. Alternation on a weekly

<table>
<thead>
<tr>
<th>Country</th>
<th>Academic days</th>
<th>Fully closed (%)</th>
<th>Partially closed (%)</th>
<th>Fully or partially closed (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brunei Darussalam</td>
<td>273</td>
<td>22.7</td>
<td>20.1</td>
<td>42.9</td>
</tr>
<tr>
<td>Cambodia</td>
<td>227</td>
<td>47.1</td>
<td>37.4</td>
<td>84.6</td>
</tr>
<tr>
<td>Indonesia</td>
<td>291</td>
<td>48.8</td>
<td>41.2</td>
<td>90.0</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>276</td>
<td>21.7</td>
<td>27.5</td>
<td>49.3</td>
</tr>
<tr>
<td>Malaysia</td>
<td>306</td>
<td>44.8</td>
<td>13.1</td>
<td>57.8</td>
</tr>
<tr>
<td>Myanmar</td>
<td>307</td>
<td>78.5</td>
<td>12.1</td>
<td>90.6</td>
</tr>
<tr>
<td>Philippines</td>
<td>207</td>
<td>86.0</td>
<td>2.9</td>
<td>88.9</td>
</tr>
<tr>
<td>Singapore</td>
<td>266</td>
<td>10.2</td>
<td>10.2</td>
<td>20.3</td>
</tr>
<tr>
<td>Thailand</td>
<td>262</td>
<td>33.6</td>
<td>0.0</td>
<td>33.6</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>245</td>
<td>13.9</td>
<td>20.4</td>
<td>34.3</td>
</tr>
<tr>
<td>China</td>
<td>276</td>
<td>23.9</td>
<td>39.5</td>
<td>63.4</td>
</tr>
<tr>
<td>India</td>
<td>338</td>
<td>60.4</td>
<td>34.6</td>
<td>95.0</td>
</tr>
</tbody>
</table>

Note: “Academic days” refers to calendar days excluding scheduled academic breaks. Data cover 16 February 2020
to 18 January 2021 inclusive. Data includes rounding errors.
basis appears to be more efficient given the COVID-19 incubation period. For instance, with about half of the weeks in class, the increase in the number of cases can be reduced by a factor of three, while schedules with a choice between in-class and remote teaching on a daily basis would not improve the reduction much. The study also concludes that a random selection of the weeks of in-class teaching activities would not reduce the number of new infections as effectively as an optimal choice, but would nevertheless achieve a substantial reduction compared to full opening.

The use of distance learning is increasing rapidly

As students were abruptly forced out of schools, distance learning strategies were rapidly developed and implemented worldwide in an effort to provide continuity of learning and stave off the economic costs associated with a delayed education. Psacharopoulos et al. (2020) estimate the net present value of the losses caused by a four-month educational delay to be as high as 61% of current year GDP, with low-income countries and the least educated most affected proportionally. Crucially, these estimates are made under the assumption that the closures are of fixed length and that distance learning is a perfect substitute for in-person learning in terms of learning quality. Both of these assumptions are particularly strong. Not only did some ASEAN countries have initial school closures lasting longer than four months (Cambodia), but several countries have had to reclose schools in whole or in part in response to deteriorating epidemiological situations (Malaysia, Myanmar, China) (UNICEF EAPRO, 2020a).

Figure 2.11 shows the quarterly downloads of educational mobile apps since the start of 2017, with Q1 2020 (the start of the declared pandemic) having the most downloads. In some Emerging Asian countries, the practice of distance learning is not new. For instance, nearly 6.5 million students in China were enrolled in open and distance learning in 2016. This is the equivalent of 17.8% of the country’s total student population (Qayyum and Zawacki-Richter, 2019).

![Global mobile education app downloads, Q1 2017 to Q1 2020](https://doi.org/10.1787/888934228210)

Keyword searches related to Internet-based learning significantly increased starting from the first quarter of 2020, the period when physical distancing restrictions began to be implemented in many ASEAN countries. Figure 2.12 shows keyword search trends on selected national learning platforms for each corresponding country. These trends suggest growing awareness of digital learning. Evidence from Singapore also indicates acceleration of the National Digital Literacy Programme due to the COVID-19 pandemic (Singapore Ministry of Education, 2020a). The programme, which previously intended to equip every
secondary school student with a personal digital learning device by 2028, has progressed faster than planned. Within a few weeks, there was universal adoption of digital learning, and teachers in some schools shifted to delivering online lessons overnight.

**Figure 2.12.** **Keyword search trends related to selected national learning platforms, 2020**

![Keyword search trends related to selected national learning platforms, 2020](image)

Note: Numbers represent search interest relative to the highest point on the figure for the given country and time (January-October). A value of 100 is the peak popularity for the term. A value of 50 means that the term is half as popular. A score of 0 means there was not enough data for this term.


Among the ASEAN-10, each country developed national strategies to implement distance learning, with some freedom for subnational authorities to make modifications relevant to their localities. While every country utilised Internet-based learning, several turned to television, radio or mobile phone as alternatives. In some cases, instructors or authorities delivered physical learning materials to students in a safer manner.

- **Brunei Darussalam** provides online learning advice for both teachers and parents, including an overview of the technologies being used to deliver content, advice on creating a proper home learning environment and a reminder that physical activity is still key for children. The Ministry of Education is delivering content through a variety of Google applications, as well as other tools for group work and teacher screen sharing, while WhatsApp is being used to facilitate communication between teachers and parents. Lessons are also delivered by television for some grade levels (Ministry of Education of Brunei Darussalam, 2020).

- In **Cambodia**, the Ministry of Education, Youth, and Sport is delivering educational content through Facebook videos posted to official agency pages. After being streamed live on Facebook and multiple television channels, the videos also become available on an official YouTube channel and a mobile application developed by the government to facilitate distance learning by mobile phone. Owing to agreements between service providers and the government, accessing lessons by mobile phone does not incur data usage and charges. Lessons are available for all grade levels, as well as for the Basic Education Equivalency Programme, a joint initiative with UNESCO allowing out-of-school learners to achieve Grade 9 equivalency (UNESCO, 2020b).
• **Indonesia** is providing lessons on TVEdukasi, a television station run by the Ministry of Education and Culture since 2004. There are two channels, one for students and another for teachers. “Rumah Belajar” (Learning House) is an online hub for lessons, textbooks, assignments and evaluations developed by the ministry. Similar to the situation in Cambodia, the ministry has partnered with service providers to render access to the hub free of charge (World Bank, 2020a).

• Lessons in **Lao PDR** are mostly being delivered by Internet, television and radio, as only students in Grades 5, 9 and 12 have returned to the classroom to prepare for state exams at the end of primary, lower secondary and upper secondary education (UNICEF, 2020). This arrangement achieves the dual objectives of safety (through physical distancing in schools) and maintaining quality education and progress (by prioritising students with upcoming exams, while not compromising the others).

• In **Malaysia**, a Ministry of Education online resource hub called EduwebTV and an online learning platform called MoE-DL are available, with lessons and digital textbooks for all levels. But the country is focusing much of its new distance-learning effort on radio and television, as a significant share of the population lacks Internet access. Public broadcaster Radio Televisyen Malaysia (RTM) launched TV Okey on 6 April with these students in mind. Initial broadcasts lasted two hours per day, with plans to expand this, and the streams are archived on the RTM website (World Bank, 2020a).

• The **Myanmar** Digital Education Programme is the source for digital education materials accessible by computer or mobile app. WhatsApp and Viber are used for student-teacher communication. People requiring a low-tech arrangement receive a drive with all the materials loaded on it. The no-tech households, which have no digital devices and are reliant on solely physical tools, are being sent textbooks and workbooks with instructions for self-paced learning in a collaboration between the Ministry of Education and the postal service. The programme includes reference to the need to provide appropriate aid to students with special needs (Myanmar Ministry of Education, 2020).

• The **Philippines** Department of Information and Communication Technologies, in collaboration with the Department of Education, launched the Digital Teachers and Learners Project in July 2020, as a pilot project in San Juan. DepEd Commons, an online platform, was also developed to support the continuous delivery of basic education during the pandemic.

• **Singapore** launched Home Based Learning in response to the COVID-19 pandemic, blending online and offline elements. The intention is for students to use their family’s devices, but a family unable to provide a device for each child can borrow the necessary equipment from the school. The schools can also help facilitate Internet access (or improved Internet access) if necessary. The device loan programme is unique within ASEAN (Singapore Ministry of Education, 2020b).

• **Thailand**’s Ministry of Education will rely on Distance Learning Television as its main instructional mode for all grades. This project has been used locally for several years and is being expanded nationwide in response to the COVID crisis (UNESCO Bangkok, 2020). Some material is available and more lessons are being recorded. The government also collaborated with the Asia Foundation to develop an online learning platform for primary and secondary students (Chang, 2020).

• **Viet Nam** has seen the growth of multiple e-learning platforms from the telecommunications providers VNPT, FPT and Viettel, all of which are allowing free access. The same basic technology has also been repurposed for other uses, such as
doctor-patient conferencing and professional communication. The Viettel platform hosts more than 29,000 lessons and had been distributed to more than 26,000 schools as of March, with 41 million visitors in the prior month (Dharmaraj, 2020).

**Colleges and universities should maintain quality in a remote setting**

The COVID-19 pandemic has led colleges and universities to transition to online learning. In areas with weaker Internet penetration, however, online learning may not be possible, leading to students deferring their studies. In response to the financial pressures associated with the pandemic and an admitted decline in instruction quality, universities in the Philippines and Thailand are considering whether to refund tuition fees in whole or in part, while Viet Nam is providing scholarships for students whose families have been most adversely affected by the pandemic (Yarrow, 2020).

Policies should focus on student retention, both during and after the period of restriction. Governments may need to subsidise tuition or offer soft student loans, with payment or interest holidays for some time after graduation. Many countries have implemented interest-free deferments on outstanding student loan payments, while Canada has doubled available grants, eliminated required fixed contributions and increased the weekly loan limit from CAD 210 to CAD 350. For assisting in employment, the Chinese government is instructing state-owned enterprises to expand hiring and reserve a portion of the created positions for new graduates.

In the event that academic terms must be repeated due to the interruptions, financial relief should be made available. It is important for educational institutions to consider whether enough of the term material was covered and whether students were properly assessed prior to any consideration of blanket advancement (i.e. automatic passing grades for every student). While there is an understandable desire for both students and institutions to have educational progress proceed unimpeded, it is important that the quality of education received by the students be equivalent at a minimum.

Another concern for universities is the administration of examinations. Typical exams are not permissible under public health measures where educational institutions are closed, and this has led to deferral of exams or graduation until either the sanitary situation changes or an alternative method can be found. Challenges include adapting exams for computer-based completion and the preservation of academic integrity. Bilen and Matros (2021) found evidence of cheating in online examinations through learning system data at an American public university where some exams were conducted with traditional methods (face-to-face and proctoring) versus asynchronously online due to closure. The paper highlights three main policy options to curb cheating: requiring students use a camera and show identification to it to prevent someone else from taking the test on their behalf; allowing professors to assess suspected cheating on their own for those who refuse to use a camera; and avoiding fitting grades to a pre-determined distribution.

A study by Prigoff et al. (2020) attempts to shed light on how grading has been disrupted by the transition to online learning and provides evidence on the impact of the transition on different tools for assessing medical students. Open-book exams and virtually proctored shelf exams, with grade adjustments, appear to be a reasonable option for medical students. This notwithstanding, the authors of the study recommend virtual proctoring through a video-conferencing application, if available, in order to avoid adjustments and student dissatisfaction.
Subjects with necessary practical components, such as sciences, engineering and medicine, require students to spend some time on campus to master the use of techniques, tools or software. It is important that students have the opportunity to complete these physical aspects of their programmes in order to be fully qualified to enter the workforce in their chosen discipline. Universities will have to work with students and authorities to develop methods of allowing students to complete this part of their education safely and with as little delay as possible. Financial investment in the development of online laboratories, typically called WebLabs or iLabs, could be envisaged as a medium to long-term solution. WebLabs would allow students to practice remotely, with direct feedback on the results of their actions. Originating in microelectronics, these online laboratories are experimental set-ups that can be controlled through the Internet from a simple web browser (Debaq et al., 2021). Some applications in chemical engineering have been documented (Klein and Wozny, 2006; Alliet-Gaubert et al., 2012).

A survey of 3 670 medical students in the Philippines provides insights into the barriers to learning they have faced during the COVID-19 pandemic (Baticulon et al., 2020). The Doctor of Medicine is a four-year programme consisting of didactic (classroom) learning, clinical rotations and licensure examinations. All phases were suspended indefinitely. The survey found that 41% of students considered themselves prepared for online learning. More than 70% of students agreed that they had enough time and resources to prepare for the next-year level, but a similar proportion believed they should automatically be given a passing grade. Fewer than half of the students believed their school had the resources to facilitate online teaching effectively, but more took issue with the administration and infrastructure than with the instructors. In terms of learning barriers, nearly 70% of students reported never having to work for extra money or facing issues meeting basic needs or with their devices. Lack of technical skills was an occasional problem (8% always, 24% never), though 89% of students reported some level of unreliability in their Internet service. The most pervasive issues related to adjusting to academics in an unfamiliar space. Nearly one-third of students reported that “difficulty adjusting learning styles” and “need to fulfil obligations at home” were constant barriers, while 80% indicated issues with a lack of space conducive to studying.

This suggests that the issues may not lie with online learning generally, but rather with the abrupt transition necessitated by public health measures surrounding the COVID-19 pandemic. It thereby reinforces the urgency for educational institutions to develop distance learning solutions, and to not abandon this pursuit when the public health crisis has passed.

Improvement of ICT infrastructure and access undergirds distance learning

Differences in Internet coverage and speed have exposed students in Emerging Asian countries to varying levels of disruption following the implementation of COVID-19-related restrictions. Levels of disruption may have been lower in countries with fast and widely available Internet, such as Singapore and China. Inversely, students living in Cambodia, India, Indonesia, Lao PDR, Myanmar and the Philippines have likely faced greater difficulties in studying remotely, as Internet availability and quality are low in these countries. In Malaysia and Thailand, broadband speed is above the world average, but low subscription rates limit the benefits. By contrast, although inequality of Internet access is lower in Viet Nam, the quality of the service is below-average (Figure 2.13).
Figure 2.13. Fixed broadband subscriptions and speed in selected Emerging Asian economies

Note: Data on fixed broadband subscriptions are as of 2019, except for Myanmar (2018) and World average (2018). Data on fixed broadband speed (download) are as of September 2020.
Source: OECD Development Centre based on data from World Bank and Speedtest Global Index.
https://doi.org/10.1787/888934228248

Access to information and communication technology (ICT) is the linchpin of the entire distance learning effort. In the short term, several countries have developed alternatives to online learning, as described above, but these have disadvantages. Radio, television and physical home learning (where physical learning materials are safely delivered to homes by officials or post) deny students opportunities to interact with teachers and receive rapid support in the event of questions or learning struggles. This may become more apparent with age, as the complexity of study may eclipse the ability of older family members to provide assistance. Radio or television learning (RTL) also commits children and their carers (often parents) to a schedule. A child who misses the scheduled broadcast misses the daily lessons, perhaps with limited if any opportunity to review. Likewise, RTL removes any opportunity for self-pacing. Students cannot advance if they have already mastered the concepts being taught and, more troublingly, students are denied the opportunity to repeat difficult lessons until mastery. With the cumulative nature of studies in compulsory school, students who struggle in an area can quickly be left behind, with little hope of closing learning gaps.

Uneven ICT infrastructure development among various provinces or regions within a country could exacerbate regional disparities. For instance, Indonesian ICT development varies significantly by province (Figure 2.14). The capital, Jakarta, and a handful of other provinces score above the national average, but the bulk of provinces display much lower scores. People who live in areas with weak ICT infrastructure will likely face greater challenges to study and work remotely compared to their compatriots from the capital and other regions with more developed ICT infrastructure.
Online learning could provide the best method of distance teaching when accounting for flexible needs of students. However, lack of availability and the cost of devices and service often deny students the necessary access. The coverage gaps are often seen in the poorest rural areas. This poses a significant problem for distance learning, as it is often students in those environments who stand to benefit the most from educational advancement. Beyond the scope of education, government investment in Internet access is worthwhile from the perspective of human capital enhancement. Some countries have already made arrangements with telecommunications providers to allow free access to online learning resources (i.e. accessing those resources does not use up purchased data). Alternatively, mobile data access could be subsidised at the student level. In any case, care should be taken in educational platform design to maximise functionality while minimising the demand for mobile data.

Some countries in the region need to bridge digital divides

Multiple digital divides exist in Emerging Asia and pose significant barriers to effective distance learning. Examples include divides among socio-economic or age groups, between genders and among and within countries. From a gender perspective, the proportion of females using the Internet is less than the proportion of males doing so. Among Emerging Asian countries for which data are available, only in Brunei Darussalam (2016) and Cambodia (2018) is the gender balance even, based on International Telecommunication Union (ITU) data (International Telecommunication Union, 2020).
The COVID-19 crisis has also highlighted the importance of digital financial literacy, yet the ability to make use of financial technology also differs among socio-economic groups. In Viet Nam, for instance, awareness of Fintech services contrasts sharply among households. Overall, households with lower incomes are far less aware of available Fintech services than the wealthier ones (Figure 2.15). The difference is particularly pronounced with respect to digital money, with only 22.4% of the lower-income households aware of this service, versus 62% in the high-income category.

Figure 2.15. Awareness of Fintech services by household income group in Viet Nam, 2019

![Graph showing percentage of survey respondents aware of different Fintech services by income group.]

Note: VND stands for Vietnamese dong.
Source: Morgan and Trinh (2020).
StatLink [^](https://doi.org/10.1787/888934229464)

The costs of digital devices and service vary widely among Emerging Asian countries, and this leads to disparities concerning Internet access in the home (Figure 2.16). Singapore leads in this area, with 98.4% of its homes connected to the Internet, rivalling or exceeding many OECD countries. The Philippines trails far behind, at 17.7%, and this situation has been a major barrier to launching online distance learning in the country. Traditional Internet penetration measures simply calculate the proportion of the population using the Internet, without regard for the means of access. These metrics do not reflect that low- or no-cost access methods, such as public or business Wi-Fi, Internet cafés and computing facilities at educational institutions, may be unavailable as a result of public health measures.

Figure 2.16. Households with home Internet access in selected Emerging Asian economies

![Graph showing percentage of households with home Internet access in various Emerging Asian countries.]

Source: International Telecommunication Union (2020).
StatLink [^](https://doi.org/10.1787/888934229483)
Two immediate solutions for bridging the digital divide in the short term, as necessitated by public health measures, are to provide data access and devices. Governments and telecommunication companies should collaborate to increase the coverage and capabilities of Internet networks in order to support more connections by more people, especially in disadvantaged areas. Alternative transitory solutions can be offered using mobile Internet relay, for instance via broadcasting trucks (Beaunoyer et al., 2020). Singapore is providing devices to students who do not have any, while Cambodia, Myanmar, Malaysia, Singapore and Viet Nam are providing free data to students either generally or for specific purposes (i.e. accessing educational material does not consume a purchased data allotment). Public authorities should consider keeping places that provide public access to the Internet open, with the necessary safety measures in place (Beaunoyer et al., 2020). In addition, several different video streaming platforms that offer different streaming formats and resolutions could be explored for the conduct of online classes so that students could opt for a lower resolution for viewing in order to save their data allocations (Azlan et al., 2020).

**Lifelong improvement in digital skills is vital for education and economic mobility**

One of the most persistent barriers to digital education is instructors’ poor digital skills (OECD, 2020a). The education component of the Fourth Industrial Revolution, called “Education 4.0” and taught by “Teacher 4.0”, requires teaching, research and service, and includes the use of learning technologies such as blended learning (a mixture of physical classroom and online learning) and Massive Open Online Courses (MOOCs) – large courses delivered by the Internet, often with minimal standards for enrolment (Xing and Marwala, 2017). In a MOOC environment, instructors and assistants deliver recorded content, but they must be prepared to answer questions from a student body displaying a broad range of competency levels and respond to technical issues.

In some countries, digital learning technologies sit unused simply because instructors do not know how to operate them (OECD, 2020a). This has been laid bare by the need to pivot swiftly to digital education in response to COVID-19. Evidence from the Philippines suggests that many instructors are uncomfortable with online learning tasks. A survey by Alda et al. (2020) also revealed that instructors frequently overestimate their digital skills.² This illustrates the need for digital skills development as a component of lifelong learning.

Each career or discipline will likely also have specialised digital skills that must be learned by a person desiring to enter the field, such as software applications common in an office setting (spreadsheets, presentation builders) or specialised software (e.g. CAD for engineering, point-of-sale software for businesses) or skills (programming or troubleshooting and technical support). The ability to master new digital skills rapidly will be critical for stabilising employment and income mobility. Computers and Future Skill Demand (Elliott, 2017) suggests that low and middle-skilled workers will be most affected by the shift to computers as jobs become automated, while survey data collected from 2011 to 2015 by the OECD’s Programme for the International Assessment of Adult Competencies (PIAAC) showed the employment rate to be 72.7% for respondents with basic computer skills compared to 52.5% for those without. In a separate study, 78.2% of respondents with advanced computer skills reported employment, suggesting that there is significant benefit to a basic level of aptitude, though continuing to develop skills may also be beneficial.

Several strategies can be implemented on a short-term basis to increase people’s capacity to interact efficiently with new technologies. The first could be to reinforce household and family support (typically intergenerational) and community peer support to promote the uptake of digital skills. In the short term, this could be achieved with the help of volunteers interacting with digitally disadvantaged people by phone. In a longer-term perspective, the establishment of digital alphabetisation units at community level...
Learning and knowledge acquisition are no longer finite processes

In an economy that is increasingly globalised and knowledge-based, skills development can no longer be thought of as a finite process upon reaching the end of compulsory schooling or some other arbitrary point in adulthood. As more of the economy moves to digital platforms with no indication that the trend will ever be reversed, people without some basic aptitude will be left behind in their careers. While a “basic level” is not strictly defined by any governing body, this could include, for instance: safely starting and shutting down a computer, smartphone or tablet; successfully and efficiently browsing the web to retrieve desired information; establishing and using an e-mail account; safely installing software; detecting cybersecurity threats (e.g. spam, malicious links); downloading or transferring files; and being able to use a word processor to create and save a typical document (e.g. a memo or letter).

Countries in the region should ensure that lifelong learning for employment is tangibly beneficial and should encourage employers to do the same. Lifelong learning efforts should be widely recognised and lead to benefits such as increases in wage, job security or employability. Educational authorities should be in regular communication with industry experts about labour market conditions to direct people to the areas of need and to continuously update curricula to fit current industry standards. Micro-credentialing should be used to allow workers to communicate their skills accurately. Micro-credentials “focus on modules of learning much smaller than those covered in conventional academic awards, which often allow learners to complete the requisite work over a shorter period” (Chakroun and Keevy, 2018). Combining these credentials with macro-credentials (the type issued in full college, university or TVET programmes) into a portable digital format that is secure and verifiable will allow both employers and workers to have confidence that the credentials the worker presents are legitimate and valuable. According to Chakroun and Keevy (2018), blockchain technology may be of use in this regard, as “the implications for digital credentials include the ability to provide ‘a single secure record of educational attainment, accessible and distributed across many institutions’”. The development of world reference levels in training will allow for globalisation of the labour market and reduce frictions from labour mismatch. However, it
is imperative that quality of the qualifications be transparent and maintained; otherwise trust in the system of credentials may be undermined.

TVET will play a vital role in the recovery but it must adapt

Technical and vocational education and training (TVET) equips learners with knowledge and skills for employment. These skills are often less theoretical and more practical in nature than those acquired through education in a college or university, and the training can end with an apprenticeship. The COVID-19 pandemic has wrought havoc on the TVET sector due to closure of workplaces as part of public health measures, depriving students of the practical learning they need. The TVET sector has had to scramble to adapt digitally, perhaps even more so than colleges and universities.

Millions of workers in Emerging Asia, especially in the travel and tourism sectors, will need to reskill in order to earn a living during and after the COVID-19 pandemic. The pandemic and ensuing public health measures shut down international travel almost entirely, and put significant restrictions on domestic travel that lasted in some countries past the period of home confinement. As demand for tourism has collapsed, employees have been laid off and many businesses have failed. According to estimates by the International Labour Organization (ILO), more than half a million workers in the tourism sector in Thailand lost their jobs due to the pandemic, with the hardest hit areas found in the southern and central parts of the country (ILO, 2020c). Many will not be able to return to their former jobs. In addition, ILO estimates show that only 7% of workers in Southeast Asia and the Pacific are engaged in occupations that would allow them to carry out their work from home (Figure 2.17). It is thus vitally important for affected workers to be able to acquire new skills that will enable them to seek employment in other sectors. Some learning platforms are offering solutions to idle workers, including those who are not able to continue their regular activities and are unable to work remotely, as well as furloughed workers, workers in informal sectors and self-employed workers. For example, Mexico’s Capacitarse Para El Empleo online portal is currently offering free access to its hundreds of courses, as well as several diploma degrees for technical occupations, and has developed partnerships to expand this access to several countries in Central America (World Bank, 2020b).

Figure 2.17. Estimates of home-based work probabilities by sub-region, 2020

Note: The “Southeast Asia and the Pacific” aggregate is comprised of the following jurisdictions: Australia, Brunei Darussalam, Cambodia, Cook Islands, Fiji, French Polynesia, Guam, Indonesia, Kiribati, Lao PDR, Malaysia, Marshall Islands, Micronesia, Myanmar, Nauru, New Caledonia, New Zealand, Niue, Norfolk Island, Palau, Papua New Guinea, the Philippines, Samoa, Solomon Islands, Singapore, Thailand, Timor-Leste, Tokelau, Tonga, Tuvalu, Vanuatu and Viet Nam.
Source: ILO (2020a).
StatLink © https://doi.org/10.1787/888934229502
Some individuals might find returning to full-time study infeasible (World Bank, 2020b). TVET offers a unique solution because many TVET disciplines have an apprenticeship component. As an apprentice, one can learn and perform paid work simultaneously. The role of the state in facilitating reskilling will be to support individuals in training prior to the apprenticeship phase. This may take a number of forms, separately or in combination: tuition waivers or financing; preferential placement programmes that give priority to people who are unemployed and have a high likelihood of not being able to return to their former job or field; work-study opportunities for adults that give TVET students an opportunity to work at something else to earn an income until they reach the apprenticeship portion of their studies; and assistance with domestic duties (World Bank, 2020b).

TVET institutions can co-ordinate with authorities to participate in the health response to COVID-19 while simultaneously encouraging reskilling of newly unemployed workers in sectors expected to have slow or incomplete recoveries. This is already occurring in the region: TVET institutions in Thailand have been asked to contribute to the production of hand sanitiser; some Malaysian TVET institutions are assisting with the production of ventilators; Indonesian TVET institutions are beginning or expanding training for medical equipment technicians; institutions in the Philippines are producing hand sanitiser and masks. Culinary arts students in the Philippines are also contributing to the provision of food for frontline workers (Majumdar and Araiztegui, 2020). For as long as COVID-19 poses a public health threat, medical supplies will remain in high demand. Educational authorities may consider adopting a production school model, where trainees work under supervision as they learn, with only the most necessary theory to perform their required tasks. If these programmes were offered to individuals in need of reskilling, they could provide a short-term solution to unemployment caused by COVID-19 and restrictive measures, while giving them skills to build on for a more permanent career.

It is important to note that qualifications should be achieved as quickly as possible without sacrificing competency. Furthermore, policy makers should fortify credit-transfer systems across disciplines and levels of education. TVET graduates who wish to expand their skillset should have their prior credentials acknowledged as much as possible. This would allow people seeking upskilling to study only the new skills in depth, reducing the time to qualification and the associated cost. Transfers across levels of education should be streamlined and, in disciplines where this would be appropriate, work experience should be accepted as an alternative to college or university credit. For instance, a trained electrician who desired to move into electrical engineering should benefit from his or her prior experience. Likewise, any theoretical knowledge from secondary or post-secondary studies that is relevant to the TVET qualification of interest should count in favour of the student. Quality assurance is essential, and it would not be unreasonable to ask students seeking credit transfer to provide proof of learning or take a competency examination.

Two programmes of interest are the Kartu Prakerja programme in Indonesia and the Skills Passport programme in Sri Lanka. Kartu Prakerja is a government initiative where participants are enrolled in a TVET training course of their choosing, at no cost to them, and receive monthly stipends to help defray living costs. Participants also receive a further cash bonus if they successfully complete the course. The programme is open to anyone age 18 or over who is currently unemployed, with the exception of government officials and their family members (Government of Indonesia, 2020). The Skills Passport is a secure card containing the holder’s identity and skills information. This allows the card holder to be matched to jobs in a centralised database. The project is a joint venture of the Tertiary and Vocational Educational Commission of Sri Lanka, the Employers’ Federation of Ceylon and the ILO (Government of Sri Lanka). It is primarily targeted at Sri Lankan migrant workers who need recognition of their skills and experience gained abroad, but Sri Lankan authorities are also seeking bilateral skill-recognition agreements
with multiple countries. Failure to recognise skills earned in foreign countries creates unnecessary labour market frictions, at a cost to both the potential employer and potential employee.

Several approaches could be envisaged for ensuring the digitalisation of TVET (Table 2.5). Additionally, with the rapid shift of TVET to digital modes, maintenance of quality instruction is essential. In the European Union, for instance, the European Network on Quality Assurance (ENQA) and the European Quality Assessment Register (EQAR) have guided national quality assurance agencies on their responses. Where physical visits were not permitted due to public health measures, agencies were encouraged to visit by video or postpone the visits to a later date. Regional programmes such as the ENQA and EQAR provided national or subnational education authorities with advice on content development and practical matters for the transition to online study for both learners and instructors. This assistance also included assessment planning and procedures to maintain academic standards. All of these are vital aspects of the transition to fully digital or blended learning so that neither graduates from these learning modes nor industries are disadvantaged. The ENQA is already working with several other organisations alongside ASEAN to train quality assessors for the region (ASEAN-QA Quality Assurance Training Course). Forming bodies similar to the ENQA and EQAR at the regional level within ASEAN could help with information sharing on methods to improve TVET education and could also provide more support to reciprocal recognition of TVET training from accredited institutions in ASEAN countries.

### Table 2.5. Examples of approaches towards digitalising TVET in selected Emerging Asian economies

<table>
<thead>
<tr>
<th>Approach</th>
<th>Description of approach</th>
<th>Examples of countries where the approach has been deployed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Massive Open Online Courses (MOOCs)</td>
<td>Large courses delivered by the internet, often with minimal standards for enrolment (King and Marwala, 2017). In a MOOC environment, instructors and assistants may not need to deliver lectures live, but be prepared to answer questions from a student body displaying a broad range of competency levels, as well as being able to respond to technical issues.</td>
<td>Malaysia: Zulkifli et al. (2020) find that TVET students in Malaysia are open to learning in MOOCs and are prepared to do so. Philippines: The Technical Education and Skills Development Authority of the Philippines has developed some TVET-themed MOOCs. A MOOC can be used for “remote and flexible TVET programmes for agriculture” and to “promote TVET in the Philippines through the development of quality-assured and competency-based training courses and modules” (Ehlers, 2020). China: Under an initiative by the Ministry of Education, more than 18,000 MOOCs have been built, with cumulative enrolment of 310 million.</td>
</tr>
<tr>
<td>Open Educational Resources (OER)</td>
<td>An OER is defined as “learning, teaching and research materials in any format and medium that reside in the public domain or are under copyright, that have been released under an open licence, that permit no-cost access, re-use, re-purpose, adaptation and redistribution by others” (Ehlers, 2018). OER have the potential to contribute substantively in the task of skilling people. Increased availability and use of OER will lead to better access, thereby contributing to more equity, and to higher quality and improved efficiency of TVET (Ehlers, Schuwer and Janssen, 2018).</td>
<td>In a recent study conducted by OERasia, the usage of OER was found to be widespread in Asian countries, with China using them the most. Many ASEAN countries have followed suit and are reaping the advantages, with Viet Nam and the Philippines utilising OER for both individual and institutional purposes (Abeywardena and Dhanarajan, 2012).</td>
</tr>
<tr>
<td>Digital simulators</td>
<td>TVET institutions are developing digital simulators for trainees to develop their practical skills despite the COVID-19 public health restrictions. Simulations range from the ability to explore a tool or device to being able to perform simulated procedures that an apprentice would typically perform in the workplace. Even if development via simulators is not perfect, they can shorten the time to qualification once TVET facilities are again allowed to operate. Qualifications can be issued in a provisional manner that requires real practice when conditions permit.</td>
<td>Simulators are data intensive and as such may have limited utility in some countries in Southeast Asia.</td>
</tr>
</tbody>
</table>
The road forward in digital education

The rapid adaptation of education to the COVID-19 situation should be considered a great achievement. The sudden need to adapt to a digital environment posed challenges for schools, teachers and parents, and much progress has been made. However, a considerable amount of work remains to be done.

- ICT infrastructure expansion and access to the Internet and digital devices are crucial.
- Educational authorities were largely unprepared for this type of scenario, so curricula and protocols for digital instruction were new to most countries. Educational authorities faced twin pressures of minimising the learning losses from an extended time out of school, while also delivering a quality educational experience. Curricula and protocols need to adapt and should undergo continuous review with a goal of necessary modifications being made if needed.
- Students kept out of school likely suffered learning losses, with those unable to participate fully in remote learning seeing the harshest effects. Education officials must plan to help these students catch up and fill gaps in their education. As delays in educational progress carry their own costs, individualised approaches are likely to be necessary.
- Distance learning may require new assessment approaches and techniques. Emphasis should be placed on formative rather than summative assessments, though passage through educational milestones must be maintained as much as possible (UNICEF EAPRO, 2020b; UNESCO, 2020c). However, it is important to ensure that students are prepared to advance from any grade. Learning gaps compound over time and can have permanent negative effects on educational attainment, employment and well-being. According to a United Nations (2020), simulations in developing countries participating in PISA suggest that a learning loss of one-third in Grade 3 might result in 72% of students dropping out or being unable to learn new material by Grade 10.
- Schools that reopen must adhere to safety protocols, including a plan on how to cope with students or staff contracting COVID-19. The return to in-person classes should be largely voluntary, allowing families to take account of their own situations. Students will need to be able to participate in online learning without falling behind their in-class peers.
- Colleges and universities must maintain quality in a remote setting. Some institutions were already holding online instruction prior to COVID-19, while others had to transition quickly. Colleges and universities may need to work with government officials to provide tuition relief for students whose economic situations have changed. As with primary and secondary school, there must be thoughtful consideration of graduation, especially if the situation has left courses incomplete.
- People returning to education for the purposes of reskilling may be adults with responsibilities that are incompatible with full-time study. Courses should be designed so that people being reskilled can also work to provide for themselves or families. Government support in caretaking duties may prove helpful to those with children or elderly parents at home.
- Many instructors and teachers in the region have deficient ICT skills, which presents another barrier to online learning. There is also the new challenge of managing an online classroom in a way that keeps all learners engaged with teachers and with each other. Training efforts must address these issues in the short term as part of a learning continuity response to COVID-19, but they also need to be addressed
in the long term through instructor education. ICT skills and distance lesson delivery must be incorporated into the required training of candidate teachers, professors and instructors, regardless of the level or discipline in which they desire to work. Regular ICT upskilling must also occur. Training should be continually reviewed to capture the newest digital education technologies and should be taken as professional development on an annual basis. Instructors must also learn to manage a digital classroom, fielding content questions and facilitating discussion when students are not physically present in the same location. Use of discussion boards found on many learning management systems may be helpful, along with incentives for participation.

- Teachers will need to collaborate with parents to ensure that learning objectives are being met and that issues are addressed in a timely fashion. For students learning offline, there may be no interaction with teachers. Radio and television lessons likewise provide no opportunity for interaction, leaving parents to work with the students. For parents who are essential workers, this may pose a significant challenge. Areas where radio and television are the main modes of distance learning should work to facilitate regular communication between teachers and parents or students. This would allow parents and students to approach the teacher with concerns or questions about the material and to progress through it.

- TVET disciplines will likely require continued in-person instruction. Simulators may help somewhat, but they will be of little use in low-tech environments. Continuing apprenticeships should be a priority, and provisional qualifications with deferred in-person evaluation may be an avenue to consider. The recognition, development and use of OER can help TVET authorities adapt quickly to distance learning, minimising disruption. TVET can be a vital tool in reskilling efforts. Subsidised short TVET courses can help get people back into the workforce quickly and with stability. Secure digital micro-credentials can allow workers to specify their skills while maintaining trust. Education and training records based on block chain technology may play a role.

**Accelerating Industry 4.0 in the post-COVID-19 era**

Today’s technological advancement has brought the world to a new phase of industrial revolution. Generally referred to as Industry 4.0, the fourth industrial revolution focuses heavily on automation, interconnectivity and real-time data across the manufacturing supply chain, resulting in a smart factory. Additive Manufacturing (3D printing), advanced robotics, artificial intelligence (AI), augmented and virtual reality (AR/VR) and the Internet of Things (IoT), among others, are examples of technology associated with Industry 4.0.

Despite the widespread use of Industry 4.0 technologies in advanced economies, low penetration can still be observed in emerging economies. In a globalised world, where economies participate in global value chains, non-adoption of Industry 4.0 technologies may have significant economic consequences. This is particularly true for emerging countries where labour-intensive manufacturing makes an important economic contribution. With automation, a developed country may no longer see the advantage of offshoring. For instance, the unit labour cost of producing a cotton shirt in the United States and Europe would fall from USD 7.00 to USD 0.40 if sewing robots were employed, and countries such as India and Cambodia, where the approximate cost of producing the same shirt is USD 0.50 and USD 0.33 respectively, would eventually lose their competitiveness (ADB, 2018).
The importance of adopting Industry 4.0 technologies has been highlighted by the COVID-19 crisis. Restrictions on movement have slowed economic activities. Lockdown measures also disrupted the functioning of global value chains, which was particularly problematic for countries with high dependency on foreign suppliers. Adopting Industry 4.0 technologies can keep employees safe from exposure to disease while maintaining operational activities.

**Some countries in Emerging Asia are moving ahead with Industry 4.0**

Several countries in Emerging Asia have translated their awareness of the potential of advanced digital technologies for economic progress into a national policy agenda (Table 2.6). China, India and Singapore are among the region’s early adopters of the Industry 4.0 concept. ASEAN-5 countries have also started transforming their industrial sectors by embracing Industry 4.0 technologies, but the CLM countries (Cambodia, Lao PDR, Myanmar) lack a national strategic plan to adopt advanced technologies for the industrial sector.

<table>
<thead>
<tr>
<th>Table 2.6. Examples of Industry 4.0 initiatives in Emerging Asia</th>
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<td><strong>Country</strong></td>
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<td>ASEAN-5</td>
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<td>Indonesia</td>
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<td>Malaysia</td>
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<td>Philippines</td>
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<td>Thailand</td>
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<tr>
<td>Viet Nam</td>
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<tr>
<td>Brunei Darussalam and Singapore</td>
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<tr>
<td>Brunei Darussalam</td>
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<td>Singapore</td>
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<tr>
<td>China and India</td>
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<tr>
<td>China</td>
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<tr>
<td></td>
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<tr>
<td>India</td>
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</table>

Source: OECD Development Centre compilation based on national sources.

As countries seek to reform their industries, the region has seen wide adoption of industrial robots. Asia remains the strongest market for industrial robots, with the share of newly installed robots accounting for two-thirds of global supply (IFR, 2020). China’s annual installation of industrial robots is the highest globally, with around 140 500 new robots installed in 2019 (Figure 2.18). This may be explained by the fact that the country is shifting away from labour-intensive manufacturing. In terms of robot density, however, China stands at 187 units per 10 000 workers, far below Korea and Singapore, where industrial robot density is the highest globally. India and Thailand were among the 15 largest markets for industrial robots in 2019, with 4 300 newly installed in India and 2 900 in Thailand.
COVID-19 has sparked progress towards Industry 4.0

As the pandemic disrupted global economies, including in Emerging Asia, manufacturing activities were negatively affected. According to the United Nations Industrial Development Organization (UNIDO), a decline of 6% in global manufacturing output growth was recorded in the first quarter of 2020. In the Asia-Pacific region, developing countries registered a manufacturing growth rate of -2.5% year-on-year during the same period (UNIDO, 2020a). Nonetheless, the pandemic appears to be working as a trigger for accelerating the process of the fourth industrial revolution. Indeed, innovation, agility and flexibility in production systems are proving essential for firms to survive during the coronavirus pandemic, and Industry 4.0 technologies are allowing firms to stay responsive to market needs. In Denmark, Italy and the United States, firms temporarily converted their activities in an effort to generate revenue during the COVID-19 crisis. In Denmark, plastic production companies began producing personal protective equipment (PPE) such as visors, which are in high demand. In the United States, a manufacturer of high-end lighting used manufacturing apps to allow their workers to assemble protective gear for health professionals from home (WEF, 2020). In Italy, the regional 3D printing community, consisting of companies, labs and universities, was actively involved in making available 3D-printed valves and parts within a short time (WEF, 2020). Such initiatives are also taking place in Emerging Asia.

In China, manufacturing output dropped by 14.1% in the first quarter of 2020 (UNIDO, 2020a), but activities resumed by the end of the second quarter and recovery is forecast to take place faster than in other countries (OECD, 2020c). The adoption of digital technology may partially explain China’s higher business resilience and rapid recovery. The Chinese State Council attributed the rebound in economic activity to a surge of new engines, new business and new models. High-tech industries are playing a key role. During the first seven months of 2020, investment in high-tech manufacturing industries and high-tech services increased by 8.8% and 7.2%, respectively (NBS, 2020). In addition, more than 30% of Chinese companies participating in a survey responded that they were accelerating automation initiatives. This number is significantly higher than in the rest of Asia (16% of respondents) and the rest of the world (18%) (Agrawal et al., 2020).
Despite a slowdown in factory activities in India, the pandemic seems to be accelerating innovation and the adoption of Industry 4.0 technologies. The government co-operated with big manufacturers, start-ups and academia to respond to increasing demand for medical equipment and PPE. Manufacturing of ventilators is a case in point. Europe and China have been the primary sources of imported ventilators for India, but given the disruption of trade during the lockdown, several Indian non-medical industries shifted their activities and collaborated with engineering and technological institutes across the country to boost domestic ventilator production. Workers and engineers collaborated remotely due to restrictions on movement. 3D printing is being used in the production process, as this technology allows lower costs for making prototypes and testing new products. As a result, India was able to produce 60,000 ventilators within three months, a significant advance from previously producing almost no ventilators domestically (Aggarwal et al., 2020).

In Singapore, firms are moving forward with digital transformation, and manufacturers have made shifts in production activity to help fight COVID-19. For instance, automotive and electronics manufacturers responded to requests for the production of ventilators, while breweries and distilleries converted their activities to produce hand sanitiser (Keat, 2020). The pandemic’s impact is accelerating innovation in other Singaporean industries. For example, a medical device producer developed an Alpha ventilator that can be controlled over the Internet. Unlike conventional ventilators, which need to be read and adjusted manually, the remote-controlled Alpha ventilator reduces the need for health care workers to gear up with PPE merely to take readings or make adjustments (EDB, 2020).

In Thailand, the Board of Investment has offered measures to accelerate investments in the medical industry. Complementing a pre-existing tax holiday of three to eight years for qualified companies in the medical device, equipment and supply industry, the new measures include a 50% reduction in corporate income tax for a further three years (OBG, 2020). Moreover, an exemption from import duties on machinery will be given to manufacturers who adjust their existing production lines to manufacture medical devices or parts. With such incentives, manufacturers are being pushed to innovate and increase their production capacity to respond quickly to the increasing demand for medical equipment during the pandemic.

In parallel, the need to manage cash flow pressures that have arisen during the pandemic has pushed many firms to improve business efficiency through the use of technology. Many businesses in Emerging Asia, including SMEs, are tapping into the opportunities offered by the digital economy as a way to cope with the COVID-19 crisis. New initiatives have also been introduced or previous initiatives adjusted by governments to spur digitalisation of businesses to allow them to thrive amid the pandemic (Table 2.7).

### Table 2.7. Initiatives to support digitalisation during COVID-19

<table>
<thead>
<tr>
<th>Country</th>
<th>Initiative</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>IoT Smart Machine</td>
<td>Providing IoT Smart Machines to retail markets, pharmacies and supermarket chains to minimise personal interactions when people purchase daily necessities and groceries</td>
</tr>
<tr>
<td>Malaysia</td>
<td>National Economic Recovery Plan (PENJANA)</td>
<td>Offering a set of incentives for MSMEs and mid-tier companies to encourage adoption of e-commerce and to digitalise operations and trade channels</td>
</tr>
<tr>
<td>Philippines</td>
<td>Small Enterprise Technology Upgrading Programme (SET-UP)</td>
<td>Providing assistance to MSMEs for procuring necessary equipment and training, and offering an innovation-enabling, interest-free loan of up to PHP 5 million (Philippine pesos)</td>
</tr>
<tr>
<td>Thailand</td>
<td>Saphan Digital</td>
<td>Offering local businesses, individuals and NGOs a wide range of digital support and access to experts to help them acquire digital skills</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>Digital transformation campaign</td>
<td>A campaign to step up digital transformation using cloud computing technology; some domestic cloud-computing enterprises have committed to offer a 20% discount to new users to stimulate demand</td>
</tr>
</tbody>
</table>
Industry 4.0 faces country-specific challenges in Emerging Asia

While there are some common challenges in the region with regard to Industry 4.0, some country-specific challenges prevail, as each country is at a different level of readiness and has a different economic structure. These challenges include lack of digital awareness, insufficient budget, a shortage of skilled labour and inadequate infrastructure. Table 2.8 presents a brief summary of the current state of play. The countries will be considered individually thereafter.

Table 2.8. Country-specific challenges for Industry 4.0 in Emerging Asia

<table>
<thead>
<tr>
<th>Country</th>
<th>Industry 4.0 challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASEAN-5</td>
<td></td>
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<tr>
<td>Indonesia</td>
<td>Raising awareness of new digital technologies</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Addressing financing issues to boost digitalisation of SMEs</td>
</tr>
<tr>
<td>Philippines</td>
<td>Meeting the need for future skills</td>
</tr>
<tr>
<td>Thailand</td>
<td>Overcoming skills shortages</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>Creating incentives for digital transformation</td>
</tr>
<tr>
<td>Brunei Darussalam and Singapore</td>
<td>Fostering digital awareness and SME development</td>
</tr>
<tr>
<td>Brunei Darussalam</td>
<td></td>
</tr>
<tr>
<td>Singapore</td>
<td>Boosting technology adoption among SMEs</td>
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<tr>
<td>CLM countries</td>
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<tr>
<td>Cambodia</td>
<td>Enabling conducive industrial infrastructure</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>Expanding digital connectivity</td>
</tr>
<tr>
<td>Myanmar</td>
<td>Improving basic infrastructure</td>
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<tr>
<td>China and India</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>Setting technological standards</td>
</tr>
<tr>
<td>India</td>
<td>Fostering SME participation and addressing cybersecurity</td>
</tr>
</tbody>
</table>

Source: OECD Development Centre based on various national sources.

Affordable and reliable Internet connectivity is fundamental for firms to go digital, and it becomes more crucial during a pandemic to support remote working activities. Yet Internet speed in many countries of the region is still below the global average (Figure 2.13). Fixed broadband, which offers a more reliable network and higher data transfer speeds, also remains costly in some countries, and countries where the cost of fixed broadband is higher have fewer subscribers.
Indonesia: Raising awareness of new digital technologies

Technology adoption by Indonesian firms remains low. According to a study by the Asian Development Bank (ADB), only 6% of surveyed firms can be considered technologically advanced (ADB, 2020a). In contrast, 64% of firms still have low technology adoption, mainly performing their activities manually and on paper, or with basic tools such as spreadsheets and e-mail. They often have no in-house research and development (R&D) or innovation capability. The other 30% can be classified as intermediate technology adopters, as they already employ some advanced technologies, such as SAP, Oracle, ERPs, customer relationship management, computer-aided manufacturing and a collaborative supply chain. This group of intermediate adopters may be motivated to innovate but is often hindered by a lack of resources.

Lack of access to information on digital technologies is another issue. Although the government launched Making Indonesia 4.0 in 2018 to assist companies and help address barriers to technology adoption, 93% of the firms in the survey said they were unaware of this initiative (ADB, 2020a). Further efforts to alert firms to the availability of such programmes may be needed. The government could complement its Indonesia Industry 4.0 Readiness Index initiative by providing facilities to increase collaboration between firms and other innovation stakeholders and to showcase the real value of new technological applications. Barriers to the adoption of new technologies that were highlighted in the survey are shown in Table 2.9.

Table 2.9. Barriers to technology adoption across manufacturing firms in Indonesia

<table>
<thead>
<tr>
<th>Ecosystem enablers</th>
<th>Inadequate digital infrastructure</th>
<th>Lack of access to expertise</th>
<th>Lack of access to information</th>
<th>Lack of incentives</th>
<th>Lack of skills</th>
<th>Technology cost</th>
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<tbody>
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<td><strong>Advanced</strong></td>
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<td>Y</td>
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<tr>
<td>Electronics</td>
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<td>Food and beverages</td>
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<tr>
<td>Textiles, clothing and footwear</td>
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<td><strong>Intermediate</strong></td>
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<td>Textiles, clothing and footwear</td>
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<td><strong>Basic</strong></td>
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<td>Automotive</td>
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<td>Electronics</td>
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<td>Textiles, clothing and footwear</td>
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</table>

Source: Adapted from ADB (2020a).

Malaysia: Addressing financing issues to boost digitalisation of SMEs

The positive attitude shown by Malaysian SMEs towards digital technology adoption was evident from the start of the COVID-19 pandemic. A large number of manufacturing companies took advantage of downtime to study their operations and processes, and seek technologies able to support their needs (FMM, 2020). However, despite positive attitudes toward ICT, the use of software or digital automation to improve business processes is not common among Malaysian SMEs (MPC, 2020). Approximately half of SMEs responding to a survey by SME Corp and Huawei Technologies identified financing as a barrier to making
desired improvements. Sixty per cent were unaware of financing options, and some still mistakenly believed advanced ICT tools like cloud computing to be expensive (SME Corp and Huawei, 2018). In a separate survey by the Federation of Malaysian Manufacturers (FMM), affordable automation and digitalisation packages were found to be among the most desired for manufacturing SMEs.

The government has introduced initiatives, mainly financial aid, to help SMEs adopt digital tools. However, these initiatives come with restrictions, including a limit on the number of SMEs that can apply. For instance, the SME Digitalisation Grant is limited to the first 100 000 applicants (MDEC, 2020), while the Readiness Assessment of Industry 4.0, a programme launched under the Malaysia’s Industry4ward policy, has seen a very limited take-up rate. Among respondents to the FMM survey, only 23% had applied for the programme, and just 36% of these applicants were selected. Firms that did not apply mentioned limited budgets and lack of awareness of the programme as among the main reasons (FMM, 2020). The government might therefore need to reduce restrictions on participation and expand outreach to help boost digitalisation of SMEs.

**Philippines: Meeting the need for future skills**

Use of digital technologies in the Philippines has increased during the COVID-19 crisis, helping individuals, businesses and the government to cope with physical distancing measures. Around 17% of Philippine companies with digital transformation projects reported that the crisis pushed them to start implementing the projects (Grant Thornton, 2020). However, technology adoption in the manufacturing sector is relatively slower than in the services sector. In the services sector, Information Technology and Business Process Outsourcing (IT-BPO) is one of the largest contributors to the country’s economy (Kim et al., 2019). With talented workers, a beneficial cost structure and a stable socio-political and economic environment, the Philippines has become the second outsourcing destination globally, behind India (Chang et al., 2016; Tholons, 2016). BPO is dominated by call centre activities that absorb 87.6% of workers in the sector (Figure 2.19). 46.2% of BPO establishments engage in the sector’s second largest field, computer-related activities. Other activities in the sector include medical transcription and animated films and cartoon productions.

**Figure 2.19. BPO sector in the Philippines, 2016**

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Establishments</th>
<th>Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call centre</td>
<td>50.4</td>
<td>87.6</td>
</tr>
<tr>
<td>Computer-related</td>
<td>46.2</td>
<td>11.6</td>
</tr>
<tr>
<td>Medical transcription</td>
<td>2.4</td>
<td>0.5</td>
</tr>
<tr>
<td>Animated films and cartoon productions</td>
<td>1.1</td>
<td>0.3</td>
</tr>
</tbody>
</table>

StatLink [https://doi.org/10.1787/888934229521](https://doi.org/10.1787/888934229521)
BPO firms in the Philippines are shifting toward more specialised BPOs, such as cover-fraud analytics, data integration, project management, R&D, merger and acquisitions valuation and product profitability analysis (World Bank, 2020c). This makes it essential to upskill and reskill the labour force. Mismatches between technical skills taught in classrooms with skills needed in the workplace are cited by many ICT firms (World Bank, 2020c). This has led to firms hiring IT professionals from abroad or invest in training for new hires, including those with ICT-related credentials.

Thailand: Overcoming skills shortages

Under the Thailand 4.0 policy, the country has invested massively in connectivity and digital infrastructure. A study covering 320 firms found that a majority (approximately 59%) would use technology to compensate for the shortage of workers during the COVID-19 crisis (UNIDO, 2020b). The demand for tech-savvy workers is likely to increase, yet the country faces a shortage of industry-ready skilled workers, most importantly with IT and STEM-related skills. For instance, vocational colleges and universities in the vicinity of the Eastern Economic Corridor can fill only 30% of the demand for skilled workers, while more investors in the area are adopting modern technologies (Asia Foundation, 2020). Low enrolment in STEM fields also constitutes a challenge. As of 2016, the share of graduates from STEM programmes in tertiary education remained low, at 27.86%, significantly lower than 68.82% of students graduating in the same year from programmes other than STEM (Figure 2.20).

![Figure 2.20. Distribution of tertiary graduates by field of study, Thailand](image)

Source: UNESCO (2020d), UIS Statistics (database). StatLink [https://doi.org/10.1787/888934229540](https://doi.org/10.1787/888934229540)

Thailand will need to invest in human capital to provide more Industry 4.0-ready professionals. Adjustments within the education system, for instance by enhancing the role of TVET in producing graduates with specialised skills needed for Industry 4.0, could help. Raising awareness of IT and STEM-related careers in manufacturing might be needed as well, since public perceptions of this sector in Thailand are often negative (Jones and Stowell, 2019). A public awareness campaign could inspire more people to pursue careers in manufacturing 4.0. Examples include “Dream It. Do It.” in the United States and Young Engineers Australia.

Viet Nam: Creating incentives for digital transformation

Viet Nam’s government began focusing on Industry 4.0 as early as 2017 with a directive on strengthening access to the Fourth Industrial Revolution (Directive No. 16/CT-TTg). Through massive investment and development in public IT infrastructure, Viet Nam was
among the world's first countries to test 5G, which will have its commercial launch in 2021. The country also boasts the region's lowest-cost fixed broadband. Moreover, the ICT industry has been growing rapidly: exports of ICT goods amounted to 33.45% of Viet Nam’s total goods exports in 2017, compared to 4.95% in 2007 (Figure 2.21).

![Figure 2.21. ICT goods exports, Viet Nam 2007-17](image)


Favourable IT infrastructure, strong performance in the ICT sector and large smartphone penetration are among key enablers of the surging digital economy in Viet Nam. The COVID-19 pandemic accelerated digital transformation in the retail sector, with many businesses rushing to adapt. E-commerce, online shopping and online delivery services contributed positively to the Vietnamese retail market in the first quarter of 2020 (IDEA, 2020).

Having a clear national vision can help Viet Nam maximise its potential to use Industry 4.0 as a means of becoming competitive with its ASEAN neighbours. Lack of financing and insufficient information, particularly regarding the economic benefits of technology adoption, have been identified as barriers to digital transformation in Vietnam (Cameron et al., 2019). The government could develop action plans and policy mechanisms to maximise potential, such as offering financial incentives, readiness assessment or other assistance for firms willing to embark on digital transformation.

**Brunei Darussalam: Fostering digital awareness and SME development**

The economy of Brunei Darussalam has been heavily reliant on the oil and gas sector, which accounted for more than 90% of its exports in 2019 (DEPS, 2020). For long-term economic sustainability, the government shifted its focus in past years to economic diversification. Industrial sites have been established and basic and digital infrastructure improved, with a sharp increase in fixed broadband penetration for households and businesses, from 20.1% to 51.6% in 2019 (MoFE, 2020). Concerning human capital, Brunei Darussalam was ranked third among ASEAN countries in reading, mathematics and science performance in the 2018 PISA rankings. With highly skilled workers, high quality infrastructure and strong political will to diversify the economy, especially through the digital economy, Brunei Darussalam has great potential to benefit from Industry 4.0.

In 2020, the government launched the Digital Economy Masterplan 2025 with a vision to become a smart nation through digital transformation. Digitalisation of industry is among the plan’s key strategies, but barriers remain. First, businesses lack understanding of digitalisation due to unfamiliarity with the implementation of Industry 4.0 technologies (MTIC, 2020). The government plans to assess the capabilities and readiness of business to
adopt Industry 4.0 solutions. Industry awareness activities and pilot projects to showcase advanced technologies may also help to address this issue. Second, SMEs, which account for roughly 98% of the country’s enterprises, are still in the early stages of growth (OECD, 2018). Many of these establishments are struggling with competitiveness issues, which limit their capacity to innovate. To overcome these barriers, the government may need a strategy to strengthen the development of local SMEs. As of 2018, specific policies targeting SMEs were still lacking, with regulations often covering all types of business (OECD, 2018). These non-specific regulations can potentially hold back the development of SMEs.

Singapore: Boosting technology adoption among SMEs

Infrastructure and enabling environment are being continuously set in place to support Industry 4.0 in Singapore, and digital adoption within the industry sector has improved in recent years. The level of technology adoption varies, however. While basic digital tools, such as computers and websites, are widely adopted, the use of advanced digital technologies, such as AI, data analytics and IoT, remains low. This low rate of advanced technology adoption among firms is found to be driven by SMEs (Tan and Chian, 2019). As of 2019, SMEs made up 99% of all enterprises in Singapore and contributed to 72% of employment (Singstat, 2020). Supporting SMEs in their digitalisation efforts is therefore critical. A set of government initiatives has been introduced to help SMEs harness digital technologies. These include the Technology Adoption Programme, the Productivity Solutions Grant and the SMEs Go Digital programme.

According to an ASME-Microsoft study, 83% of SMEs in Singapore had digital transformation strategies in place as of October 2020 (Microsoft, 2020). However, more than half of the SMEs surveyed reported delays in their digitalisation plans due to COVID-19. SMEs that had already started implementing their digital transformation initiatives also reported only moderate levels of success: only two in five perceived they were successful in transforming digitally. The study highlights that high implementation costs remain the biggest challenge faced by SMEs in their digitalisation journey, but it also found that most were unaware of government initiatives targeted to SMEs. In fact, government schemes tend to benefit larger firms, the study found. Plans to adopt advanced technologies including AI, business process apps and big data analytics in the coming year are particularly prevalent among larger companies. Outreach activities to increase awareness of existing government initiatives could enhance advanced technology adoption by Singapore’s SMEs and improve their digital transformation success rate.

Cambodia: Enabling conducive industrial infrastructure

Cambodia’s government emphasises the digital economy and Industry 4.0 as key drivers of economic diversification under its Rectangular Strategy Phase IV, which intends to achieve the vision of becoming a high-income country by 2050 (RGC, 2018). With wide use of smartphones by its population, increasing foreign direct investment (FDI), the development of Special Economic Zones and other supporting factors, Cambodia has the potential to leapfrog into Industry 4.0. However, the country faces key barriers.

First, Cambodia needs to improve its basic infrastructure, notably electricity. The high cost and insufficient supply of electricity are challenges for many companies, with around half of manufacturing firms experiencing electrical outages (UNDP, 2020b). The high cost of electricity can also create a competitive disadvantage, especially for the emerging manufacturing sector with a high dependency on electricity. Second, reliable digital infrastructure is also important. Cambodia has the highest 4G coverage and Internet penetration among CLM countries (Economist Intelligence Unit, 2020), yet there has been little progress in broadband connectivity. Fixed broadband costs are relatively
high and subscriptions remain low, with only one of every 100 inhabitants subscribed. Therefore, to adopt Industry 4.0, the country needs to work on industrial infrastructure, most importantly by closing the gaps in electricity supply and broadband coverage.

**Lao PDR: Expanding digital connectivity**

The electricity sector makes a high contribution to industry in Lao PDR, accounting for 10.6% of the country’s GDP in 2017 (LSB, 2018). Three-quarters of total production in 2018 was exported (AMRO, 2020). In comparison, the manufacturing sector accounted for only 7.49% of GDP in 2017 (LSB, 2018). Lao PDR can benefit from Industry 4.0 adoption within its industrial sector. By using the IoT in the electricity sector, it will be easier to monitor dam and hydropower systems. In the manufacturing sector, automation can boost productivity and further increase competitiveness. However, Lao PDR lags behind its peers in terms of Industry 4.0 adoption. Digitalising the economy is still absent from the country’s development agenda, and the overall business environment needs to be improved so that entrepreneurs can do business more efficiently and compete internationally. More importantly, inadequate digital infrastructure needs to be addressed as it remains a major barrier for the country to embrace Industry 4.0.

Lao PDR has seen rapid expansion of mobile broadband Internet services. However, the coverage is limited, with many rural and remote areas still unserved. Among the CLM countries, Lao PDR has the lowest coverage of 3G and 4G networks. Latest data from the Economist Intelligence Unit revealed that 3G and 4G networks cover only 78% and 43% of the population (Figure 2.22). In comparison, the 4G network serves 80% and 75% of the population of Cambodia and Myanmar, respectively. With such limited access, Lao PDR may find it difficult to respond to the boom in online economic activities. In addition, fixed broadband services remain limited. Many consumers and private companies are reluctant to use fixed broadband Internet due to its unreliability and high cost (UNCTAD, 2018). Therefore, there is an urgent need to improve the availability, affordability and quality of both mobile and fixed broadband services. Regulatory reforms may be needed to stimulate digital infrastructure investments and to boost competitiveness among service providers. To expand network coverage, especially in rural and remote areas, the government can boost private investment, for example through private-public partnerships.

**Figure 2.22. Network coverage in CLM countries, 2020**

<table>
<thead>
<tr>
<th>Country</th>
<th>4G Coverage</th>
<th>3G Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myanmar</td>
<td>75.0%</td>
<td>94.1%</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>43.0%</td>
<td>78.0%</td>
</tr>
<tr>
<td>Cambodia</td>
<td>80.3%</td>
<td>85.1%</td>
</tr>
</tbody>
</table>

*Source: Economist Intelligence Unit (2020), The Inclusive Internet Index 2020 (database), [https://theinclusiveInternet.eiu.com/](https://theinclusiveInternet.eiu.com/)*

StatLink: [https://doi.org/10.1787/88893429578](https://doi.org/10.1787/88893429578)
**Myanmar: Improving basic infrastructure**

Myanmar’s manufacturing sector has experienced significant expansion in recent years. According to the country’s Central Statistical Organisation, the sector’s contribution to GDP rose to 23.8% in early 2018 from 12.8% in 2006. There has also been rapid growth within the garment sector, with exports rising to more than USD 2.5 billion in early 2018 from less than USD 1 billion in 2015 (CSO, 2019). However, further expansion of manufacturing can be hindered by issues related to basic infrastructure, such as unstable electricity supply. Due to frequent power outages, manufacturers are relying on large-scale generators to maintain production activities (AHK, MSR and Roland Berger, 2019). The electrification rate in Myanmar is the lowest in the region, and only 66% of the population has access to electricity (Figure 2.23).

**Figure 2.23. Population with access to electricity in Emerging Asian economies, 2018**

![Population Access to Electricity](https://doi.org/10.1787/888934229597)

With respect to telecommunications and technology, Myanmar’s effort to liberalise the sector has led to a significant drop in SIM card prices and has increased access to affordable mobile broadband (AHK, MSR and Roland Berger, 2019). While there are few concerns related to service provision of mobile broadband, challenges remain on fixed and wireless infrastructure. Such infrastructure mainly covers urban areas, such as Yangon, Mandalay and Nay Pyi Taw (MoTC, 2020). In addition, the cost of fixed broadband services is relatively high in terms of gross national income per capita. Addressing the issue of fixed broadband affordability may help Myanmar to expand Industry 4.0 adoption.

**China: Setting technological standards**

The Made in China 2025 initiative marks the first step of the Chinese government’s plan to make the country the world’s leading manufacturing power by 2049. In modernising the manufacturing industry, the government foresees a key role for industrial Internet platforms. There is room for further improvement in the Chinese manufacturing industry. In particular the digital connectivity of manufacturing equipment remains uneven (Arcesati et al., 2020). A set of strategies has however been introduced which, in addition to the industrial Internet platforms operated by many companies, may facilitate this improvement. Moreover, big data usage is not yet optimised for high-value creation or predictive maintenance, as the majority of Chinese industrial digital platforms are
still limited to helping firms connect devices into a cloud (Arcesati et al., 2020). Among firms that already use sensors to collect data, relatively few use the data to discover new insights or develop forecasting and optimisation models (Deloitte, 2017).

Interoperability standards and regulations on data security would improve digital performance of SMEs in China. The interconnection of machines and devices is possible when data are standardised. However, as reported by some Chinese cloud and Industrial IoT platform providers, many SMEs have incomplete information systems or tend to stick with old systems (Arcesati et al., 2020). In a survey of companies, issues with interoperability standards were reported by more than half of respondents as the main challenge in applying Industrial IoT (Deloitte, 2017). In addition, the industrial intelligent software deployed by the Chinese manufacturing industry may vary, making production equipment and facilities incompatible (Feng et al., 2018). The development of interoperability standards would allow Chinese manufacturing to realise the full potential of the IoT.

India: Fostering SME participation and addressing cybersecurity

India is focusing on Industry 4.0 in light of the government’s target of increasing manufacturing output to 25% of GDP by 2025, from 16% in 2016 (Grant Thornton, 2017). As initiatives are put in place, such as the Centre of Excellence on IT for Industry 4.0, firms in the manufacturing sector are starting to adopt digital solutions. However, Industry 4.0 is still in its infancy in India. Clarifying the economic benefits of adopting digital solutions and resolving cybersecurity issues would likely speed its progress, particularly among large manufacturing organisations (EY, 2020). At the same time, India’s SMEs have very little access to automation technologies (Jadhav and Mahadeokar, 2019). A study conducted by the Asian Productivity Organisation found that lack of digital capabilities, insufficient knowledge, especially with regard to cybersecurity, and difficulty in defining the starting point are among main barriers faced by SMEs in adopting advanced technologies (NPC, 2018; NPC 2019).

As lack of knowledge is often cited as a major barrier for SMEs, a good first step might be to increase awareness of digital technologies and the benefits of their adoption. SMEs need to be given easy access to automation technologies and assistance in starting their digital transformation. Improving collaborative efforts among government, academia and industries, including technology providers, could help address the issue. The Centre of Excellence on IT for Industry 4.0 is indeed a good start. This initiative could be developed to better serve SMEs in undertaking digital innovation. Public authorities might also need to address challenges related to cybersecurity. This is in line with findings from India’s Cybercrime Survey, that 79% of enterprises included cybersecurity among the top five business risks (KPMG, 2017).

Greater regional co-operation is needed for a smooth transition to Industry 4.0

Several Emerging Asian countries have taken initiatives to remain competitive by adopting the Industry 4.0 concept as the main driver of economic growth. However, implementation is still in its infancy. More can be done for the region to thrive in the era of advanced technology. Lack of awareness, inadequate infrastructure, shortages of skilled workers, limited financing capacity and weak cybersecurity are among the main factors that contribute to low adoption of Industry 4.0 technologies. Existing government initiatives mainly benefit large companies and have not reached many SMEs, the backbone of Emerging Asian economies. In CLM countries, both basic and digital infrastructure have deficiencies that must be rapidly addressed.
Industry 4.0 can be considered as a data-driven revolution, since data are a key ingredient for industrial production. The COVID-19 crisis led some businesses to transform their operations digitally, and many are joining the digital economy. The seamless flow of data and information is a fundamental component of this transformation. The ability to access, process and store data across borders can bring many benefits, for example increasing the range of cloud service providers available to firms. Access to larger resources can also create opportunities for new forms of collaboration to improve performance and increase efficiency. Moreover, open data sharing platforms can catalyse collective innovation among countries. Despite these benefits, the free flow of data can also bring challenges, especially issues related to confidential and sensitive information placed on commercial servers, such as health records and financial transactions. Therefore, countries must co-ordinate in setting rules and regulations that govern cross-border data flows.

The region also needs to involve the private sector in the process of deepening the regional co-operation in the field of cybersecurity. The cybersecurity threats do not concern only the national institutions (Shahar et al., 2019), but have cross-border implications as well. From 2014 to 2019 Cambodia and Lao PDR did not conduct any cybersecurity research, while Singapore, Malaysia and Myanmar conducted 70% of the research in the ASEAN region over the same interval (Shahar et al., 2019). The countries are also at different stages of development regarding data privacy, data protection and cybersecurity legislation. These facts make it harder to facilitate a common cybersecurity co-operation network.

Nonetheless, ASEAN might need to invest more to respond to increasingly sophisticated cyber threats and to strengthen cyber resilience in the region. A regional co-ordination platform could: facilitate information sharing related to threat detection; improve awareness; and enable cross-border co-operation. Regional co-operation is also needed to harmonise cybersecurity standards and regulations. Differing country-level regulations may burden firms that seek to expand their business internationally. By harmonising cybersecurity standards and regulations, compliance costs for firms can be reduced.

The ASEAN member countries have launched ASEAN Digital Integration Framework (DIF) in order to overcome the barriers to digital integration. The DIF’s main targets are to facilitate seamless trade, protect data while supporting digital trade and innovation, enable seamless digital payments, broaden digital talent base, foster entrepreneurship and co-ordinate actions. The project was finalised in 2018 and adopted in 2019 (ASEAN, 2019). ASEAN countries have had earlier frameworks such as the Framework on Digital Data Governance in 2012 and ASEAN Framework on Personal Data Protection in 2016.

One of the initiatives launched as an action to the ASEAN Digital Integration Framework is the Go Digital ASEAN initiative which aims to equip MSME enterprises, which account for 99% of businesses in key sectors in most ASEAN economies, and youth, especially in the periphery, with crucial digital skills and tools. The digital integration, a key part of the project, can lead to the crucial digital inclusion, which is crucial for the success of the region. The project is implemented by The Asia Foundation and approved by ASEAN Coordinating Committee on Micro, Small and Medium Enterprises (ACCMSME) (The Asia Foundation, 2020).

**Cyberspace regional initiatives in ASEAN in response to COVID-19**

With more devices connected to the Internet and more activities performed on line, vulnerability to cyberattacks will increase. Responses to the COVID-19 pandemic caused more businesses and individuals to go on line due to physical distancing measures. This has generated an online environment ripe for cybercrime. According to Interpol (2020), main regional cybercrime threats were fraud; phishing; and sale of illegal or counterfeit medical supplies, drugs and PPE. Fake news and spread of misinformation were also reported among the survey participants. The participating countries consider that the
lack of cybersecurity knowledge hinders prevention of the most common cybercrimes. In the Philippines, for instance, the National Bureau of Investigation recorded a 200% increase of phishing scams since the country went into lockdown (Lin, 2020). In Malaysia, cybersecurity incidents during the Movement Control Order increased by 82.5% compared to the same period last year (Devanesan, 2020).

Box 2.5. Rise in ransomware incidents in Singapore

Singapore’s Cyber Security Agency (CSA) reported a steady increase in the number of ransomware incidents relative to last year, and has also reported several trends associated with this increase. Since 2019, cybercriminals have shifted their sights from low hanging opportunist targets to larger businesses and institutions that have higher value data, in the hopes of setting more lucrative ransom amounts (CSA, 2020a). Particularly concerning is the exposure of hospitals to this type of cyber threat, as they can lead to fatalities and other complications for hospitals that are already overburdened by the COVID-19 pandemic. In September 2020, there was a reported ransomware incident in Germany that led to the death of one citizen (HSCCC, 2020).

Although there have not been any reported fatalities related to ransomware incidents affecting hospitals in Singapore, this overall rise in ransomware cases reveals a potential threat to the health care sector. CSA received 61 reports of ransomware from January to October, an increase of almost 75% over the entirety of 2019.

Figure 2.24. Number of ransomware cases reported to CSA, 2016 - October 2020

Outside ransomware threats, there have been instances of criminals taking advantage of the COVID-19 pandemic by using themes related to the virus to establish phishing scams masquerading as official sources. There have also been instances of criminals impersonating government officials using fake e-mail addresses; one particular incident in March involved an e-mail supposedly from Prime Minister Lee Hsien Loong. The World Health Organization’s e-mail handle has also been reportedly acquired and used for criminal purposes (CSA, 2020b).
ASEAN member states’ cybersecurity capabilities vary considerably. Whether cybersecurity mechanisms are purely instated at the technological or socio-economic level, those differences pose a challenge in providing a unified and cohesive response to the increase in both the amount of threats and the new types of threats that have emerged following the onset of the COVID-19 pandemic.

To combat the spread of fake news and misinformation, the governments in the region have taken strong action against online hoaxes. For example, the governments of Singapore (2020) and Malaysia (2020) have launched websites and information campaigns against fake news and misinformation. A major policy issue with cybersecurity in general, but also misinformation, is inadequate legislation. For instance, Indian legislation does not contain terminology for fake news or misinformation (LoC, 2020). Cybersecurity threats are a major problem in Viet Nam. The country ranks among the most DDoS (Distributed Denial of Service) attacked countries in the world. Significant number of these attacks are targeted at critical national infrastructure. Many Vietnamese organisations are willing to invest in technology, but not nearly as many on cybersecurity (MIC, 2019a, 2019b).

Brunei Darussalam has tackled cybersecurity threats by launching a national cybersecurity agency to co-ordinate national efforts against cyber threats and cybercrime. The agency operates under the Ministry of Transport and Infocommunications. The agency is mandated to offer cybersecurity services and awareness to both the public and private sectors and to improve national cyber-resilience (CSB, 2020). Indonesia (BSSN), Malaysia (NCSA), Thailand (NCA), Cambodia (CamCERT) have also founded their own specific cybersecurity agencies (Yaksha, 2018). Given that cybersecurity threats are not constrained by borders, this issue requires a regional approach. However, ASEAN investment in developing cybersecurity measures and policies remains limited. Some initiatives to enhance the security of regional cyberspace are underway, including the ASEAN Cyber Capacity Programme, funded by Singapore, and the ASEAN-Japan Cybersecurity Capacity Building Centre, which is intended to develop a cybersecurity workforce.

The rapid increase in digitalisation will gradually usher in greater concern for cybersecurity, resulting in more initiatives being undertaken in this sphere by ASEAN countries. More developed countries, such as Singapore have displayed this pattern and continue to make strides in the enhancement of cybersecurity capabilities. In April 2015, Singapore established a Cyber Security Agency (CSA), giving it the responsibility to protect Singapore’s cyberspace. The CSA is given the tasks to monitor, mitigate and respond to cyber threats and protect critical information infrastructure (CII) within the country. Furthermore, the agency seeks to create strong links with other countries in the region, in an effort to create a more cyber resilient environment. The agency is currently working to establish an operational technology Cybersecurity Expert Panel (OTCEP) to provide advice to other ASEAN governments on improving their cybersecurity capabilities. The first meeting of the panel is scheduled to occur during first half of 2021. CSA also launched an innovative Cybersecurity Labelling scheme in an effort to better educate consumers in the domain of cybersecurity and allow them to make informed decisions when purchasing digital equipment.

ASEAN countries have no common regulation of cross-border data flows and have different levels of domestic regulation. Singapore, Malaysia, Indonesia and the Philippines have legislation, Thailand is acknowledging the issue, while Brunei Darussalam, Cambodia, Lao PDR and Myanmar have personal data protection legislation (ERIA, 2020).

Malaysia was one of the first ASEAN countries to set privacy legislation. The Personal Data Protection Act was passed in 2010. Legislation on the subject from as early as 1997 was used to initiate these laws. The Consumer Protection Act was also amended in 2010 in
order to protect consumers against e-commerce related scams and other safety concerns. Indonesia has been establishing e-commerce governance in the 2010’s. The Ministry of Trade has issued a law on trade, which requires e-commerce service providers to provide relevant data and information. The data to be provided include product descriptions, merchant qualifications, payment details and delivery procedures. Indonesia has also issued a Presidential Regulation on the e-commerce roadmap for 2017-19. The roadmap guides government agencies and central, local and regional governments to develop sector policies, programs and supporting and accelerating the development of e-commerce. The roadmap consists of eight e-commerce related sectors, including customer protection and cybersecurity, for instance. The roadmap has been divided to 26 programmes that have been carried out between 2017 and 2019 (ERIA, 2020).

The work-from-home arrangements in response to COVID-19 have highlighted the reality that cybersecurity capabilities are indeed crucial going forward. A secure cyberspace fosters both growth in business activity and governmental stability. Co-operation between the public and private sector is more vital than ever. This co-operation was evidently displayed during the fifth edition of the Singapore International Cyber Week (SICW) held from 5 to 9 October 2020 and organised by the CSA, where 6000 participants from 60 countries were in attendance. The participants and speakers came from various government and industry backgrounds. According to Singapore’s Safer Cyberspace Masterplan 2020, the CSA has funded research initiatives to develop AI technologies to help combat cyber threats and is currently collaborating with local industry firms to design an architecture for an integrated and automated Security-as-a-Service (SaaS) solution (CSA, 2020c).

Furthermore, a cyberspace that is governed at the regional level instead of at the national level creates a more unified system that is more resilient to cyber threats. During the 5th ASEAN Ministerial Conference on Cybersecurity (AMCC) held in October 2020, discussions were focused on the development of a rules-based cyberspace and strengthening Critical Information Infrastructure (CII) protection (CSA, 2020d). Capacity building is also a key development area in cybersecurity. The ASEAN-Japan Cybersecurity Capacity Building Centre, located in Bangkok and established in 2018; and the ASEAN-Singapore Cybersecurity Centre of Excellence located in Singapore and established in 2019 are both entities focused on achieving this goal.

Key challenges must be addressed to bolster cybersecurity

Cybersecurity development in ASEAN varies by country. A country’s secure critical infrastructure acts as an artery for a complex network of information and communication technology (ENISA, 2016). However, a current infrastructure technology gap exists within ASEAN, and cybersecurity capabilities follow this trend. Closing that technology gap logically precedes the development of technologies that safeguard that very infrastructure. ASEAN countries must strengthen the development of critical infrastructure technology and subsequently establish robust cybersecurity safeguards. In September, Viet Nam not only held meetings with neighbouring countries to discuss cybersecurity issues, but also participated in a meeting with the European Union (Viet Nam Ministry of Public Security, 2020).

There are several challenges in combatting cybercrime, particularly in crafting the right balance between privacy and security. Cyberspace currently provides a certain level of anonymity to criminals who have hostile transnational intentions, and the smarter the individual criminal or organisation, the more sophisticated the layers of anonymity become. In order to peel back the layers, there must be an increase in law enforcement presence on line, particularly on the dark web, where criminals benefit from encryption.
to conceal their identities and activities. According to a joint partnership study between United States National Institute of Justice and the RAND Corporation, 57% of the websites on the dark web are used for criminal purposes (Goodison et al., 2019). Law enforcement faces both technical and labour barriers to efficient monitoring of such a vast and increasingly complex cyberspace.

Developing ASEAN countries, such as Cambodia and Lao PDR, are lacking cybersecurity legislation or the policies are outdated, whereas advanced countries, such as Malaysia and Singapore, have more effective and up-to-date legislation.

In addition to many infrastructural and legislative challenges to cybersecurity, ASEAN countries also face shortages of skilled workers in the field. These can be ameliorated through educational incentives and tight government collaboration with universities and industry. Due to the public health responses to COVID-19, more people are working from home. These decentralised arrangements have exposed companies to more cyber threats, and companies are expected to allocate more resources to combat this issue. Thus, not only will the demand for cybersecurity professionals to provide enterprise-level solutions increase, but McKinsey & Company anticipates that companies will be particularly motivated to instate or fortify cybersecurity training for employees (Anant, Caso and Schwarz, 2020).

**Conclusion**

The rapid changes brought by digitalisation present both opportunities and challenges for Emerging Asia. The unprecedented environment created by the COVID-19 pandemic demonstrated the importance of digitalisation. Use of e-commerce and e-payment, online learning and health applications increased significantly due to the health crisis. The flexibility of digital tools and their effective use provided the ability to adapt quickly in various sectors, including health, education and business.

- Digital health showed its huge potential for solving pressing health issues during the COVID-19 crisis by reducing hospital attendance, enabling rapid delivery of diagnosis and treatment, and providing equality in access to health care. With more users incorporating digital health into their health care options, a radical shift from the traditional clinical approach is needed.

- In the education sector, further efforts are needed to ensure the continuity of education without sacrificing the quality of knowledge acquired or the well-being of students. Lifelong learning programmes and TVET have large potential to contribute to strengthening digital skills. However, these programmes need to adapt to the changing environment.

- The COVID-19 pandemic also triggered an acceleration of digital transformation to support Industry 4.0. The agility and flexibility offered by Industry 4.0 solutions allowed firms to increase business resilience amid restrictions on movement. In adopting Industry 4.0 technology, the region needs to increase digital security and co-operation, while country-specific challenges must also be addressed.
Notes

1. The survey used a four-point Likert scale (“strongly disagree”, “disagree somewhat”, “agree somewhat”, “strongly agree”) to ask five questions about the response to COVID-19 in their medical education. Students were asked: 1) whether they considered themselves physically and mentally capable of studying on line for the rest of the semester; 2) whether medical schools should give a passing grade to all their students (i.e., mass promotion); 3) whether they had enough time and resources for online learning; and 4, 5) whether the resources of their schools and the skills of their educators were adequate. The survey also identified ten barriers to online learning and asked students to answer how often they encountered these barriers by “never”, “sometimes”, “often” and “always”. The barriers identified were “difficulty adjusting learning styles”, “lack of basic needs”, “no device or limited access”, “need to work for extra income”, “lack of technical skills”, “mental health difficulties”, “unreliable or no Internet access”, “limited space conducive for studying”, “poor communication with educators” and “need to fulfill responsibilities at home”.

2. A sample of 450 teachers and school administrators from teacher training institutions in the Philippines responded with an average of 2.86 (“Agree”) on a 1-5 Likert scale (“Strongly Disagree”, “Disagree”, “Neither Agree nor Disagree”, “Agree”, “Strongly Agree”) to the statement “As a faculty, I am ready for Education 4.0 because I...” with eight different conclusions to that statement. Despite the moderately positive overall score, the respondents provided an average value of 2.4 (“Disagree”) to the statement “As a faculty, I am ready for Education 4.0 because I am skilful in the use of learning management system, google classroom, and online class modality”. If the teacher education instructors are unprepared, then they would be unable to pass the requisite digital skills onto their pupils for use in their classrooms. It is worth noting that respondents averaged 3.51 (“Strongly Agree”) to the statement “As a faculty, I am ready for Education 4.0 because I attend seminars and conferences to enhance my technological and pedagogical skills”, which suggests they are trying to make improvements.

References


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2. Reallocating Resources for Digitalisation in Response to COVID-19: Health, Education and Industry 4.0


