Chapter 2

Upgrading education for the digital era

Digitalisation and new technologies are developing rapidly, affecting businesses and the labour market. The digital era presents a huge opportunity while at the same time also brings significant risks. Business in the digital era will demand labour with a new set of skills. Education systems will therefore need to adapt to meet this new demand. Emerging Asian countries need to adopt an all-encompassing approach to support teaching at all levels, including providing sufficient ICT infrastructure to schools, improving ICT skills of teachers, adapting curricula to include ICT and addressing the gender digital divide. Enhancing the role of TVET and lifelong learning is another priority area in providing education for the digital era.

Introduction

The digital era is bringing important new developments for businesses and the workforce. New technologies, such as robotics, artificial intelligence and advances in information and computer technology (ICT), are changing the way societies interact, produce and create. These advances present a huge opportunity to improve human welfare and well-being through increased productivity and the personalisation of services to fit people's needs. Moreover, as success in the digital era will require a new set of skills, education systems and lifelong training programmes need to adapt in order to give people the means to thrive in this new context and prepare them for the future.

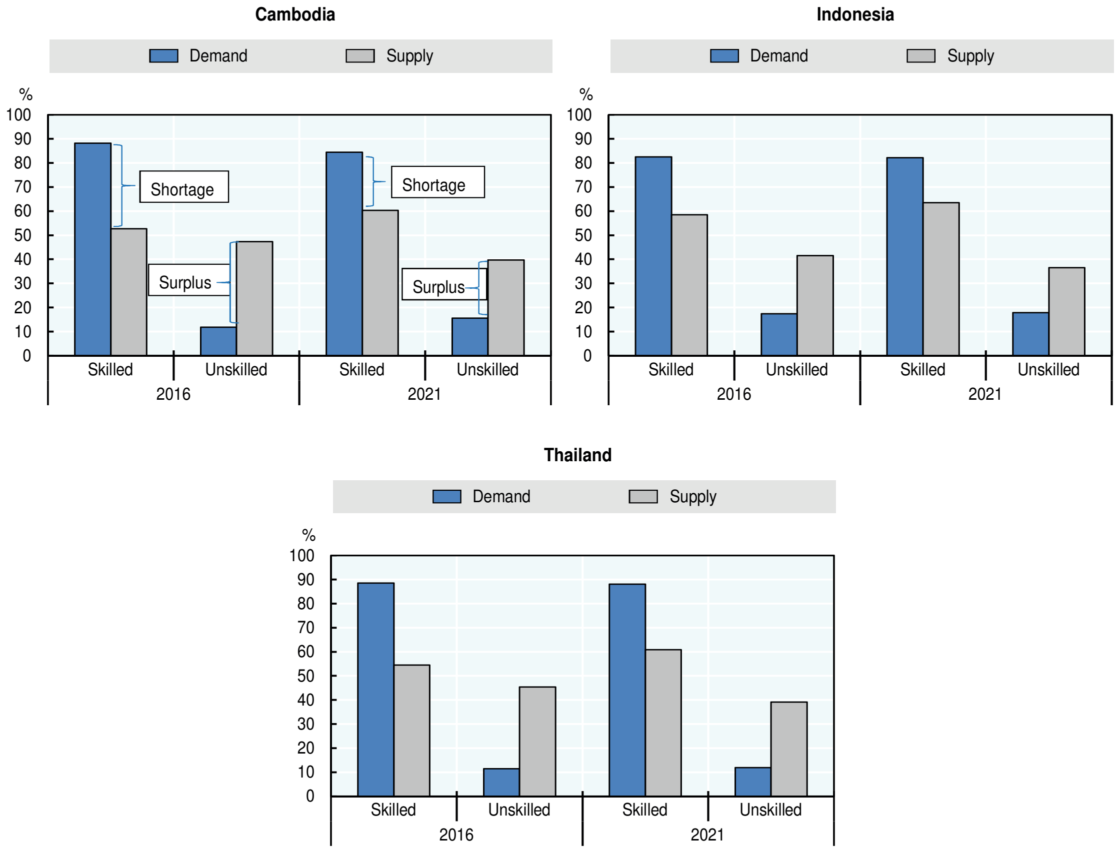
This chapter begins with an overview of how the digital era is changing the workplace, creating demand for new digital skills. It then examines how education systems can adapt to provide people with the tools necessary to succeed in these changed circumstances, with examples from OECD countries and Emerging Asia. The chapter next focuses specifically on the education challenges facing Emerging Asian countries as demand for digital skills outpaces the supply of qualified workers. Finally the chapter explores how societies can make digital education more inclusive by upgrading two alternative pathways: Technical and Vocational Education and Training (TVET) and lifelong learning.

Boosting digital readiness in Emerging Asia[1]

Digitalisation reshapes the way people work and the type of work they do. According to the *OECD Skills Outlook* (OECD, 2019a), technologies can (i) lead to automation of some jobs, pushing the workers affected to acquire skills that still have demand; (ii) change the way non-automated jobs are done, necessitating upskilling and reskilling of employees; and (iii) create new types of jobs that would call for practically new skillsets. The impact of technology will vary across occupations and over time. It will largely depend on the technical and economic feasibility of replacing functions with technology alternatives. The overall effect of digitalisation on employment is still hard to gauge, as new occupations will be created while others will be destroyed. However, evidence on the distributional effects suggests that highly skilled workers benefit from digitalisation while lower skilled workers are vulnerable. The main reason is that highly skilled workers tend to perform tasks that are complementary with technology, while lower skilled workers perform substitutable ones.

To be internationally competitive in the digital era, countries need a skilled labour force. In general, the lack of skilled labour is a key challenge in the region. Figure 2.1 shows that Cambodia, Indonesia and Thailand all currently experience a shortage of skilled labour to varying degrees. Cambodia currently faces the largest shortage of skilled workers and Malaysia the smallest, reflecting the two countries' development levels. Looking at the long-term trends, skills mismatch is likely to decrease in 2021 in both skilled and unskilled labour. However, simulation shows that a shortage of skilled labour will remain high in some countries, including Cambodia, Indonesia and Thailand. Indeed, policies to address the lack of skilled labour are strongly needed in the region, in general. Figure 2.1 defines skilled labour broadly and outlines a trend, though a sector-level approach is needed to get a picture of what is happening within the skilled categorisation for each country and to see what type and level of skills will be needed.

Figure 2.1. **Current and future skills demand and supply in three Emerging Asian countries – simulation**



Note: Skilled refers to all occupations above ISCO-08 level 1 and levels of education above ISCED 1997 level 1, while unskilled refers to all occupations of ISCO-08 level 1 and levels of education ISCED 1997 level 1. Forward-looking data points are based on linear projections. Skill levels on the demand side were obtained by mapping ISCO-08 occupational categories from the Labour Force Surveys into ISCO-08 skill levels according to ILO (2012), merging levels 2, 3 and 4 as "skilled". Demand for skills refers to the occupational structure of employment. Skills levels on the supply side were obtained from the educational attainment variable in the Labour Force Surveys and mapped to ISCO-08 skill levels based on ILO (2012). The supply-side structure of skills was then compared with the demand-side data to determine mismatches.

Source: OECD Development Centre calculations based on ILO and national sources data.

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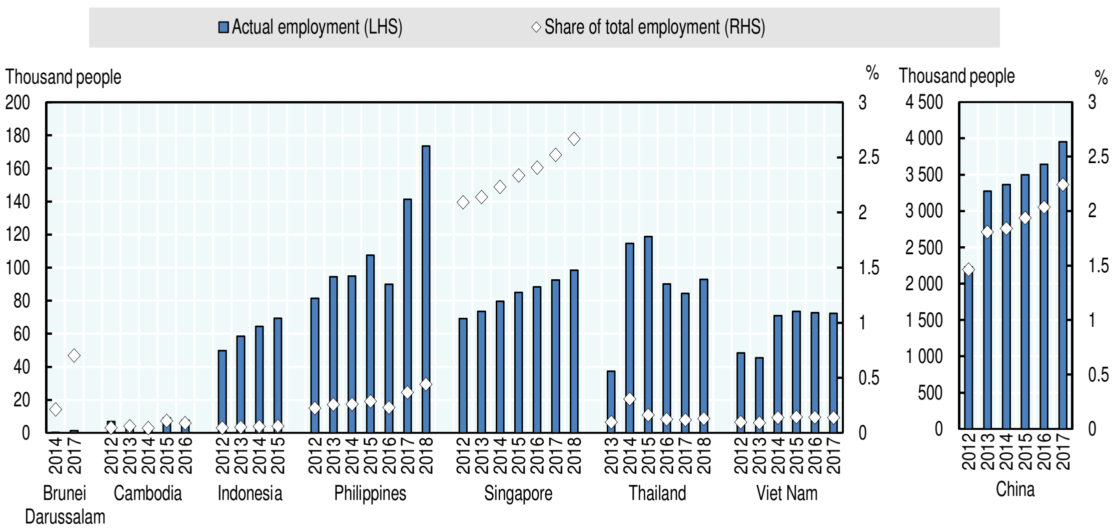
Rising demand for specialised ICT skills in Emerging Asia

Demand for ICT skills is growing worldwide, and professionals with these skills are earning higher wage premiums. The *OECD Skills Outlook 2019* identified occupations with high demand for digital skills such as software and applications developers and analysts, database and network professionals, and ICT operations and user support technicians (OECD, 2019a). What sets workers in these professions apart from their counterparts is their proficiency in literacy, numeracy and problem-solving skills in technology-rich environments, according to the study, which used the Survey of Adult Skills (PIAAC) in its analysis.

Different forms of ICT skills will be needed in the digital era as digitalisation changes the tasks associated with different occupations. New industries requiring advanced and specialised ICT skills are already arising: all Emerging Asian countries have workers employed in the new ICT services sector (Figure 2.2). However, not all countries stand equal when it comes to reaping the benefits of this growing sector. It represents a large share of employment in Singapore, is strong in the Philippines and greater numbers are participating in Brunei Darussalam, Indonesia, and Cambodia to a lesser extent. However, according to the latest available data, the sector has stagnated in Thailand and Viet Nam in recent years. Based on a broader definition due to data constraints, thereby including more than just the purely ICT-related sectors, the sector has grown steadily in China over the last years.

Figure 2.2. **Employment in the ICT sector in Emerging Asia**



Note: Employment for Southeast Asian countries refers to ISIC rev. 4 Section J., division 62 (Computer programming, consultancy and related activities) and division 63 (Information service activities), and data come from ILO. For Cambodia, there is no division 62 data available for 2012, 2013 and 2014 and no division 63 data available for 2016. Employment for China refers to Information Transmission, Computer Service and Software sectors classified by the National Bureau of Statistics in China which is also the source of data.

Source: OECD Development Centre calculations based on ILO and CEIC data.

StatLink https://doi.org/10.1787/888934063993

Enhancing the curriculum and updating teachers' skills

In light of digitalisation's job-market implications, developed and developing economies are taking advantage of ICT to retool the delivery of education and strengthen the resilience of the workforce. The 2015 Qingdao Declaration on harnessing the Internet to meet educational challenges proposes utilising ICT to meet Sustainable Development Goal 4 on education and to narrow opportunity gaps across social and income groups (UNESCO, 2015). Retooling education for the digital era involves two key facets: the curriculum and the quality of teachers, particularly in pre-tertiary levels.

The curriculum plays a pivotal role in programmes to incorporate ICT into education. Essentially a plan for learning, the curriculum determines learning outcomes and how to achieve those outcomes (Zarmati, 2019). It identifies core versus optional subjects and typically underlines to what extent and how tools should be used in a classroom setting. Against this backdrop, the curriculum should reflect students' needs and competencies even as it creates paths for specialisation for certain students, for example those with strength in ICT. Facilitating a seamless transition for students from one level to another and from school to the job market is another key consideration in curriculum design.

Countries have adopted different approaches for updating the curriculum in order to keep abreast of changing demands. Economies like Finland, Norway and Hong Kong, China, take an ongoing approach (i.e. periodical curriculum updating), while Ireland and the Netherlands renew their curricula on an ad hoc basis (Voogt et al., 2017). The choice is influenced by procedural, socio-economic and political factors. However the curriculum renewal is approached, engaging various stakeholders is deemed necessary. In their 2017 study, Voogt et al. found that integration of ICT into the curriculum and alignment with pedagogies were key to fostering positive outcomes. The study catalogued empirical exercises in different countries that show a mixed effect of ICT on students' proficiency in reading, writing, mathematics and other subjects, depending on how the use of ICT tools is approached. A number of Emerging Asian economies have recently transitioned or are in the process of updating their curricula.

Factors affecting curriculum-based outcomes include the availability, sufficiency and quality of materials and academic facilities and, importantly, the quality of teachers, as underscored by SDG 4. This is validated by empirical studies (OECD, 2018), and national authorities share the sentiment (UNESCO, 2018a). Broadly, the quality of teachers entails their understanding of the curriculum, their grasp of students' ICT needs and their ability to deliver instructions effectively using the available tools.

Two main underlying dimensions are the quality of higher education for aspiring teachers and the quality and regularity of professional training programmes that help teachers adapt to developments. Selection of aspiring teachers can be strengthened through competitive examinations before they enter teacher training or begin a teaching career, although this can be a problem in countries where there are teacher shortages (OECD, 2018). Regarding professional training programmes, UNESCO's ICT Competency Framework for Teachers provides guidelines for pre- and in-service training and incorporates ways to utilise open education resources (UNESCO, 2019a; n.d.). Indeed, bolstering online training can help address ground-level concerns in Emerging Asian economies, such as difficulty in accessing training locations and in harmonising schedules. The OECD's Innovative Learning Environment project proposes collaboration among teachers in order to foster an enabling environment among students and educators for understanding the nature and use of ICT tools (OECD, 2017; 2015a).

These dimensions are discussed in detail below, taking into account the country-specific conditions in the region. Issues related to financing will be tackled in the Update edition of the 2020 Outlook.

The gender digital divide in Emerging Asia

Despite efforts by the region's policy makers to improve ICT access within the education system and to maximise its utilisation for learning activities, women in Emerging Asia continue to face special challenges due to their limited access to ICT.

Women around the world have less access to ICT and make less use of digital technologies than men do (ITU, 2017a), and this issue is of special concern for Emerging Asia. In the Asia-Pacific region, the estimated gender gap in Internet use was 17% in 2017 – i.e. the proportion of women using the Internet was 17% lower than the proportion of men. By comparison, the Internet-use gender gap in Europe stood at 7.9% in the same year.

Improving ICT access for women and increasing their digital skills would boost their participation in the modern economy, yet a gender employment gap persists among ICT specialists. This is partly due to the low proportion of female students in ICT-related training and studies (ILO, 2019). Globally, in higher education, women represent only 35% of students in the science, technology, engineering and mathematics (STEM) fields, and a tiny 3% of students of ICT (UNESCO, 2017). The same trend is observed in the TVET sector, where women participate in ICT-related fields of study less frequently then men do (ILO, 2019). In the Philippines, even though women are better represented in higher education, their most common field of study is business administration, while information technology is the most common field among men (NSCB, 2014). And an ILO report that examined ICT skills shortages in India, Indonesia and Thailand found that women were less represented than men in the ICT sector despite its promise of future employment opportunities.

Against this backdrop, strategies to increase the participation of girls and young women in the field of ICT are needed in Emerging Asia. Some such programmes already exist. For example, India's WeTech Afterschool programme, which targets girls in middle school and high school, proposes technology-based activities for three months to allow them to discover different ICT careers and gain some of the technical skills needed to launch a start-up. Another example is Thailand's Agritech Using ICT training programme, which aims to improve the digital skills of female students and to help them develop smart farming in rural areas (Box 2.1). Indeed, strengthening efforts to improve ICT skills in the agriculture sector is crucial in particular for women, smallholders and youth in rural areas. This can be done by introducing training, education and agricultural extension services aimed at improving the ICT skills of farmers and farm workers

Box 2.1. **Teaching digital skills to rural women in Thailand**

Thailand introduced its Agritech Using ICT capacity-building programme in 2017 to impart digital skills to female students in rural areas. The initiative, held under Thailand's Girls In ICT Day programme, was launched by the country's Ministry of Digital Economy and Society in collaboration with the Food and Agriculture Organization (FAO), the International Telecommunication Union (ITU) and the private sector. In 2017, more than 200 female students participated in workshops conducted by the Research Centre of Communication and Development Knowledge Management at Sukhothai Thammathirat Open University (ITU, 2018).

The programme was continued in 2018, with UNESCO, the National Electronics and Computer Technology Centre and other private stakeholders joining as partners. The training focused on ICT skills and other knowledge necessary to apply the Smart Farm Model. The 2018 agenda offered training on the use of unmanned aerial vehicles, or drones, and other digital solutions to drive innovation in agriculture (FAO, 2018). Girls and young women were also taught entrepreneurship skills through courses on agritech start-ups and on smart farmer advance online marketing.

In 2019, the programme proposed training on Blockchain in agriculture, and also touched briefly on the water sector and smart agriculture (ITU, 2019a).

Country-specific challenges in Emerging Asia

While digitalisation brings common challenges in the region, each country's government also needs to focus on specific challenges. Some need to address the lack of infrastructure and increase access to ICT. In countries where infrastructure is relatively better, teaching capacity needs attention. A skills mismatch is another major issue in some countries in Emerging Asia. Country-specific challenges are discussed below.

Table 2.1. **Country-specific challenges for digital education in Emerging Asia**

Countries	Digital education challenges
ASEAN-5	
Indonesia	Ensuring access to technology at schools across the country
Malaysia	Bridging the gap between ICT graduates and industry demands
Philippines	Providing schools with more ICT infrastructure and trained teachers
Thailand	Improving teachers' readiness for digital education
Viet Nam	Strengthening vocational education to meet demand for digital skills
Brunei Darussalam and Singapore	
Brunei Darussalam	Fostering teachers' capacity for ICT use in classrooms
Singapore	Strengthening teachers' belief in ICT use in the classroom
CLM	
Cambodia	Improving ICT infrastructure and power supplies for better access
Lao PDR	Increasing access to ICT tools for both teachers and students
Myanmar	Providing quality ICT to all schools
China and India	
China	Bridging the digital talent gap between demand and supply
India	Raising digital literacy through broader access to digital devices

Indonesia: Ensuring access to technology at schools across the country

The path to digital readiness in Indonesia is hampered by a lack access to ICT infrastructure in schools (OECD/ADB, 2015). A majority of Indonesian teachers surveyed about ICT use in the classroom indicated that limited access to facilities was the main factor holding them back (Son, Thomas and Indra, 2011). Heavy public investment in education has brought improvements, but there is still progress to be made. In 2017, only 61.4% of public secondary schools had access to computers for educational purposes and 39.7% had access to the Internet in 2018 (Table 2.2). This indicates that while computer access remains low, the schools that do have computers also provide access to the Internet.[2]

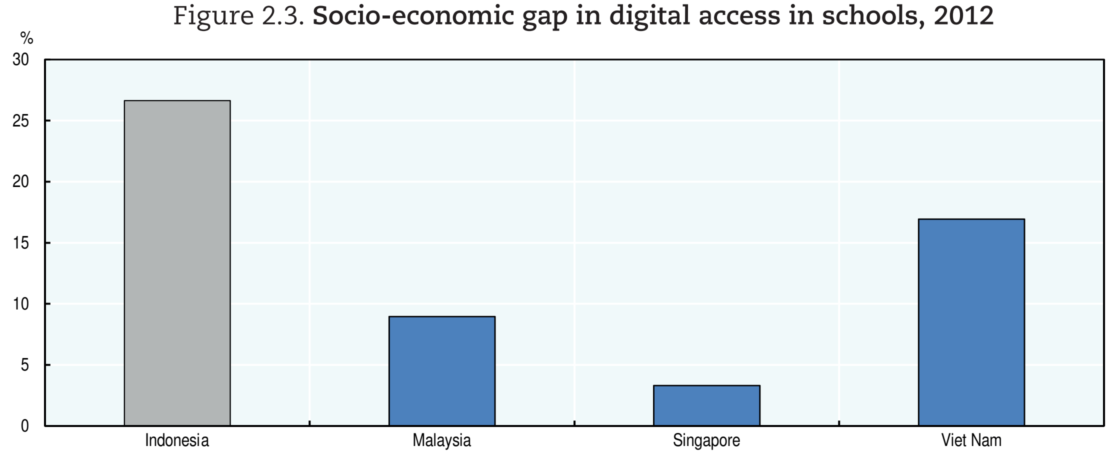
Table 2.2. **Key figures on ICT and education sectors in Indonesia**

Access to digital technologies, 2018 or latest year available		
a.	Percentage of individuals using the Internet	39.8%
b.	Percentage of females using the Internet	37.4%
c.	Percentage of males using the Internet	42.2%
d.	Percentage of individuals using a computer	19.0%*
e.	Mobile-cellular telephone subscriptions per 100 inhabitants	119.8
f.	Proportion of public secondary schools with access to Internet for pedagogical purposes	39.7%
g.	Proportion of public secondary schools with access to computers for pedagogical purposes	61.4%*
TVET and lifelong learning, 2018 or latest year available		
h.	Share of all students in secondary education enrolled in vocational programmes	19.7%
i.	Share of female students in secondary education enrolled in vocational programmes	17.2%
j.	Share of male students in secondary education enrolled in vocational programmes	22.1%
k.	Existence of lifelong learning opportunities	Yes

Note: (*) 2017 data.
Source: a, b, c, d and e: ITU (2019b); f, g, h, i and j: UNESCO (2019b); k: UIL (2017).

The uneven distribution of ICT infrastructure across Indonesia's schools provides insight into equality of chances and the country's digital divide. According to PISA 2012, there are large differences among schools of different socio-economic backgrounds in terms of access to computers with an Internet connection. In schools where students' mean socio-economic status is above the country's average, the share of computers connected to the Internet is 73.9%, while the share is only 47.3% in schools where the students' mean socio-economic status is low (OECD, 2015b). This gap is much wider than in the other ASEAN-5 countries, where the average difference is 7.1% (Figure 2.3).

Figure 2.3. **Socio-economic gap in digital access in schools, 2012**



Note: The socio-economic gap in digital access in schools is defined as the difference in internet connection access between schools with students of high socio-economic background and schools with students of low socio-economic background. The high and low socio-economic background schools are defined based on their students being part of the top quarter or bottom quarter of the PISA index of economic, social and cultural status (ESCS).

Source: OECD (2015b), *Students, Computers and Learning: Making the Connection*.

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Nonetheless, Indonesia has made progress in connecting schools to the Internet through the Centre for ICT for Education, or Pustekkom, which is part of the Ministry of Education and Culture, and especially the Jardiknas and SchoolNet programmes (Butcher and Bodrogini, 2016). According to Pustekkom (2019), 103 779 Indonesian schools had an Internet connection in 2019, and growth in connections amounted to 16.4% on average over the last three years. Indonesia should continue its investment policy in the future, paying close attention to reducing the gap in access and maintaining stable funding for Jardiknas and SchoolNet. In the past, budget cuts and the yearly nature of budget allocations have hindered the rollout of Internet connections at schools (Butcher and Bodrogini, 2016). Beyond access, the manner and extent to which ICT tools are employed are just as important for achieving good outcomes (Box 2.2).

Indonesia's government has included ICT as a subject in the curriculum since 2004, first as a stand-alone subject and, since the introduction of a new curriculum in 2013, as an element to be integrated into all subjects (Mahdum, Hadriana and Safriyanti, 2019). This ICT-based curriculum, which has been implemented in some pilot schools, uses computer-based learning, blended e-learning, web-based learning, ICT-based assessment, digital libraries and school database applications (Widyastono, 2015).

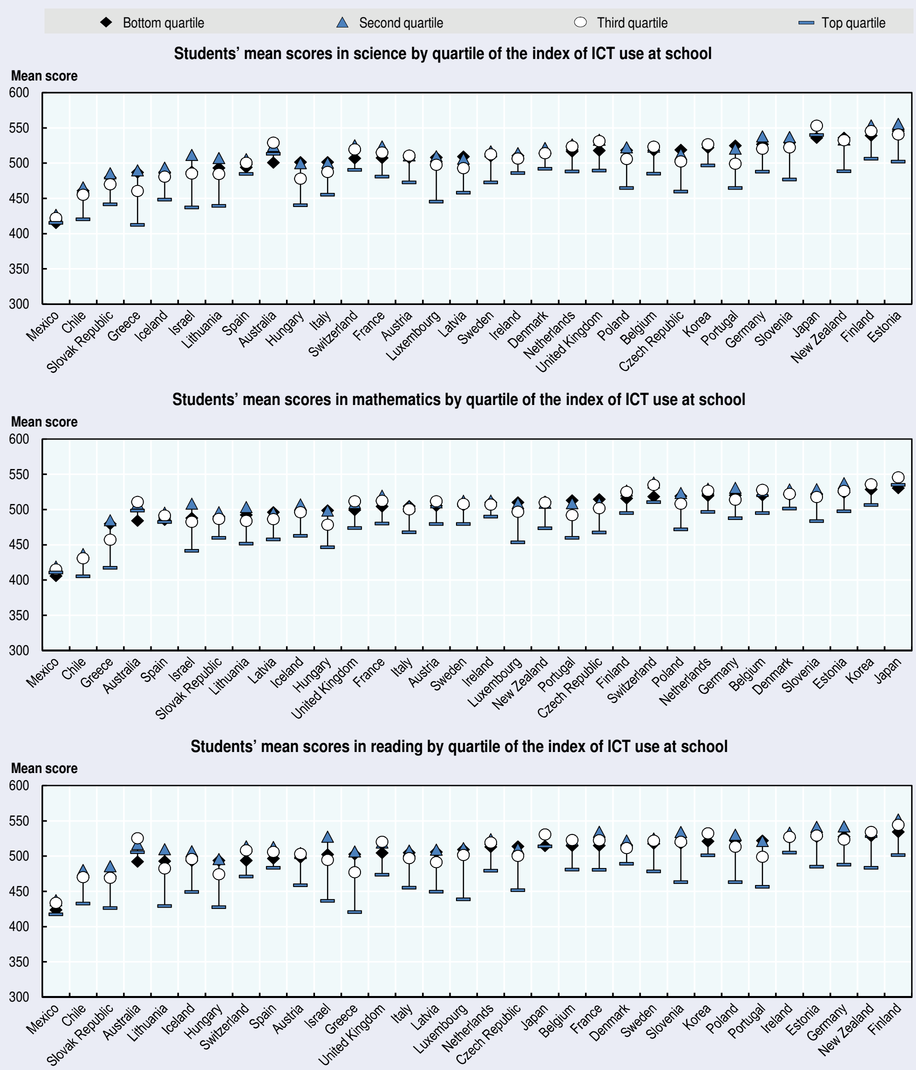
Nonetheless, uneven classroom use of ICT by teachers remains a challenge. For instance, in a survey of public high school teachers in rural districts, more than half (54.17%) indicated that they rarely or never used ICT in their classrooms (Mahdum, Hadriana and Safriyanti, 2019). Efforts have been made to tackle this issue. Under the Universal Service Obligation, the government provides training programmes for teachers in remote areas. However, due to the infrastructure issue, the target number of teachers trained has not yet been reached (MOCI, 2016).

As the new curriculum requires ICT integration in all subjects, teachers need adequate ICT competency in their field. However, a recent study found that Indonesian secondary mathematics teachers had insufficient knowledge of both ICT and the use of ICT in teaching their subjects. For instance, while mathematical software has emerged and is widely used in schools around the world, teachers' knowledge of mathematical software (e.g. Dynamic Geometry Software, Computer Algebra System) was found to be lower than their knowledge of general software, such as word processing and spreadsheets (Mailizar and Fan, 2019). It is therefore important to improve teachers' knowledge of subject-related technology.

Box 2.2. **ICT use in schools: How much is too much?**

Data from PISA 2015 showed that extensive use of ICT is associated with lower student performance. These findings hold true in science, mathematics and reading (Figure 2.4) with the exception of Australia, where students in the top quartile of ICT usage at school performed better than those at the bottom quartile. One plausible explanation is that extensive technology use is crowding out more efficient educational practices.

Figure 2.4. **PISA 2015 performance and ICT use at school**



Note: The figure displays students' mean scores in science, mathematics and reading by quartile of the index of ICT use at school. The index of ICT use at school measures how frequently students make a variety of digital device uses at school: playing simulations; posting one's work on the school website; practicing and drilling (such as for foreign languages or mathematics); downloading, uploading or browsing material from the school's website or intranet; chatting online at school; using email at school; doing homework on a school computer; using school computers for group work and communication with other students; browsing the Internet for schoolwork. The frequency of uses goes from never or hardly ever (value of 1) to every day (value of 5). Countries are ranked by the mean score of students in the bottom quartile of the index of ICT use at school.

Source: OECD calculations based on OECD (2015c), *PISA database 2015*, http://www.oecd.org/pisa/data/2015database/.

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Box 2.2. **ICT use in schools: How much is too much?** *(cont.)*

The value of ICT in the classroom largely depends on how it is used. To be effective, ICT should be included in formal curricula as a learning tool that complements teaching, and not as an end in itself.

Teachers in Australia perform better than their counterparts in other OECD economies in terms of problem solving in a technology-rich environment. Classroom use of ICT also resulted in better student performance. Australia's use of an all-encompassing approach to pass on digital skills allows students to diversify their use of ICT, from creating artwork to critically analysing a particular topic). The development of ICT capabilities is similarly viewed as a learning continuum rather than a subject-specific endeavour. At the institutional level, the Australian Curriculum Assessment and Reporting Authority (ACARA), formed in 2008, designs the framework for allowing students to use ICT tools to communicate information and ideas, solve problems and collaborate in various ways (ACARA, n.d.).

Several key competencies are highlighted in the ACARA framework. A key pillar is the ability to apply social and ethical protocols when using ICT (recognising intellectual property and following digital information security practices). Other competencies are the ability to investigate using ICT tools (organising information searches and locating, generating, accessing and evaluating the information); creating with ICT (generating ideas, plans and processes); and operating ICT (understanding ICT systems and software) (ACARA, n.d.).

Another example is the Canadian province of Manitoba, where digital competencies are included in all areas of the curriculum, and students are asked to think critically and creatively about their ICT use and to use digital tools safely and ethically (Manitoba Education and Training, n.d.). In Emerging Asia, India has incorporated ICT into its formal school curriculum based on a set of guiding principles (MHRD, n.d.). The ICT curriculum is generic, drawing on a wide range of technological applications and focusing on educational purposes. It emphasises ICT literacy, defined as the knowledge and ability to wield tools and devices. It considers the sharing of learning and critical evaluation of the learning as integral to the strategy. The curriculum promotes safe and secure use of ICT. Finally, it promotes the full utilisation of infrastructure and resources, integrated with the school's programme.

Malaysia: Bridging the gap between ICT graduates and industry demands

A key challenge to Malaysia's objective of developing the ICT services sector is a lack of industry-ready ICT graduates. Development of the sector was emphasised in the mid-term review of Malaysia's 11th development plan as part of the plan's 6th pillar, "strengthening economic growth". While demand for graduates has been steadily rising in core ICT areas such as computer science, information technology and software engineering, supply has not kept pace. Indeed, a recent report found that 66% of digital companies in Malaysia face talent shortages (MDEC, 2018).

The Malaysia Digital Economy Corporation (MDEC) projects that the country will face a shortage of 1 200 fresh ICT graduates by 2020 (MDEC, 2018). It expects an oversupply of graduates in fields such as business administration and an undersupply of ICT graduates. A forward-looking education policy is needed if Malaysia is to close its shortage of skilled ICT workers by 2021 (as projected in Figure 2.4, above). While the contribution of the ICT services sector to GDP has been growing steadily, Malaysia has seen a steady decline in the share of ICT services sector workers to total employment.

Malaysia also faces a skills mismatch between ICT graduates and industry. New ICT graduates rarely have the skills needed to transition directly from school to business: only 10% of new entrants to the ICT workforce are directly employable, while the remaining 90% require training before they can start work (PIKOM, 2014). At the same time, most unfilled ICT jobs are in positions requiring experience. In this regard, the low supply of new ICT graduates can be attributed in part to the perception of poor career prospects (Tan and Tang, 2016).

An underlying reason for the skills mismatch is the slow pace at which tertiary education programmes develop compared to industry requirements. For instance, Malaysian universities only started offering data science courses from 2015 onwards (Tan and Tang, 2016). As a response to the mismatch, all universities are required to appoint an Industry Advisory Panel to provide feedback on the curriculum and learning activities. Furthermore, government agencies such as the MDEC and the Talent Corporation Malaysia Berhad help to bridge the gap between graduates and industry by offering internship and apprenticeship schemes. The use of internships could be standardised in graduate programmes to smooth the transition from university to industry and ensure that future graduates have a foothold in the private sector upon graduation.

Another issue relating to human capital development is the lack of a clear classification of the ICT skills that fall under different degrees. This causes firms to hire workers who fail to meet their expectations, as there are significant differences between courses in computer science and computer use (PIKOM, 2015). The Malaysian Qualifications Agency has set standards for curricula covering various areas in ICT, but awareness among firms could be raised in this area. Naming degrees in a way that reflects the distinct disciplines in ICT would help to create a more transparent market for ICT graduates.

At lower educational levels, Malaysia has implemented various policies to build ICT competency among students. One of these is the Smart School Initiative (Box 2.3).

Box 2.3. **Malaysia's Smart School Initiative**

Malaysia's government promotes ICT at schools through its Malaysian Smart School Initiative (MSSI), an all-encompassing approach to digitalisation at schools. It aims to provide ICT for all as a teaching and learning tool, integrated in other subjects or on a stand-alone basis, and to use ICT to increase the productivity, efficiency and effectiveness of the management system (Lee and Soon, 2016). A pilot study involving 88 schools was launched in 1997, and the initiative was rolled out across the country in 2005 under the "making all schools smart" programme. The overarching aim of the MSSI is to "help students cope and leverage on the information age" (MOE Malaysia, n.d.a).

The MSSI aims to cover all aspects of the digitalisation of the school system. It involves the provision of ICT infrastructure (both hardware and Internet connection), teacher training, curriculum enhancement and support through the release of courseware and other resources for teaching (Lee and Soon, 2016). The MSSI is a dynamic and ongoing programme that was rolled out in four waves. After the pilot study, Wave 2 focused on the consolidation of smart school principles, Wave 3 saw the expansion of the programme to all schools in Malaysia and Wave 4 involved the consolidation and stabilisation of progress (Lee and Soon, 2016).

Box 2.3. **Malaysia's Smart School Initiative** *(cont.)*

Another key characteristic of the MSSI is outreach. It was designed as a multiple stakeholder process including parents, the community and the private sector. The Ministry of Education (MOE) formed partnerships with leading industry and community players to accelerate the use of ICT at schools. Partners included parent-teacher associations, companies, teachers' unions, alumni and educational associations (Lee and Soon, 2016). Digital industry leaders were asked by the MOE to train teachers to use ICT in schools, to develop digital curriculum materials and to develop information management systems for schools. Partnering with the private sector allowed the MOE to overcome human capital shortages in ICT and to keep up with technological developments. Co-ordination with teacher associations helped to smooth the process of adoption of ICT by teachers.

To ensure the correct rollout of the expansionary phase of the MSSI, and based on experiences from the pilot phase, a monitoring tool called the Smart School Qualification Standards (SSQS) was set up. The SSQS is a set of indicators to monitor, evaluate and categorise schools in the usage and impact of technologies. Its key objectives are to increase the use of ICT in schools; to measure ICT integration in administration, teaching and learning; and to provide a basis for policy planning and programme improvement (Lee and Soon, 2016). The final outcome is a star rating assigned to each school based on an established criterion.

Another initiative is the Malaysia Education Blueprint 2013-25, which aims to provide students with 21st century "higher order thinking skills" and to embed ICT in the curriculum. It includes a Virtual Learning Environment to provide teachers and students with broad access to learning materials. Adequate provision of infrastructure allowed the implementation of this initiative. Indeed, as of 2018, 90% of Malaysia's public secondary schools are equipped with computers and 95.2% have access to Internet (Table 2.3). As of 2016, the Education Ministry had added more than 13 000 learning sites (MOE Malaysia, 2017).

Table 2.3. **Key figures on ICT and education sectors in Malaysia**

Access to digital technologies, 2018 or latest year available		
a.	Percentage of individuals using the Internet	81.2%
b.	Percentage of females using the Internet	78.7%
c.	Percentage of males using the Internet	83.5%
d.	Percentage of individuals using a computer	69.8%*
e.	Mobile-cellular telephone subscriptions per 100 inhabitants	134.5
f.	Proportion of public secondary schools with access to Internet for pedagogical purposes	95.2%
g.	Proportion of public secondary schools with access to computers for pedagogical purposes	90%
TVET and lifelong learning, 2018 or latest year available		
h.	Share of all students in secondary education enrolled in vocational programmes	11%
i.	Share of female students in secondary education enrolled in vocational programmes	9.6%
j.	Share of male students in secondary education enrolled in vocational programmes	12.4%
k.	Existence of lifelong learning opportunities	Yes

Note: (*) 2017 data.
Source:a, b, c, d and e: ITU (2019b); f, g, h, i and j: UNESCO (2019b); k: UIL (2017).

Despite these initiatives, ICT use in the classroom remains uneven in Malaysia due to some challenges: lack of training for teachers on how to integrate ICT into pedagogy, minimal involvement of school leadership in implementing ICT policies and infrastructure issues (Gryzelius, 2015). A study of Malaysian primary and secondary school teachers found a low level of pre-integration activities, such as producing and delivering presentation slides or preparing lesson plans (Umar and Hassan, 2015). The study also found a low level of actual integration activities, such as teaching computer skills and using ICT in teaching and learning. In an effort to improve teachers' capacity, an Online Digital Literacy Course was implemented in two phases, in 2015 and in 2016 (MOE Malaysia, 2017).

Philippines: Providing schools with more ICT infrastructure and trained teachers

Active government support in the Philippines has increased ICT representation in school curricula and raised social awareness of digital education, yet the country still faces major challenges including poor school infrastructure for ICT education and a lack of qualified teachers to provide training. Programmes implemented to date include the Philippine Digital Strategy 2011-16, which calls for integration of ICT in the curriculum across all levels of the education system (CICT, 2011); the Department of Education (DepEd) Computerisation Programme, which advocates the deployment of computer packages to public schools (DepEd, 2010); and the DepEd Internet Connectivity Project, which aims to provide Internet access to public secondary schools (DepEd, 2009). As of 2016, the proportion of public secondary schools with access to computers and Internet for pedagogical purposes has reached 86.1% and 53.9% respectively (Table 2.4).

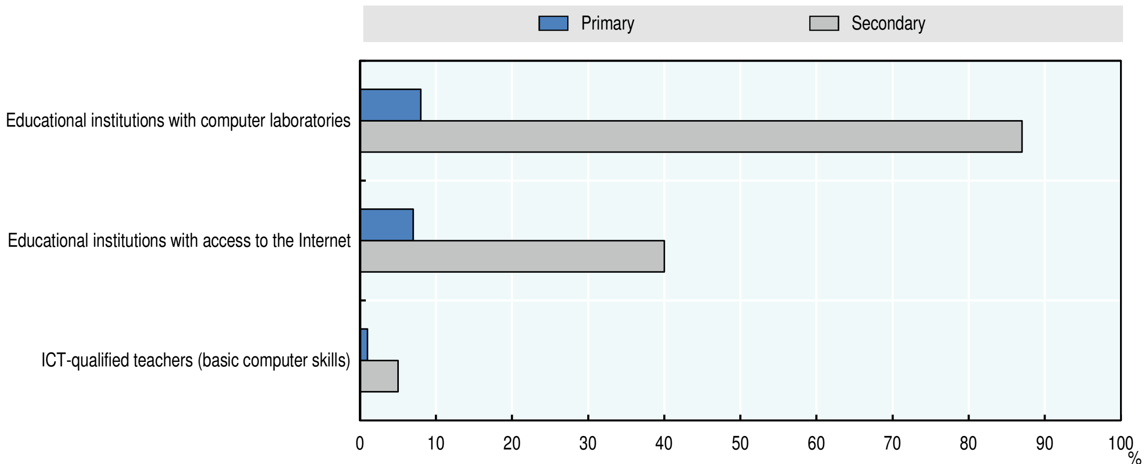
Table 2.4. **Key figures on ICT and education sectors in the Philippines**

Access to digital technologies, 2017 or latest year available		
a.	Percentage of individuals using the Internet	60.1%
b.	Mobile-cellular telephone subscriptions per 100 inhabitants	110.1
c.	Proportion of public secondary schools with access to Internet for pedagogical purposes	53.9%**
d.	Proportion of public secondary schools with access to computers for pedagogical purposes	86.1%**
TVET and lifelong learning, 2017 or latest year available		
e.	Share of all students in secondary education enrolled in vocational programmes	6.3%
f.	Share of female students in secondary education enrolled in vocational programmes	5.6%
g.	Share of male students in secondary education enrolled in vocational programmes	7.0%
h.	Existence of lifelong learning opportunities	Yes

Note: (**) 2016 data.
Source: a and b: ITU (2019b); c, d, e, f and g: UNESCO (2019b); h: UIL (2017).

In 2012, according to data on the Philippines from the United Nations Educational, Scientific and Cultural Organisation (UNESCO), about 8% of primary schools and 87% of secondary schools had computer laboratories, while about 7% of primary schools and 40% of secondary schools had access to the Internet (Figure 2.5). Philippine schools generally had weaker ICT infrastructure than other Emerging Asian countries with available data (China, Malaysia, Singapore and Thailand), especially for primary schools. In the Philippines, one computer is shared on average by 412 primary students, compared to 24 students in China, 15 in Thailand and 17 in Malaysia, while one computer is shared by 49 secondary students in the Philippines, compared to 13 in China, 14 in Thailand and 9 in Malaysia (UIS, 2014).

Figure 2.5. **ICT in education in the Philippines, 2012**



Source: UNESCO (2019b), *UIS Statistics* (database), http://data.uis.unesco.org/.

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In addition, few teachers in the Philippines have sufficient training in computer skills to be able to provide basic digital education. As shown in Figure 2.5, only 1% of teachers in primary schools and 5% in secondary schools have basic computer skills. At this level, the lowest one in the region, each teacher with basic skills would need to train more than 500 students on average, and this could have significant negative impact on the learning experience. The lack of qualified teachers with computer skills could lower the efficiency of digital education in Philippine schools, as the spread of digital literacy is directly linked to the number of computer literate teachers (Bahian and Sari, 2017).

The implementation of the Philippines' K-12 system beginning 2012 (discussed in the Country Notes, Chapter 3) has arguably broadened the ICT component of the basic education curriculum. Emphasis is placed on ICT as a tool of instruction, and ICT training is offered as non-mandatory courses after the primary level. Exploratory courses are offered to students in grades 7 to 8 under the technology and livelihood subject, while specialised courses are offered in grades 9 to 12 under an optional technical-vocational-livelihood track. Options are aligned with courses offered in the country's separate TVET programme and span subjects from hardware diagnostics to programming (DepEd, 2016). Digital literacy has also been incorporated into the alternative learning system (DepEd, n.d.). The Education Ministry facilitates the use of ICT in teaching and learning through seminars and training sessions (Arayata, 2017; Dar, 2017).

Assessment of ICT use in the curriculum in recent years is difficult in the Philippines given the absence of publicly available national indicators, both on the quality of instruction and on teachers' perceptions. Nonetheless, empirical evidence based on small-sample studies provides a picture of the challenges faced by teachers. Studies by Alba and Trani (2018) and Caluza et al. (2017), which examined teachers' ICT use and competency using primary survey data, suggest that teachers require more training to apply basic ICT skills proficiently in the classroom. Concerns include limited time available for accessing ICT equipment and tools, lack of an Internet connection, a shortage of computer units and other equipment, and lack of technical assistance for operating, maintaining and troubleshooting ICT tools (Caluza et al., 2017). These findings are supported by an earlier study that analysed teachers' ICT competency under UNESCO's ICT Competency Standards for Teachers (Marcial and de la Rama, 2015). The study found that teachers scored well in pedagogy, curriculum and assessment, and professional learning, but that use of ICT tools was still at a basic level and that the ability to use new processes in teaching and learning was limited in practice.

More attention should be devoted to primary schools and to schools in the provinces, which lag substantially behind the National Capital Region in terms of ICT infrastructure (Bonifacio, 2013). It is also necessary to explore alternative sources of funding for further ICT integration in schools, such as overseas development aid and private-sector contributions, as government resources may not be enough.

Thailand: Improving teachers' readiness for digital education

Delivery of basic education in Thailand is guided by the 2008 Basic Education Core Curriculum (Grades 1-12) and the 2003 Early Childhood Curriculum (OEC, 2017). For vocational courses, in which 10.3% of all students in secondary education are enrolled (Table 2.5), the 2013 Curriculum for the Certificate of Vocational Education (revised in 2014) and the 2014 Curriculum for Diploma of Vocational Education serve as blueprints. Under the basic education curriculum, eight core subjects are common across all levels (primary to upper secondary), including one on occupations and technology. This core area includes strands that focus on developing a good understanding of ICT and the processes behind it, as well as the practical applications and ethical dimensions of ICT use (MOE Thailand, 2018). Grade-level indicators, which are prescribed by law, suggest the intent of introducing students to ICT in a rigorous manner. The indicators cover ICT principles, information search, programming and problem solving, data analysis, product development and ethical assessment, among others.

Table 2.5. **Key figures on ICT and education sectors in Thailand**

Access to digital technologies, 2018 or latest year available		
a.	Percentage of individuals using the Internet	56.8%
b.	Percentage of females using the Internet	55.9%
c.	Percentage of males using the Internet	57.8%
d.	Percentage of individuals using a computer	30.7%*
e.	Mobile-cellular telephone subscriptions per 100 inhabitants	180.2
TVET and lifelong learning, 2018 or latest year available		
f.	Share of all students in secondary education enrolled in vocational programmes	10.3%*
g.	Share of female students in secondary education enrolled in vocational programmes	8.3%*
h.	Share of male students in secondary education enrolled in vocational programmes	12.1%*
i.	Existence of lifelong learning opportunities	Yes

Note: (*) 2017 data.
Source: a, b, c, d and e: ITU (2019b); f, g and h: UNESCO (2019b); i: UIL (2017).

Despite the addition of detailed grade-level indicators, and interval indicators for Grades 10-12, a report found that the curriculum was not clear on its theoretical underpinnings, student performance standards, effective pedagogical methods and strategies to meet the needs of different learners (OECD/UNESCO, 2016). A review of the curriculum was initiated in 2011, and a National Scheme of Education (2017-2036) was launched to support the reform agenda. The reforms pursued since 2014 focus on six key areas: appropriateness of class hours; management and decentralisation; staffing and teachers' workload; standards to evaluate students; workforce skills upgrade; and the use of ICT in teaching and learning and in knowledge management (OEC, 2017). Separate initiatives have also been developed, including one to introduce coding courses to primary students (MOE Thailand, 2019).

Thailand's teachers are well-acquainted with ICT tools, given the country's long-standing commitment to incorporate ICT in education and teacher training. Separate surveys in 2008 and 2011 showed that more than 80% of basic education teachers had their own computers, while in 2010, the ratio between trained and non-trained teachers on ICT stood at 5.5 to 1

(Makaramani, 2013). Moreover, results in 2011 indicated that almost 70% of teachers used application programmes to produce teaching materials, more than 84% used ICT to enhance traditional learning activities and more than 81% used ICT to create and manage innovative teaching. However, like other developing economies, Thailand faces challenges that complicate the teaching of ICT. In addition to infrastructure and material constraints, such as the quality and accessibility of digital materials for both students and teachers, gaps have been noted in the ability of teachers to deliver ICT modules effectively.

Thai teachers sometimes lack the knowledge and confidence to transmit ICT skills to students, while monitoring of ICT policies is not entirely effective and a coherent framework for investment in ICT is missing (OECD/UNESCO, 2016). Thailand has set out plans to use ICT as a tool to enhance teaching and learning, particularly at the basic education level and coverage of ICT infrastructure is broadening through government and private-sector initiatives, although efforts can be made regarding the maintenance of ICT tools at school (TDRI, 2019). Thai teachers also show mixed attitudes towards the usefulness of ICT as a teaching and learning tool, according to survey data, and this lack of motivation could harm the promotion of ICT usage at schools (OECD/UNESCO, 2016).

The IEA International Computer and Information Literacy Study (ICILS) in 2013 found that Thai teachers systemically display lower confidence levels in performing basic ICT tasks than their counterparts from other countries. This result is noteworthy given that research strongly indicates that the successfulness of ICT use in teaching crucially depends on the teacher's confidence and attitude in using digital technologies (Conrads et al., 2017; Enochsson and Rizza, 2009).

Moreover, 59% of teachers in Thailand tend to feel unconfident in preparing lessons that involve ICT. Thai teachers reported lower than average confidence levels in performing tasks such as installing software, using a word processing programme, producing presentations, etc. (Fraillon et al., 2014). Ultimately, the student performance can be constrained if the ability of the teachers to deliver ICT-related lessons is wanting (Box 2.4).

Box 2.4. **Perspective on teachers' digital skills from OECD economies**

The *OECD Skills Outlook* argued that teachers' skills, motivation and attitude are essential to reaping the benefits from ICT use in classrooms. Teachers not only need basic digital skills allowing them to use a computer, but also more complex digital skills that allow them to tailor the use of technology for their own teaching. Student performance in general is highly correlated with the quality of teachers, and this is also true for ICT skills. It is estimated that students' test scores in computational problem solving and mathematics could increase by 50% in some countries were they to increase their teachers' problem-solving skills in a technological environment to the level of the OECD's front runner in this field, Australia.

Evidently, even among OECD economies, there is a large disparity in the ability of the teachers to use ICT tools (OECD, 2016a). Australia has the highest teacher proficiency in ICT, with only 5% rated as low performers and 63.5% as high performers. In Israel, in contrast, 29% of teachers are lower performers and 30% are top performers. In most OECD countries, more than 30% of teachers declare a need for further training to perform their duties, and one in five specifically mentions the need to develop their ICT skills for teaching. Training in ICT skills for teaching is one of the most needed types of professional development reported by teachers in the OECD Teaching and Learning International Survey (TALIS) (OECD, 2019b).

The key to improving teachers' confidence is training. Thailand has already made significant efforts towards preparing teaching staff for the digital era. Future teachers are required to master ICT to fulfil their training (OECD/UNESCO, 2016), and research has shown that Thai teachers display higher than average participation rates in ICT related-professional development activities (Fraillon et al., 2014). Such activities include "training-the-trainer" schemes, where a few teachers transmit the relevant knowledge to their colleagues, school-organised training sessions and external training sessions organised by Education Service Areas. Through digital tools, effective professional learning communities can be built to share best practises across the country. Teachers in Thailand often miss the link between theory and practice (TDRI, 2019), in particular in rural areas. It follows that Thai training schemes should put more emphasis on meaningful uses of technology in the classroom. Teacher confidence could be increased by making ICT skills transmission more intuitive through more hands-on work during teacher training.

A good practice example is Chile, where the government has promoted the use of ICT in schools since the 1990s. Chile now boasts a teaching force with high confidence in the pedagogical use of ICT relative to the other OECD countries (OECD, 2019b). Chile's programme involves initial in-person training before gradually moving on to use of ICT tools at a distance so that teachers can experience the potential of ICT in learning processes. Another example is Israel, where teachers earn credits that lead to wage improvements upon successful completion of the ICT training programme, a strong motivational factor (OECD, 2019b).

Exploring ways to train teachers merits greater attention. A survey-based study found a need for innovation in teacher training to improve their understanding of ICT applications and practical skills (Akarawang, Kidrakran and Nuangchalerm, 2015). Issues raised in the study include: insufficient attention to teachers' needs in teacher-training curricula; distant training locations and limited training time; greater focus on description than on practical aspects; and poor post-training support. The study proposed exploring blended methods that combine traditional training and computer-based instruction, as well as web-based training, which can give teachers practical experience and help overcome scheduling and distance constraints. More than two-thirds of the survey participants expressed support for the blended method.

Thailand has taken many initiatives to bridge gaps in teacher training over the years. For example, the Lead Teacher Programme of the Institute for the Promotion of Teaching Science and Technology commenced in 1999 (OECD/UNESCO, 2016). Private-sector companies have been involved in this endeavour (e.g. the Microsoft Partners in Learning programme and Intel's Teach Thailand programme), as have schools and universities that organise ICT training for teachers. A related undertaking is Teacher Training on ICT Devices and Teaching Methods for Migrant and Thai Teachers, now being conducted for the third time. In this initiative, teachers are taught to use tablets with a learning app that contains e-learning materials in the Thai, Burmese and Karen languages (UNESCO, 2018b). They are also trained in the use of Trueplookpanya satellite TV, the Internet and teaching techniques by experts from the Ministry of Education and its private partners, and they are expected to come up with ICT-integrated lesson plans as a result.

Viet Nam: Strengthening vocational education to meet demand for digital skills

Viet Nam has shown outstanding performance in general education, with PISA scores equivalent or higher than the OECD average (OECD, 2016b). Yet at a time when demand for digital skills is growing in the country, ICT education is insufficient. According to UNESCO data, very few tertiary education students are graduating from ICT programmes: 1.34% in 2015 and 2.06% in 2016 (UNESCO, 2019b). Meantime, the local job market is seeking talent in big data, cloud computing, software and user testing, software engineering management and mobile development (LinkedIn, 2017). In order to bridge the gap between supply and demand, and as general education is insufficient to achieve this goal at the moment in the country, Viet Nam needs to strengthen its Technical and Vocational Education and Training (TVET) in the field of ICT. In addition, the existence of lifelong learning programmes in the country, as indicated in Table 2.6, could be an alternative to tackle the supply-demand gap.

Table 2.6. **Key figures on ICT and education sectors in Viet Nam**

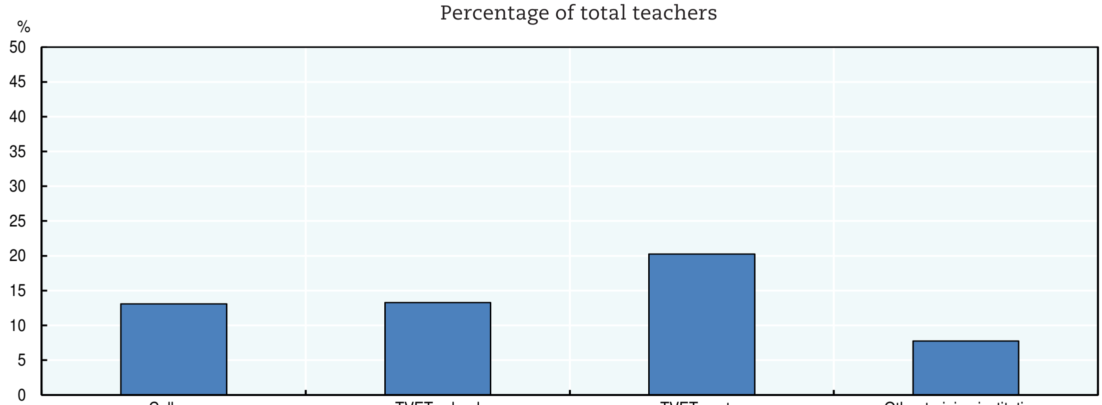
Access to digital technologies, 2018 or latest year available		
a.	Percentage of individuals using the Internet	70.3%
b.	Mobile-cellular telephone subscriptions per 100 inhabitants	147.2
TVET and lifelong learning, 2018 or latest year available		
c.	Existence of lifelong learning opportunities	Yes

Source: a and b: ITU (2019b); c: UIL (2017).

Viet Nam's most recent national development plan recognises the importance of vocational education and training in fields such as software development, computerisation and automation (GOV, 2016). However, to make TVET for digital skills more effective, a number of problems need to be addressed. Despite rapid improvements in general qualification in recent years, vocational teachers remain weak in computer skills, which limits their ability to provide quality ICT training (Figure 2.6). A 2017 survey by National Institute for Vocational Education and Training (NIVET) indicates that the overwhelming majority of vocational teachers (88.4%) do not possess certificates of national occupational skills (NOS), which assess skills for occupations including IT and computer programming. Partly as a result, most training curricula are developed by teaching staff with outdated knowledge and disconnection from industry, and do not correspond to the requirements of the workplace (ADB, 2014). This is especially critical for digital skills training, as digital technologies update at a significantly faster pace than other occupational knowledge.

Figure 2.6. **Vocational teachers with satisfactory computer skills in Viet Nam, 2017**

Percentage of total teachers



Note: The data refer to teachers in under-enterprise TVET institutes which are institutes that operate under enterprises, companies or business corporations to provide training.

Source: OECD Development Centre calculation based on NIVET (2018).

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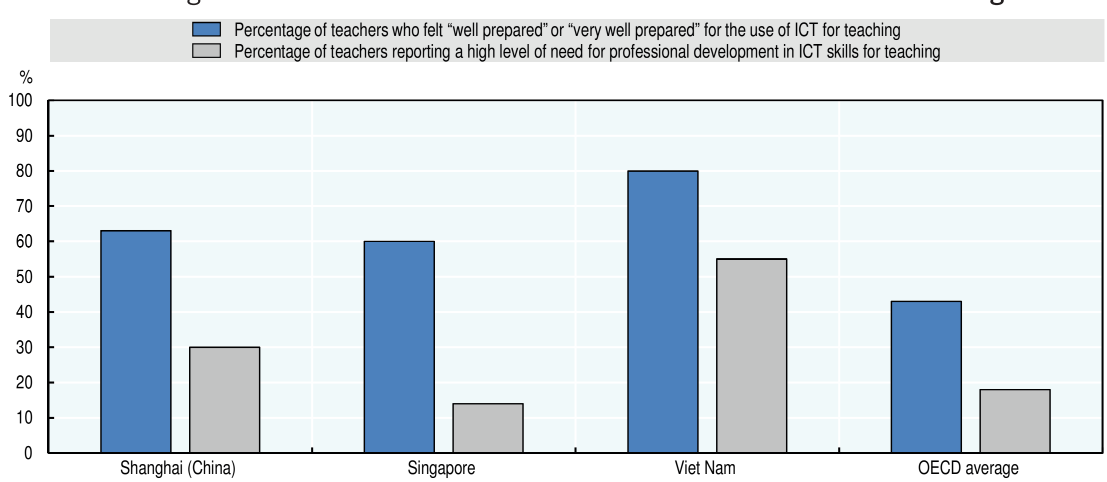
To strengthen TVET for digital skills training, vocational teachers need improved ICT capabilities. Policy makers should place more emphasis on TVET centres, which tend to have a lower share of teachers with satisfactory computer skills. While the NOS certification system could be useful in assessing the digital skills of teachers, low participation remains an issue; the government should raise awareness of the benefits of obtaining NOS certificates to encourage higher exam attendance. Finally, the government should invite participation of all stakeholders in fostering digital skills and enhance collaboration among government agencies, TVET institutions and the private sector to ensure that training curricula are consistent with labour market requirements.

In a separate development, Viet Nam's Ministry of Education unveiled a new general curriculum in December 2018 after years of planning and consultation. Among the changes, this curriculum incorporates compulsory ICT courses at all three levels of basic education: primary, lower secondary and upper secondary (MOET, 2018a). More than 20 subject programme guidelines were issued, including one in computer science and another in technology (MOET, 2018b). The new curriculum is to be implemented on a staggered basis over 2020-25. The overarching idea is to modernise the basic education system, integrate the levels more seamlessly and open more learning options for students. The curriculum also seeks to ensure the quality of outcomes vis-à-vis job market demands through more flexible teaching methods. ICT is set to play a crucial role in teaching and learning within this framework, in line with the socio-economic and development plan 2011-15 (World Bank, 2015).

A significant challenge is ensuring that disruptions during the shift are not substantial, especially in terms of the availability of resources and teachers in all schools across the country. For instance, considering the expansion of the ICT course in the new core curriculum, it may be difficult to meet demand for highly qualified computer-science teachers.

At the same time, 55% of Viet Nam's teachers report a high need for professional development in ICT skills for teaching (OECD, 2019b). This is despite the fact that 80% say they feel well prepared for the use of ICT for teaching (Figure 2.7). The high demand for further training on how to use ICT in class is an encouraging signal moving forward.

Figure 2.7. **Teachers' attitudes towards the use of ICT for teaching**



Source: OECD (2019b), *TALIS 2018 Results (Volume I): Teachers and School Leaders as Lifelong Learners*, TALIS, https://doi.org/10.1787/1d0bc92a-en.

StatLink https://doi.org/10.1787/888934064088

The Enhancing Teacher Education Programme, which aims to train and re-train teachers and academic administrators and is jointly supported by the government and the World Bank, will be crucial in this respect. Indeed, despite progress in developing a teacher training plan and preparing for the first teacher-training module, a number of shortcomings remain (World Bank, 2019).

Specifically, the government is urged to work more on: technical risks; the implementation capacity and resources of the Ministry of Education, its programme management unit and the lead teacher-training universities; and the operability of implementation arrangements.

Meeting the objectives of the new curriculum will depend on the success of the Master Plan on Information Technology Application (IT) in Education, which is currently being developed (MOET, 2019). Key elements include identifying potential synergy areas between the business and education sectors, especially at the primary and secondary levels, and broadening linkages between basic and higher education institutions in the ICT sphere. A promising example is the collaboration between the Ministry of Education and the Royal Melbourne Institute of Technology University Vietnam, which trains teachers on digital strategies in classrooms (RMIT, 2016a; 2016b).

Brunei Darussalam: Fostering teachers' capacity for ICT use in classrooms

Brunei Darussalam has made significant efforts to integrate ICT into classrooms, with 100% of primary and secondary schools connected to both the Internet and fixed broadband (Table 2.7). This represents the highest level in the region, along with Singapore (UIS, 2014).

Table 2.7. **Key figures on ICT and education sectors in Brunei Darussalam**

Access to digital technologies, 2018 or latest year available		
a.	Percentage of individuals using the Internet	94.6%
b.	Percentage of females using the Internet	94.6%
c.	Percentage of males using the Internet	94.6%
d.	Percentage of individuals using a computer	58.0%**
e.	Mobile-cellular telephone subscriptions per 100 inhabitants	131.9
f.	Proportion of primary schools with Internet and fixed broadband	100%***
g.	Proportion of secondary schools with Internet and fixed broadband	100%***
TVET and lifelong learning, 2018 or latest year available		
h.	Share of all students in secondary education enrolled in vocational programmes	11.9%
i.	Share of female students in secondary education enrolled in vocational programmes	11.5%
j.	Share of male students in secondary education enrolled in vocational programmes	12.3%
k.	Existence of lifelong learning opportunities	Yes

Note: (**) 2016 data, (***) 2012 data.
Source: a, b, c, d and e: ITU (2019b); f and g: UIS (2014), h, i, and j: UNESCO (2019b); k: UIL (2017).

The government has also sought to strengthen ICT in the curriculum within the framework of the National Education System for the 21st Century, which offers preschoolers an introduction to ICT and proposes ICT as a general subject from grades 1 to 8 and as an optional subject from grades 9 to 11 in general secondary education (MOE Brunei Darussalam, 2013).

To complement this effort, the country aims to transform traditional teaching and learning activities into interactive classrooms with technologies via an initiative called e-Hijrah, Brunei's Darussalam's blueprint for ICT in education. The programme has allowed some schools to be equipped with iPads for teaching and learning purposes. This has increased student motivation and improved students' performance in group activities (Finti, Shahrill and Salleh, 2016).

The government also provides training for teachers as part of e-Hijrah, and many now use ICT tools in the classroom. However, there is room for improvement in the ability of teachers to translate this training into effective teaching.

For instance, with ICT-based learning activities prepared by teachers, primary school students did not demonstrate conceptual understanding when they were asked to apply their knowledge in a new context (Ali, Salleh and Shahrill, 2015). Another study found that the willingness of secondary school teachers to use ICT tools such as liquid crystal display (LCD) projectors was hampered by the inconvenience of setting up the equipment (Ismail, Shahrill and Mundia, 2015).

These studies confirm that more can be done to maximise the benefit of Brunei Darussalam's advanced ICT infrastructure at schools by improving teachers' technical and pedagogical capacity in the use of digital technologies.

Singapore: Strengthening teachers' belief in ICT use in the classroom

Singapore has been integrating ICT into its education system since 1997 through five-year masterplans developed by the Ministry of Education. The first masterplan put emphasis on building a foundation by conducting ICT training for teachers, providing ICT infrastructure for all schools and facilitating educational software and resources. Since then, there has been continuous scaling up and strengthening of the use of ICT at schools.

The current level of ICT infrastructure in Singapore's classrooms attests to this programme's success: 100% of public primary and secondary schools have access to computers and Internet for pedagogical purposes (Table 2.8). In addition, primary schools have a learner-to-computer ratio of 4:1 (UIS, 2014). This represents the lowest (best) ratio among neighbouring countries in the Southeast Asia region.

Table 2.8. **Key figures on ICT and education sectors in Singapore**

Access to digital technologies, 2018 or latest year available		
a.	Percentage of individuals using the Internet	88.2%
b.	Percentage of females using the Internet	87.6%
c.	Percentage of males using the Internet	88.8%
d.	Percentage of individuals using a computer	73.5%*
e.	Mobile-cellular telephone subscriptions per 100 inhabitants	145.7
f.	Proportion of public secondary schools with access to Internet for pedagogical purposes	100*
g.	Proportion of public secondary schools with access to computers for pedagogical purposes	100*
TVET and lifelong learning, 2018 or latest year available		
h.	Existence of lifelong learning opportunities	Yes

Note: (*) 2017 data.
Source: a, b, c, d and e: ITU (2019b); f and g: UNESCO (2019b); h: UIL (2017).

The government is also seeking to shift the teaching paradigm to allow students to learn independently and collaboratively. Conventional teaching methods, where the teacher is the centre of the class, are being replaced by a student-centric system. The government's desired outcome is that this new approach will allow students to develop self-directed and collaborative learning through the use of digital tools (Choi, 2015).

Singapore also aims to improve students' personal development with a more holistic curriculum and value-driven approach. The objective is to equip them with the 21st century skills that will be needed in the digital age, such as collaboration and critical and inventive thinking (MOE Singapore, n.d.b.). This is in line with a recent study indicating that the critical skills most difficult to find by enterprises include strategic thinking, problem solving, technical knowledge and soft skills such as creativity and innovation (ILO, 2016).

At the same time, teachers are being challenged to improve their teaching methods in order to make the most of ICT use. The current masterplan, which has been implemented since 2015, emphasises the quality of overall ICT integration in the education system.

However, according to the 2018 OECD Teaching and Learning International Survey (TALIS), the percentage of Singapore's teachers who frequently or always let students use ICT for project or class work stands at 43%, below the OECD average of 53% (OECD, 2019b). Fostering teachers' and school leaders' belief in the value-added impact of ICT use is essential in order for best practices of ICT integration – which are applied in five pioneer schools under the initiative of FutureSchools@Singapore – to be diffused to all schools in Singapore.

Cambodia: Improving ICT infrastructure and power supplies for better access

Cambodian students have positive attitudes towards the use of digital technology. A study comparing Cambodian and Japanese students found that, given a choice between technological tools and non-technological tools, such as paper, Cambodian students preferred technology in every instance, while Japanese students took a more varied approach to the use of both tools (Elwood and MacLean, 2009). Yet Cambodia's schools face ICT challenges including a lack of computers, poor Internet access, a shortage of teachers qualified in ICT and, perhaps most importantly, unreliable electricity supplies.

The government has taken steps to address these challenges, but there is room for improvement. Regarding Internet access, the government signed a Memorandum of Understanding with a telecommunications operator in 2009 to increase the number of schools with an Internet connection (MOEYS, 2014). However, the connection covered only 500 of the country's 4 000 schools (UN-OHRLLS, 2018). The agreement was renewed in 2015 to expand Internet coverage to all public schools.

Better teaching capacity in ICT would boost the potential shown by Cambodian students' positive attitudes towards digital technology, as indicated by Elwood and MacLean (2009). The government has introduced policy actions to improve the quality and efficiency of the education service, one of which concerns ICT training for all trainers and secondary teachers. However, a shortage of trained teachers persists, especially in ICT, the sciences and foreign languages. In this regard, the authorities plan to focus on strategies to improve teachers' capacity through training in specific subjects, including ICT (MOEYS, 2016).

Another government initiative aims to strengthen teachers' capacity by providing digital materials through open educational resources. The Ministry of Education, Youth and Sport created a website offering a wide range of materials, including interactive multimedia, posters and digital lesson plans, covering different subjects at different educational levels (MOEYS, n.d.). The website also offers manuals, tutorials and templates, as well as information to help teachers create their own digital teaching resources.

Such efforts should be accompanied by improved access to computers, the Internet and electricity. As of 2012, the proportion of combined public primary and secondary schools with access to Internet was 7% (Table 2.9). In the same year, a reliable power source for ICT use was available in only 7% of Cambodia's public primary schools and 24% of its public secondary schools (UNESCO, 2012). Power shortages occur frequently due to the high cost of electricity and unstable supplies. This creates restrictions on computer use outside class hours, with exceptions for administrative tasks performed by teachers. As a result, electricity represents the major challenge for integrating ICT use in Cambodia's education system.

Table 2.9. **Key figures on ICT and education sectors in Cambodia**

Access to digital technologies, 2018 or latest year available		
a.	Percentage of individuals using the Internet	40.0%
b.	Percentage of females using the Internet	40.0%
c.	Percentage of males using the Internet	40.0%
d.	Percentage of individuals using a computer	27.4%*
e.	Mobile-cellular telephone subscriptions per 100 inhabitants	119.5
f.	Percentage of public primary and secondary schools with access to Internet	7%***
TVET and lifelong learning, 2018 or latest year available		
g.	Existence of lifelong learning opportunities	Yes

Note: (*) 2017 data, (***) 2012 data.
Source: a, b, c, d and e: ITU (2019b); f: UIS (2014); g: UIL (2017).

Lao PDR: Increasing access to ICT tools for both teachers and students

Lao PDR faces ICT infrastructure challenges similar to those of Cambodia. The Internet is costly and its speed is unsatisfactory. In addition, ICT equipment is taxed at 30%, creating an affordability barrier for users (MPT, 2017). The high cost to users is also due to the fact that Lao PDR relies for Internet access on resellers in Thailand and Viet Nam. This because, as a land-locked country, it does not have direct access to submarine fibre optical cables (Souphavady, 2018).

Lack of ICT infrastructure has affected digital development in Lao PDR. As of 2017, Lao PDR's ICT Development Index was ranked lowest among Emerging Asian countries (ITU, 2017b). As of 2015, only 24.5% of urban households owned a computer (Jeon and Song, 2018). In addition, recent data from ITU revealed that the percentage of individuals who use the Internet was 25.5% in 2017 (Table 2.10). Computer labs exist in some schools, but not all, and due to a lack of qualified teachers, the school administration uses the labs more frequently than the students do.

Table 2.10. **Key figures on ICT and education sectors in Lao PDR**

Access to digital technologies, 2018 or latest year available		
a.	Percentage of individuals using the Internet	25.5%*
b.	Mobile-cellular telephone subscriptions per 100 inhabitants	51.9
TVET and lifelong learning, 2018 or latest year available		
c.	Share of all students in secondary education enrolled in vocational programmes	1.0%*
d.	Share of female students in secondary education enrolled in vocational programmes	1.0%*
e.	Share of male students in secondary education enrolled in vocational programmes	1.1%*
f.	Existence of lifelong learning opportunities	Yes

Note: (*) 2017 data.
Source: a and b: ITU (2019b); c, d, and e: UNESCO (2019b); f: UIL (2017).

Lao PDR also faces teacher shortages in the natural sciences, physical and arts education, basic vocational skills and ICT (MOES, 2015). A study found that a high number of teachers lack sufficient ICT knowledge and skills, and urged the government to increase teachers' ICT proficiency (Thephavongsa and Liu, 2015). In terms of the curriculum, Lao PDR's Education Sector Development Plan 2016-20 states that a review of lower secondary curricula will specifically address the inclusion of appropriate content for ICT.

One initiative aimed at improving teachers' digital literacy is the Lao LEARN project, conducted by a non-governmental organisation in partnership with the government. Through this programme, teachers were trained to deliver core subjects via tablet-enabled e-training and face-to-face training (Aide et Action, 2017). The project also aimed to build an online platform to allow publishers, authors and developers to create digital educational content.

Despite low computer ownership and limited Internet access, mobile phones are highly popular in Lao PDR. They are owned by 94.7% of urban households and 68.7% of households in rural areas (Jeon and Song, 2018). Students use mobile devices to communicate with lecturers and to access learning content and social media. Yet the development of both e-learning and m-learning is hindered by insufficient resources and training (Murphy, Jones and Farley, 2016). In order to maximise the benefits of mobile phone ownership, the government's ICT education policy should view mobile phones as a digital gateway in the education sector.

Myanmar: Providing quality ICT to all schools

Myanmar, which is undergoing rapid changes in its transition to an open economy, needs to make a major effort to catch up with its neighbours in terms of development while at the same time preparing for the digital era. Myanmar is advancing quickly in mobile Internet deployment, with more than 90% of the country now covered by 4G Internet (Opensignal, 2018). Electrification, at 34% nationwide in late 2016, is expanding rapidly as well to meet the target of 100% coverage by 2030 (GIZ, 2017). To make the most of these investments, human capital must be developed accordingly.

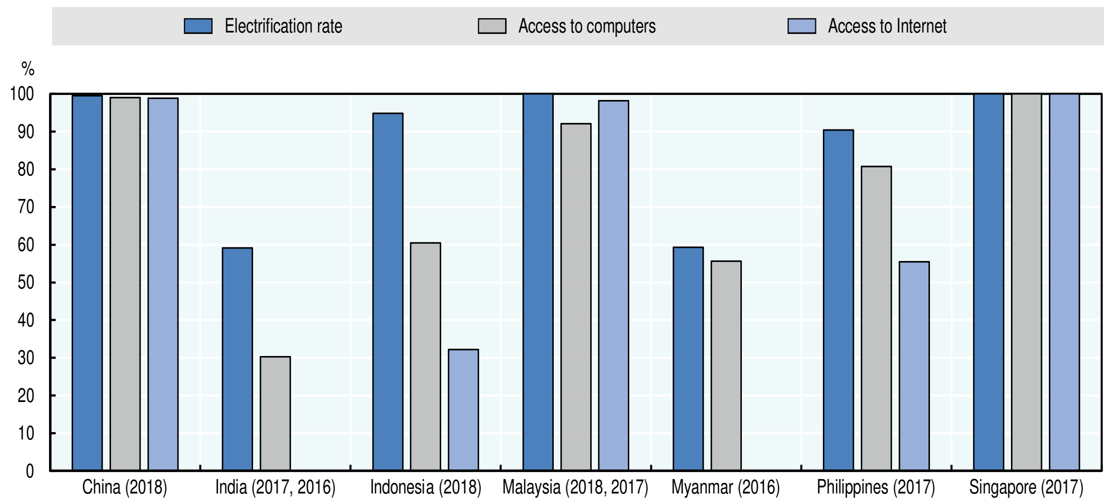
The first step is to provide access to ICT at schools. However, data from UNESCO show that only 27.4% of primary schools and 59.3% of lower secondary schools have access to electricity, making it hard to bring in any form of ICT into classrooms (UNESCO, 2019b). In addition, only 0.9% of primary schools have computers, and just 0.8% of primary schools have access to the Internet. In public secondary schools, digitalisation has been underway for a few years, with 71.2% of public secondary schools equipped with computers in 2016. Yet access to Internet remains limited, with only 0.3% of public secondary schools having access in 2017 (Table 2.11). At lower secondary level, 55.6% of public lower secondary schools were equipped with computers in 2016 and none of these computers were connected to the Internet (Figure 2.8). These data indicate that Myanmar must invest heavily to meet the needs of its students, and it might want to do so in a targeted way, given resource constraints and the large gap to be filled.

Table 2.11. **Key figures on ICT and education sectors in Myanmar**

Access to digital technologies, 2018 or latest year available		
a.	Percentage of individuals using the Internet	30.7%*
b.	Mobile-cellular telephone subscriptions per 100 inhabitants	113.8
c.	Proportion of public secondary schools with access to Internet for pedagogical purposes	0.3%*
d.	Proportion of public secondary schools with access to computers for pedagogical purposes	71.2%**
TVET and lifelong learning, 2018 or latest year available		
e.	Share of all students in secondary education enrolled in vocational programmes	0.2%*
f.	Share of female students in secondary education enrolled in vocational programmes	0.1%*
g.	Share of male students in secondary education enrolled in vocational programmes	0.2%*
h.	Existence of lifelong learning opportunities	Yes

Note: (*) 2017 data, (**) 2016 data.
Source: a and b: ITU (2019b); c, d, e, f and g: UNESCO (2019b); h: UIL (2017).

Figure 2.8. **Access to basic services at public lower secondary schools**



Note: Data were not available on Internet access for India and Myanmar.
Source: UNESCO (2019b), *UIS Statistics* (database), http://data.uis.unesco.org/.
StatLink https://doi.org/10.1787/888934064107

Options exist to reduce the costs of computerisation, for instance through the use of multi-seat computers or networked PCs. The simultaneous use of a single central processing unit and server for multiple individual keyboards and monitors is a way to ease the effects of computer shortages (OECD, 2016b). Furthermore, focusing on first providing teachers with computers might lead to higher value-for-money under a tight budget. Research has shown that ICT investments dedicated to teachers tend to yield higher student performance gains than increases in the number of computers per student (OECD, 2019a).

Internet access at schools needs to be expanded in Myanmar, as most schools across all levels of teaching do not have a connection. Using the country's 4G network to achieve this goal will probably not be enough, as the current downloading speed achieved by the network is slightly below 30 Mbps (Opensignal, 2018). Research recommends a connection of at least 500 Kbps per student for browsing the web, meaning that a connection to Myanmar's 4G network could support a maximum of 60 students working simultaneously (Fox et al., 2012). Broadband Internet therefore needs to be developed in the country and the quality of the Internet connection should be monitored on an Mbps per student basis (OECD, 2016b).

In addition, a recent study found that Myanmar had not yet integrated ICT into the school curriculum and that the limited ICT equipment available, such as computers and video projectors, often sat idle due to the inability of teachers to use the Internet (Blevins et al., 2018). Limited computer literacy among teachers is thus a major challenge.

Various public-private partnership initiatives have sought to address this challenge. For instance, under the Connect to Learn initiative in 2018, nearly 300 teachers in Myanmar were trained to use ICT in day-to-day classroom teaching (Ericsson, 2018). The programme enabled the teachers to put together teaching materials based on information found on the Internet and to create a virtual community for sharing their experiences and knowledge. Still, more efforts are needed to improve teachers' digital literacy and to integrate ICT use into the curriculum in Myanmar's education system.

China: Bridging the digital talent gap between demand and supply

The digital economy, an important engine of growth in China, has seen substantial development in the last decade. The size of the digital economy, including digital industries and digitalised traditional industries, exceeds CNY 31 trillion (Chinese yuan renminbi) and accounts for more than 34.8% of GDP (CAICT, 2019). In response to this trend, the government placed development of the cyber economy in a prominent position in its 13th Five-Year Plan (2016-20) and vowed to deepen the integration of information technology in economic and social development through China's Internet+ initiative (CCCPC, 2016). However, in order to achieve this objective and ensure healthy development of the digital economy, China needs to address the widening gap between demand for digital skills and supply.

The number of available digital jobs in China has been growing at double-digit rates, with annual demand projected to reach 12.46 million positions in 2020, almost double the level of 2017 (Huawei and CCW, 2018). Labour market demand surpasses the supply of digital talent in terms of both quality and quantity. The shortage is due to several factors. First, while university graduates in ICT-related fields make up the majority of science graduates in China each year, their number – around 1 million annually – is far below the digital skills gap of around 10 million in the country. Second, not all of these ICT graduates have reached the digital qualification required by industry due to a skills mismatch between school instruction and actual work requirements (Chen and Ma, 2017). Third, due to the growing importance of digitalised traditional industries, which in 2018 accounted for 178 million of a total of 191 million digital jobs (CAICT, 2019), most positions involving digital skills will require cross-sector experience, such as agriculture for digital farming, retail trade for e-commerce and transportation for the ride-sharing business. The supply of such hybrid skills is scarcer than the supply of pure digital skills in China at the moment. Fourth, a large portion of future demand will centre around advanced digital areas, including cloud computing, big data, the Internet of Things and artificial intelligence. These require more advanced training than basic college-level ICT education, which tends to focus on programming skills.

To address these challenges, the government needs to focus on both digital education at schools and digital training through the vocational education system, as the number of college graduates is not likely to increase drastically in future amid slowing population growth. Improving the digital literacy of the general public, especially people in rural communities, is essential for China to achieve greater development in cyber economy as envisioned in the 13th Five-Year Plan. Based on Internet penetration as an indicator of digital literacy, the number of Internet users in China has increased significantly, from 10.5% of the total population in 2006 to 54.3% in 2017, as shown in Table 2.12 (World Bank, 2019b; ITU, 2019b). However, Internet penetration in China's rural areas still trails far behind urban areas, with only around 34% of the rural population using the Internet (Figure 2.9). By June 2017, there were 201 million rural Internet users, accounting for 26.7% of total Internet users, and most rural users understand only simple Internet applications such as messaging (CNNIC, 2017). Policies on rural digital development in China tend to focus on building infrastructure. However, a recent survey indicates that non-use of the Internet in China is attributed by only 9.3% of non-users to "no Internet access devices" and by just 6.2% "no local access to the Internet", while more than half of non-users cite a lack of computer/Internet knowledge (CNNIC, 2017). In order to raise digital literacy in rural areas, emphasis should thus be placed on education and training programmes in addition to digital infrastructure.

Table 2.12. **Key figures on ICT and education sectors in China**

Access to digital technologies, 2018 or latest year available		
a.	Percentage of individuals using the Internet	54.3%*
b.	Mobile-cellular telephone subscriptions per 100 inhabitants	114.9
c.	Proportion of public secondary schools with access to Internet for pedagogical purposes	98.5%
d.	Proportion of public secondary schools with access to computers for pedagogical purposes	98.3%
TVET and lifelong learning, 2018 or latest year available		
e.	Share of all students in secondary education enrolled in vocational programmes	18.9%
f.	Share of female students in secondary education enrolled in vocational programmes	17.2%
g.	Share of male students in secondary education enrolled in vocational programmes	20.4%
h.	Existence of lifelong learning opportunities	Yes

Note: (*) 2017 data.
Source: a and b: ITU (2019b); c, d, e, f and g: UNESCO (2019b); h: National source.

Looking ahead, efforts are needed to ensure that advanced training in ICT is available in classrooms. A road map announced in 2017 outlines China's goal to be the centre of artificial intelligence (AI) by 2030. Given the current extensive development of AI technology, the education sector is key when countries develop national AI strategies (UNESCO, 2019c). Indeed, China plans to establish AI-related courses in primary and secondary schools and gradually to promote programming education (Yu and Chen, 2018).

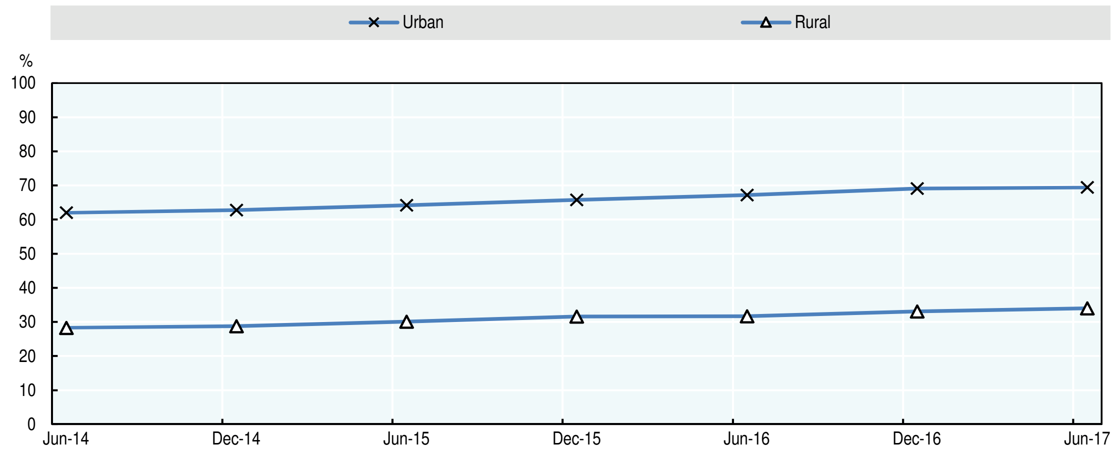
At present, AI is being taught at many colleges and universities in China, but the discipline has not received much attention in basic education. Development of textbooks, training of teachers and the provision of relevant software and hardware facilities have been slow (Yu and Chen, 2018). It is important to note that the use of AI in education is not intended to replace teachers but rather to make teaching more efficient and fulfilling for teachers (CISTF, 2018). In this respect, teachers' ICT skills are key, since they will have to interpret and implement the new courses.

China has undertaken various initiatives to improve teachers' ICT skills. In 2004, the country developed a national educational technology standard under which teachers are to have necessary ICT knowledge and skills, as well as the ability to apply them. The standard was adopted as a set of compulsory criteria for teacher certification. Teachers are encouraged to facilitate the use of ICT by students in enquiry-based classroom learning activities. They must also receive training and pass assessments based on the standard (UNESCO, 2008).

Despite these efforts, there is room for improvement. Several studies have found that teachers' knowledge of ICT and network technology is still limited in China. One study found that teachers and students in Northwest China were not well prepared for using the Internet for teaching and learning English as a foreign language (EFL) (Zhang, 2013). In another study, which surveyed secondary preservice teachers, participants reported an overall low level of ability to use technology and noted concerns about the technology training they had received (Zhou, Zhang and Li, 2011).

Figure 2.9. **Internet users in China's rural and urban areas, 2014-17**

Percentage of regional population



Source: CNNIC (2017), *Statistical Report on Internet Development in China*.

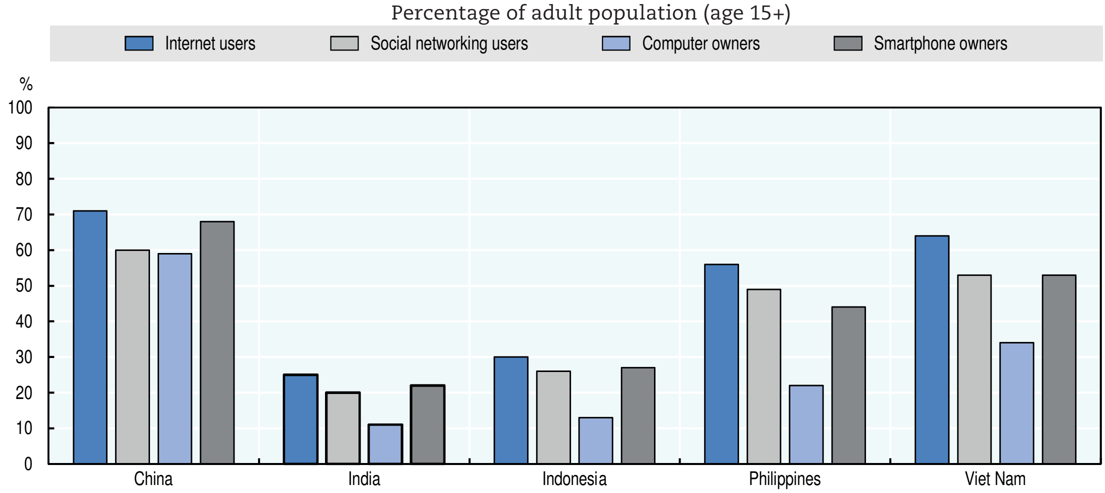
StatLink https://doi.org/10.1787/888934064126

India: Raising digital literacy through broader access to digital devices

As a major sourcing destination for IT services across the globe, India has demonstrated strong affinity with digital technologies and policy makers have made preparations for the digital era. In 2015, the government launched a nationwide flagship programme called Digital India. It aims to transform the country into a "digitally empowered society and knowledge economy" where digital infrastructure is guaranteed to every citizen as a core utility and government services are digitalised and seamlessly integrated across departments and jurisdictions to improve quality and ensure smooth and timely delivery (MEIT, 2019). However, despite the importance of ICT in the Indian economy and society, data show that India still lags behind its Emerging Asian peers in terms of use of the Internet, computers, social network platforms and smartphones (Figure 2.10). For the majority of Indians to benefit from the country's digital transformation, it is necessary to address the issues of digital literacy and universal access to ICT.

Figure 2.10. **ICT usage indicators in selected Emerging Asian countries, 2017**

Percentage of adult population (age 15+)



Note: Percentages are based on total survey sample. Computer owner data refer to 2014. Data from China on Internet users, social networking users and smartphone owners are available only for 2016.

Source: Pew (2017), *Spring 2017 Global Attitudes Survey*; Pew (2014), *Spring 2014 Global Attitudes Survey*.

StatLink https://doi.org/10.1787/888934064145

Lack of digital equipment is the biggest challenge for raising digital literacy in India. The National Digital Literacy Mission (NDLM), which was launched in 2014 and aims to train one person per household in selected blocks across India, found that almost half of the graduates from its programme were unable to apply what they learned on a regular basis due to lack of access to digital devices (CSD, 2017).

One approach could be for local governments, the private sector, non-governmental organisations (NGOs) and international organisations to collaborate in providing cheap or even free digital devices to designated regions or populations. However, since offering subsidised or free digital devices might not be financially feasible for all local governments, policy makers could consider creating a cheaper alternative for allowing regular practice of digital skills.

Another important challenge is enhancing both the curriculum and teachers' ICT skills. In 2004, the government launched the ICT@Schools programme, which aimed to provide opportunities for students to build their ICT skills and helped provide schools with ICT infrastructure. New components were added in 2010 and 2012, including incorporating ICT in the teaching-learning process. However, the proportion of public secondary schools with access to computers for pedagogical purposes was only 38.6% in 2016 (Table 2.13). Another government initiative is an annual national award for teachers who use ICT for innovation in education. The award is given to teachers who effectively and innovatively integrate technology-supported learning into the school curriculum and their teaching, and in so doing promote enquiry-based, co-operative and collaborative learning among students.

Table 2.13. **Key figures on ICT and education sectors in India**

Access to digital technologies, 2018 or latest year available		
a.	Percentage of individuals using the Internet	34.5%*
b.	Mobile-cellular telephone subscriptions per 100 inhabitants	86.9
c.	Proportion of public secondary schools with access to computers for pedagogical purposes	38.6%**
TVET and lifelong learning, 2018 or latest year available		
d.	Share of all students in secondary education enrolled in vocational programmes	1.3%
e.	Share of female students in secondary education enrolled in vocational programmes	0.5%**
f.	Share of male students in secondary education enrolled in vocational programmes	2.1%**
g.	Existence of lifelong learning opportunities	Yes

Note: (*) 2017 data, (**) 2016 data.
Source: a and b: ITU (2019b); c, d, e and f: UNESCO (2019b); g: National source.

More recently, knowledge-sharing platforms have been introduced that allow interactive teacher training. One of the most comprehensive is the Human Resource Development Ministry's DIKSHA (Digital Infrastructure for Knowledge Sharing) platform. This platform integrates ICT into all aspects of education, including teacher professional development, student assessment tools, data collection and analysis, and communication among teachers, students and parents. However, its implementation varies widely, depending largely on the capacity of states to implement the platform and to communicate and share best practices with each other (Bajpai, Biberman and Sharma, 2019).

Vocational and lifelong learning as paths to digital inclusion

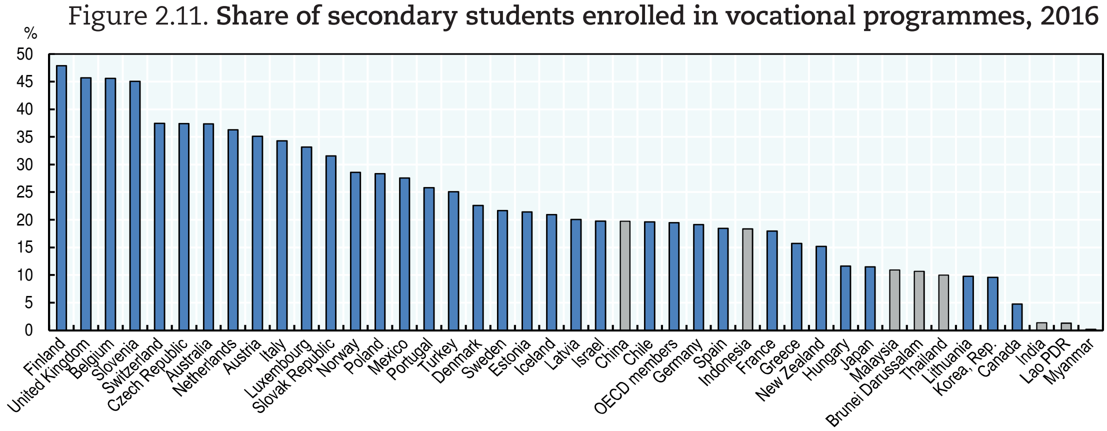
TVET and lifelong learning have an important role to play in providing education for the digital era. As alternative paths of education, they have the potential to provide digital skills while at the same time taking inclusion into account. However, challenges need to be addressed, including enhancing the image and attractiveness of TVET, encouraging private-sector involvement, improving monitoring of lifelong learning programmes and broadening publicity campaigns to boost participation. This section begins by examining the current status of TVET in Emerging Asia and within the OECD.

Rethinking vocational education in the digital era

TVET focuses on preparing students for work, with education and training programmes that are designed for, and typically lead to, a particular job or type of job. The programmes normally involve practical training as well as relevant theory (OECD, 2010). TVET usually begins at upper secondary level (ISCED 3), and typically continues at the post-secondary level. However, TVET starts as early as lower secondary level (ISCED 2) in some OECD countries, including Australia, and some Emerging Asian countries, such as China, India, Malaysia and Viet Nam, for example in India in classes 9 and 10.

In most Emerging Asian countries, secondary-level enrolment is generally much lower in vocational schools than in general education (Figure 2.11). In some countries, almost 100% of secondary school students are enrolled in general education institutions. In contrast, in some OECD countries, such as Finland, the United Kingdom and Belgium, students participate almost equally in general and vocational secondary education, with more than 45% of students enrolled in vocational education in 2016.

Figure 2.11. **Share of secondary students enrolled in vocational programmes, 2016**



Source: UNESCO (2019b), *UIS Statistics* (database), http://data.uis.unesco.org/.

StatLink https://doi.org/10.1787/888934064164

Digitalisation involves science, technology and engineering as well as ICT skills, and vocational education is playing a role in this area. In some countries, ICT training already makes up a significant part of TVET programmes. In Indonesia, for instance, around 56% of vocational secondary schools are focusing on ICT, and around 46% on technology and engineering, according to Ministry of Education and Culture data. In other countries, vocational education involves some form of e-learning. In Australia, for example, a 2013 study showed that 91% of TVET teachers/trainers communicate with learners via email and that 85% use interactive onsite learning resources involving websites, CDs or computers (FLAG, 2013). In the region, countries like Indonesia, Malaysia, the Philippines and Singapore have taken several initiatives on ICT use in vocational institutions (Table 2.14).

Table 2.14. **Examples of initiatives on ICT use in TVET**

Country	Initiatives
Indonesia	• Digital Simulation (mainly for all fields of studies in vocational secondary school) • Course Development Plans for e-commerce and Industry 4.0 in vocational higher institution level
Malaysia	• Internet of Things Expertise in Agriculture • Diploma in Database Management System and Application • Industrial Centre of Excellence for Integrated Welding Program
Philippines	• National Technical Education Skills Development Plan 2018-22
Singapore	• SkillsFuture movement

Source: OECD Development Centre’s compilation based on national sources.

Nonetheless, attracting students to vocational schools remains a major challenge, largely due to an image problem. Vocational education is often overshadowed by the increasing emphasis on general education and preparing students for university studies. TVET is also often seen by students and the general public as having a low status (OECD, 2010).

This is the case in Emerging Asia. In many countries in the region, vocational education is viewed as second-class, with a lower status than general education, no prestige and as a choice for students who are less qualified academically. Parents of students with higher academic performance prefer to send their children on a general education path. In Malaysia, for instance, the perception of TVET as a less prestigious choice of study than the general academic stream leads to low enrolment in vocational training programmes and hinders collaboration between TVET and industry (UNESCO-UNEVOC, 2019a). A similar problem is observed in Cambodia where negative perceptions of TVET have contributed to a drop of 50% in the total number of people enrolled in TVET programmes (see the Country Note on Cambodia in Chapter 3).

TVET has a relatively better image in some OECD countries, with vocational school seen as more of a choice than a last resort. A 2011 survey found that 71% of Europeans think that vocational education has a positive image in their country (Eurobarometer, 2011). TVET is perceived as offering high-quality programmes to prepare people for the world of work by developing the skills required to get a job. In the survey, 82% of respondents say that vocational education and training deliver skills that are needed by employers, 75% that vocational education offers high-quality learning, 55% that TVET leads to jobs that are well paid and 72% that TVET offers good career opportunities. A more recent survey shows similar results (Cedefop, 2017). TVET has a particularly positive image in countries where the share of students enrolled in vocational education is relatively high. The survey shows that 84% of people in Finland, 77% in Czech Republic and 75% in the United Kingdom and in Italy think that vocational education has a positive image.

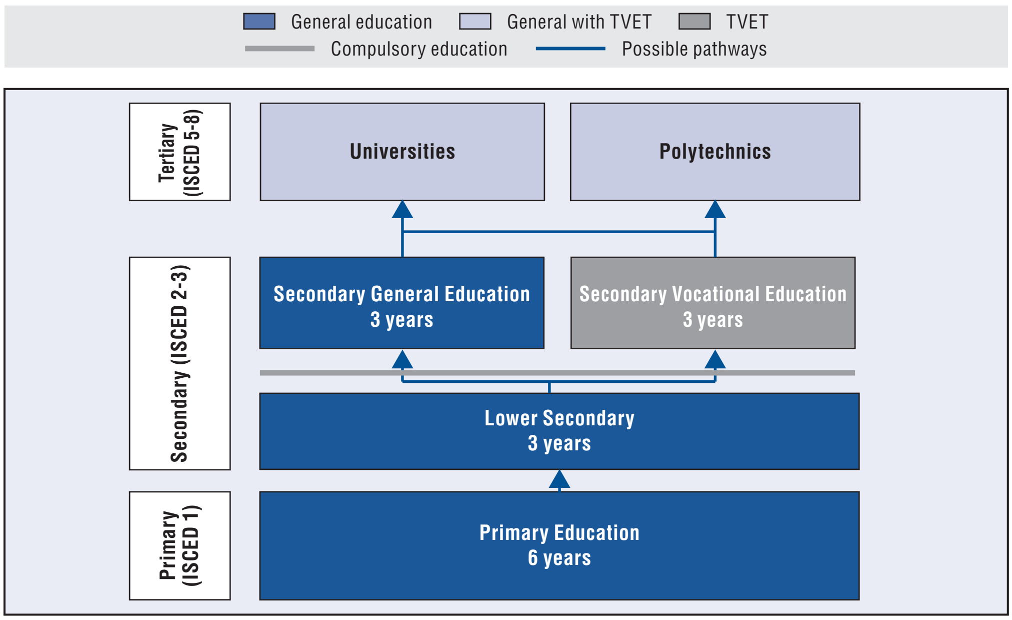
Enhancing the image of TVET in Emerging Asia

Most countries in Emerging Asia have recognised that enhancing the image and attractiveness of TVET is crucial. Some have taken initiatives to improve TVET. Indonesia, for example, is reforming its TVET system to address the lack of linkage between training and the demands of the labour market, and to encourage creativity and collaboration (See the Country Note on Indonesia in Chapter 3). In the Philippines, the Ladderised Education Act of 2014 aims to create a more open and integrated education system by allowing easier transitions between TVET and higher education. In Thailand, the Office of the Vocational Education Commission is implementing projects to increase enrolment in TVET, enhance the quality of TVET programmes and increase the efficiency of TVET administration.

However, improving TVET's image remains a big challenge in the region. One possible way to address this is to promote pathways for TVET students onto a university track. TVET programmes should be designed to prepare students not only for the job market but also for continuing to a higher level of education. A balance is needed between occupation-specific, practical skills and broader education, including core academic competencies and theoretical knowledge. To achieve this, efforts are needed by all stakeholders. Governments should formulate policy that supports the acceptance of TVET students by universities. At the same time, universities need to embrace TVET not only by accepting TVET students, but also by contributing to the development of TVET programmes.

Education systems are more permeable in some OECD countries, including Australia, Austria, Finland, France and Germany, where graduates from TVET secondary education can go on to tertiary general education. In Austria, the TVET system offers different paths at various levels to avoid dead ends and to link vocational education to general tertiary education through the professional baccalaureate. In Finland, a flexible education system allows both general education and TVET students to continue their studies at the university or at polytechnics (Figure 2.12). The country reformed the TVET curriculum to include the national core curriculum required for access to university as well as strong on-the-job training and lifelong learning components. It aims to ensure that TVET graduates are ready to enter the job market and at the same time prepared to adapt to changing skills requirements.

Figure 2.12. **The education system in Finland**

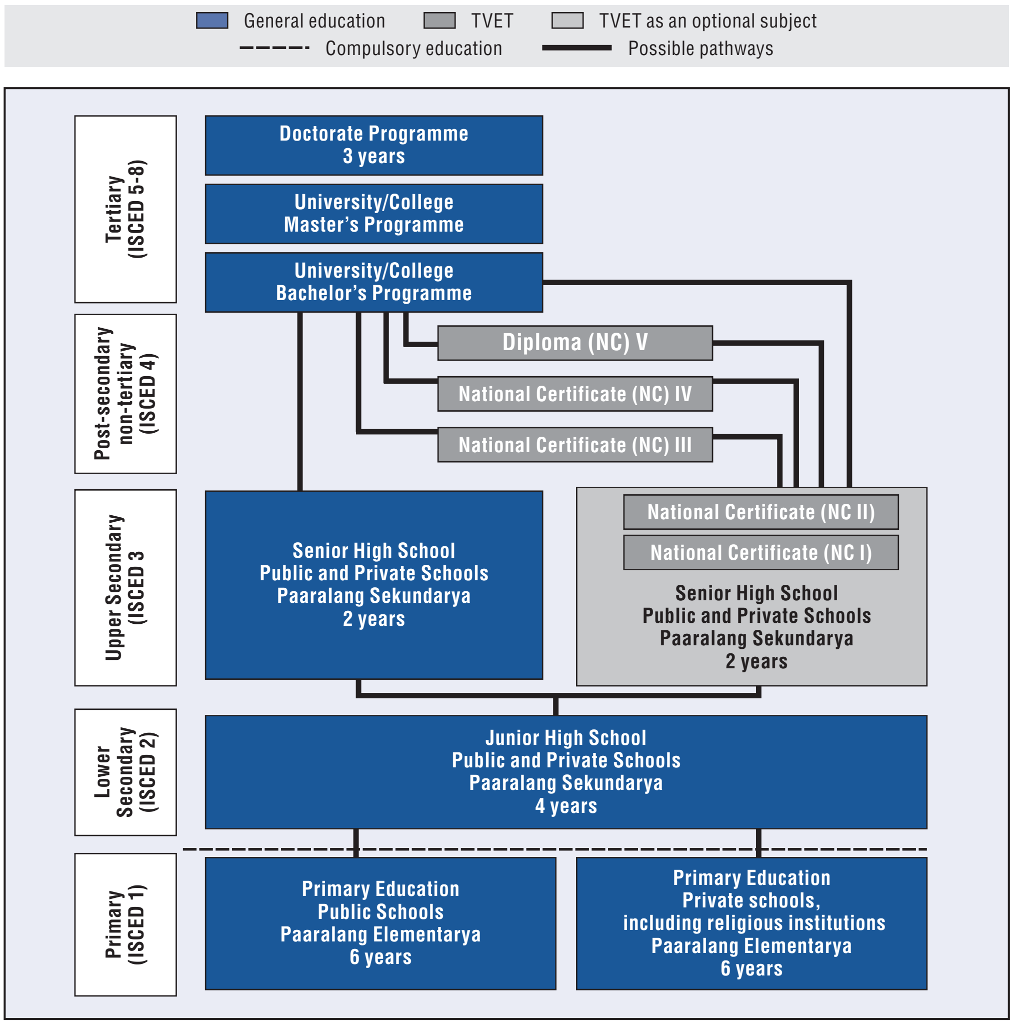


Source: UNESCO-UNEVOC (2013a), *World TVET Database Finland*.

Some countries of Emerging Asia already allow TVET students to move on to general education, although usually not directly after graduating from secondary level but rather after completing a post-secondary non-tertiary level. For example, graduates from the post-secondary non-tertiary level (ISCED 4) in Myanmar (engineering courses) and Viet Nam can go on to general education at the tertiary level (ISCED 5-8), or to high-level engineering courses (ISCED 6) in the case of Myanmar.

The framework in the Philippines gives graduates from secondary TVET programmes the option of continuing directly to university or of obtaining a national certificate first. Students with national certificates (NC) I and II can go directly into university-level Bachelor's programmes, although the transferability of qualifications and study between TVET and tertiary education remains limited (Macha et al., 2018). Students can also choose to continue to post-secondary non-tertiary TVET and obtain NC III-IV or a diploma (NC V) before going on to tertiary education to pursue a degree (Figure 2.13).

Figure 2.13. **The education system in the Philippines**



Source: UNESCO-UNEVOC (2019b), *TVET Country Profile Philippines*.

In other Emerging Asian countries, including India, Indonesia and Malaysia, vocational education is offered at the tertiary level in Bachelor-equivalent programmes (called Bachelor of Applied Science in Indonesia). In Malaysia, TVET programmes are offered at technical universities (Bachelor-equivalent programmes, diplomas and advanced diplomas), and pathways exist for students to move into general tertiary education at the Master's and doctoral level. Students graduating in India from TVET secondary schools are able to continue to a Bachelor of Vocational Education programme.

For TVET to be attractive, it should provide flexible programmes rather than focusing only on occupation-specific skills. Offering students the option of combining studies from different TVET programmes, for example robotic technology with mechanical and software engineering, is one possible approach. In addition to reforming the structure and design of TVET to allow higher permeability and diversity of programmes, the image of TVET among students and their parents can be enhanced through publicity campaigns, promotion and information dissemination (Box 2.5).

Box 2.5. **Making TVET more attractive**

Enhancing the image of TVET among students and their parents is crucial, and campaigns can take various forms. Denmark, for instance, uses television and other media to target companies, students and parents, and its national database for citizens includes an education guide detailing the country's qualifications system and outlining the requirements for particular jobs or courses. In Greece, websites were created to provide information on TVET and employment (Cedefop, 2014). TVET schools across Finland promote their services to parents by arranging regular visits and parents' evenings. In Emerging Asia, Malaysia's 11th Development Plan 2016-20 includes strategies for increasing the attractiveness of TVET, such as targeted media campaigns that showcase success stories to inform students and parents about the career and entrepreneurship opportunities that TVET can offer.

Enhancing the role of employers is also crucial. Systems that give students practical experience in the workplace can help to enhance the attractiveness of TVET. For example, the dual training system used in Germany, Austria and Switzerland allows students to work in a company on apprenticeships in addition to their classroom studies. Upon completion of the programme, qualified students receive a standardised and widely acknowledged certificate from competent issuers. Another example is England's National Apprenticeship Week, which is organised annually to promote apprenticeship as part of efforts to inform the public about the wider opportunities of TVET.

Changes in the labour market are also needed to enhance the attractiveness of TVET. These changes include the financial recognition of qualifications, the opening up of opportunities across occupations and the development of progression routes (UNESCO-UNEVOC, 2013b).

However, improving the image of TVET in the region will take time, while the rapid pace of digitalisation is affecting the labour market and the skills it requires. Relying on TVET alone is therefore not enough to provide adequate education for the digital era. Instead, the digital skills provided by vocational schools on the one hand, and general education, including universities, on the other, should complement each other. Both systems can teach the basics, with vocational education providing practical digital skills and general education providing more advanced theoretical skills.

Maximising the private sector's role in TVET

The role of the private sector is crucial in helping TVET to adapt to an evolving labour market in the digital era. The private sector can provide a clearer view of the changes occurring amid rapid digitalisation as well as information on the skills needed by industry. To ensure that TVET prepares its students to be ready for work, companies and other key stakeholders must be encouraged to co-operate and become more engaged in TVET planning and processes, including curriculum design, training and mentoring. The role of the private sector could be enhanced in many countries in the region. In Viet Nam, for instance, employers appear to be weakly engaged in the TVET system. While some vocational schools have partnerships with local companies, systematic and close collaboration with companies is not widespread, and the influence of employers in national policy making is limited (Kis, 2017).

The private sector plays a more significant role in some OECD countries. In Germany, for example, stakeholders including the government, employers and trade unions take part in decision making, with influence on the form and content of TVET. In Germany's dual system of vocational education, students spend part of their time in school and the rest as employees in companies, with an apprenticeship contract. The combination of workplace experience and school-based training allows a smooth transition of students to the labour market. Work-based learning has many benefits, both as a learning environment and as a means of fostering partnership with employers. It should be integrated into all vocational programmes while also being systematic, quality-assured, assessed and credit-bearing (Kis, 2017).

The rising importance of lifelong learning in the digital era

Lifelong learning is a key facet of the human capital development agenda in Emerging Asia. Lifelong learning can help the working population adapt to changing labour market conditions. It can help people with limited education to improve their social condition. It is also associated with initiatives that encourage older people to stay economically active. In other words, lifelong learning involves efforts to skill, upskill and reskill people across the social spectrum through formal and informal mechanisms.

Deepening digitalisation underpins the growing importance of lifelong learning in the region. To have a solid policy base moving forward, Emerging Asian economies can work on systematic monitoring of participation in lifelong learning programmes and the progress of target groups. To enhance participation, lifelong learning campaigns must be actively publicised, programmes should be co-ordinated and the expectations of participants addressed. Key to advancing this framework of learning will be the ability of governments to maximise available digital solutions, encourage private-sector participation in content design and distribution, and foster coalitions among learning institutions to generate synergy gains.

Lifelong learning has deep historical roots. It has been closely examined as a policy area on a global scale (UIL, 2017; Field, 2001; Kallen and Bengtsson, 1973) and is integrated into the development frameworks of many countries. It is also espoused by multilateral initiatives such as the 2030 Agenda for Sustainable Development and the Belém Framework for Action. Collaborators in lifelong learning initiatives can include traditional educational institutions (from basic to tertiary), portals for open online courses, open high schools and universities, community-based learning groups, and technical and vocational schools. The promotion of lifelong learning through various channels has in turn led to the idea of "learning communities" or "learning cities" in a number of countries, including in Emerging Asia (Osborne and Borkowska, 2017). The idea essentially aims to make lifelong learning opportunities available in various forms and accessible by everyone, typically spearheaded by the city or community leadership.

Southeast Asian economies have penned national strategies to pursue lifelong learning objectives by various means, and these policies are backstopped by communiqués and initiatives of ASEAN as a group.[3] There is widespread support for community learning centres in Southeast Asia, with the aim of reaching the underserved areas (UIL, 2017). Distance learning and virtual learning have been facilitated through open high schools and open universities as well as massive open online courses (MOOCs). TVET has also been integrated with lifelong learning in certain cases. The trends are somewhat similar in India, where an array of interventions have been rolled out. Adult education centres have been established in villages (UIL, 2016a). Distance learning is integrated in technical education following a blended learning model (AICTE, 2017), while MOOCs increase the reach of instruction (Chauhan, 2017). Likewise, China has employed various methods to promote adult education and lifelong learning, such as state-led training programmes, community schools and learning organisations, and the integration of learning at workplaces (Huang and Shi, 2008). The use of MOOCs in China to foster learning is also gaining traction (Wang Yidan, 2015).

To improve equity in access to learning, various sectors have been targeted by the initiatives in Asia. They include the illiterate, migrants, low-skilled people, drop-outs, rural households, women and seniors, as well as prisoners, road workers and army camps (UIL, 2017; Govinda, 2017). While this section focuses heavily on skills needed to boost labour market productivity, it is also worth noting that lifelong learning extends to other areas like personal financial management. In the context of digitalisation, approaches to financial literacy have to move outside the core principles of finance. The need to have a thorough understanding of the underlying technology in financial services delivery is growing in importance (Box 2.6). As regards promoting technological literacy per se across levels of education, Estonia's ProgeTiger programme inititated in 2012 provides some valuable lessons (Box 2.7).

Box 2.6. **Financial literacy strategies and digitalisation**

Digitalisation has transformed the way financial services are delivered, and this has implications for the promotion of financial literacy. The aim of financial literary is to minimise the build-up of credit risks. While digital financial mechanisms have improved the convenience of transactions and broadened access to financial options, they have also created new risks: digital data privacy, digital fund security, digital system stability, etc.

In Emerging Asia, Singapore is the early mover in developing a national financial literacy strategy. In 2003, MoneySense was rolled out as the country's national financial education programme under the auspices of a council co-chaired by the Monetary Authority of Singapore and the Ministry of Manpower (MoneySense, 2019). It conveys information through its online platform, social media and television as well as through forums and workshops run by its Institute for Financial Literacy. Awareness campaigns extend to alternative digital finance platforms (MAS, 2018). MoneySense also works with partner institutions, including academia, to meet the needs of various socio-demographic clusters. In addition to MoneySense, Singapore utilises its education system to boost financial literacy, with private sector involvement in many cases (Messy and Monticone, 2016; Hartung, 2019).

Other Emerging Asian economies are following suit. Strategies have mainly revolved around a national financial literacy plan, pursued along the lines of financial inclusion and consumer protection (Messy and Monticone, 2016). They are largely under the guidance of the central bank and the securities commission, although the approach tends to involve multiple stakeholders, including academia, the private sector (particularly financial institutions), nongovernmental organisations and other government agencies.

Box 2.7. **The Estonian digital education framework**

Estonia is in the process of digitalising all aspects of society. The Baltic state of 1.3 million inhabitants began this process in 1997, with e-governance, and has since brought health, public safety, taxation, voting and residency matters online (e-Estonia, n.d.). Its innovative programme aims to digitalise other aspects of society, such corporate reporting, transactions and industry. Regarding education, the country aims to digitalise all study materials by 2020 and make them available through an online "e-schoolbag", and to "implement modern digital technology efficiently and effectively in learning and teaching" (e-Estonia, n.d.).

In PISA 2015, Estonia was Europe's best performer in the sciences and second in mathematics, showing its strength and quick progress in education (OECD, 2019c). Among other initiatives, the government recently introduced the Estonian Education Information System (EHIS), a comprehensive database on education-related data from students, teachers, educational institutions, study materials and curricula. The innovative aspect of this database is its comprehensive nature: while other countries collect such data, Estonia has compounded all types of data in one framework (OECD, 2019c). The database is integrated in the accountability and monitoring framework for education, which helps the government to monitor performance.

Furthermore, in 2012 the country launched the ProgeTiger programme, which aims to enhance learners' technological literacy and digital competence, as part of Estonia's Lifelong Learning Strategy. The programme is managed by a dedicated agency for the digitalisation of education, the Information Technology Foundation for Education (HITSA), which aims to ensure that "sufficient age-appropriate digital competence necessary for further studies and to succeed in society is acquired at all levels of education, by integrating the use of digital solutions into the entire process of teaching and learning" (HITSA, 2015).

ProgeTiger is regarded as a best practise by the European Commission, which chose it as one of the best programmes in the European Union for the development of digital skills (HITSA, 2018). ProgeTiger focuses on three fields: engineering sciences; design and technology; and ICT. It has developed and adapted learning materials, trained teachers, reinforced knowledge sharing among teachers, supported procurement of technological equipment and communicated on the benefits of ICT. The programme requires teachers to integrate technology in different subjects while allowing them to choose the type of technology they use (OECD, 2019c). Teachers have access to face-to-face and online training, and benefit from the support of local networks related to the programme. An estimated 85% of Estonian schools, 44% of kindergartens and more than 4 100 teachers have benefited from the programme (HITSA, 2018).

Financing adult education and ICT human resource development

Globally, there have been improvements in key pillars of adult education and lifelong learning, namely more precise targeting of policy, governance, consultation and financing (UIL, 2016b). In terms of financing, schemes can vary, taking the form of public-private partnerships or government grants and subsidies. In Singapore, for instance, the government is highly involved in funding for lifelong learning programmes via incentives and subsidies under the SkillsFuture initiative, targeted at recipients of different ages.

One example is the SkillsFuture Credit incentive, which provides an opening credit of SGD 500 (Singapore dollars) to Singaporeans aged 25 years and above to pay for a wide range of approved courses related to work skills, including the SkillsFuture series such as advanced manufacturing, cybersecurity, data analytics and digital media (SkillsFuture, 2019a). This credit, which comes with future top-ups at periodic intervals, lapses only upon a change of citizenship or death, thus allowing beneficiaries to accumulate credit and use it at any time.

The Singaporean government also offers a SkillsFuture Mid-Career Enhanced Subsidy that allows mid-career Singaporeans, in particular those who are aged 40 years and older, to upskill, re-skill and stay responsive to the changing workplace (SkillsFuture, 2019b). These additional subsidies – for courses that are already subsidised – are intended to help address the opportunity costs that mid-career Singaporeans may face when embarking on training, due to higher competing demands in the form of job and family commitments, compared to the younger individuals targeted under SkillsFuture Credit.

Luxembourg and Korea also offer interesting funding examples. In Luxembourg, private-sector companies can benefit from government financial assistance for their training plans under co-funding legislation, with the support amounting to 15% of the company's total annual training investment (INFPC, n.d.). In Korea, the government has established special funds that mobilise profits from ICT industries to help build the ICT sector. For example, Korea's 5G spectrum auction in 2018 raised around USD 3 billion, which will be a source for the funds. This financing method has allowed the country to nurture ICT human resources and develop the ecosystem of the ICT industry (Box 2.8).

Box 2.8. **Korea's ICT human resource development policy**

Korea jump-started investment in ICT human resource development (HRD) in 1996 with the creation of an Informatisation Promotion Fund, built on the principle that profits from ICT industries should be reinvested in the ICT sector. The fund was also used for R&D, infrastructure roll-out and standardisation, and allowed the government to carry out high-cost projects with national impact.

Financing for this fund, and for a Broadcasting Communications Development Fund, came through contributions of government, telecommunications operators and broadcasting business entities. The use of these funds was governed by the Information and Communications Technology Industry Promotion Act and the Framework Act on Broadcasting Communication Development.

Two accounts were created under the Informatisation Promotion Fund: a general account and an R&D account. These accounts had separate sources of funding and served different purposes (Table 2.15).

Table 2.15. **Purposes and sources of the Informatisation Promotion Fund**

	Purposes	Sources
General account	• Build a broadband network and promote its utilisation • Facilitate informatisation in the public, regional and industrial areas • Build a foundation for growth of the ICT industry	• Government contribution • Profits from operation of the fund • Borrowings and other revenue
R&D account	• Develop ICT technologies • Nurture skilled ICT resources • Develop and set ICT standards • Build a foundation for ICT research	• Government contribution or loans • Mandatory contribution from telecommunication operators • Profits from operation of the fund • Borrowings and other revenue

Source: Ko, Sangwon (2010).

After the completion of large-scale informatisation projects, such as the information superhighway and a first-stage E-Government project, the general account of Informatisation Promotion Fund had achieved its purpose. This account was abolished

Box 2.8. **Korea's ICT human resource development policy** *(cont.)*

in 2005 and the name of the fund was changed back to its original title, ICT Promotion Fund, which has been focused on investing in R&D for ICT.

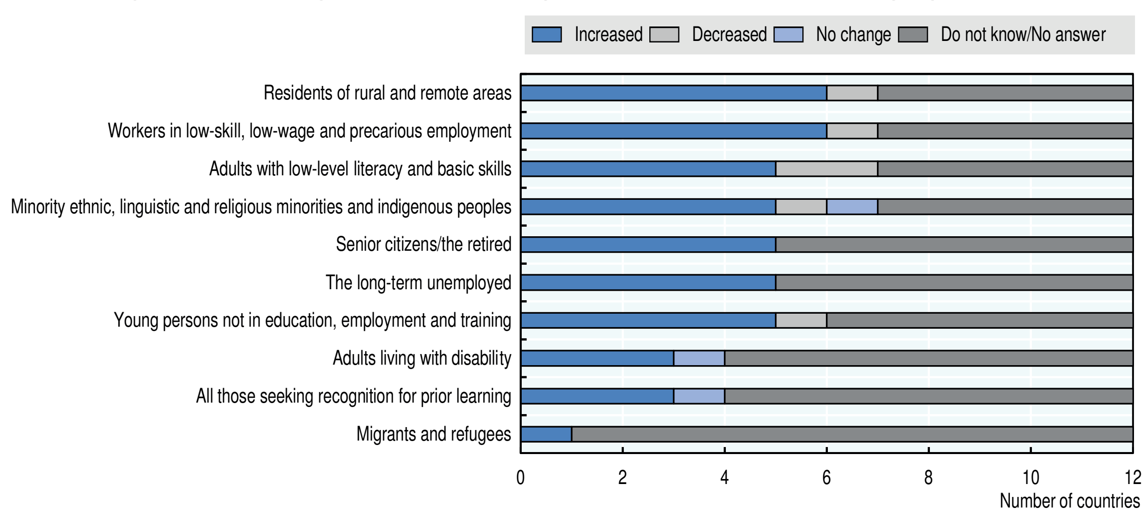
The long-term and continuous investment of the Korean government in ICT HRD was made possible largely through the Informatisation Promotion Fund. Thanks to the fund, the Korean government was financially stable and flexible enough to invest in nationwide information technology projects for the future, to respond swiftly to the changing skills requirements of the market, and to reflect shifts in the technological environment when implementing ICT HRD policies (Ko and Kang, 2014).

Monitoring and publicity can boost participation

Substantial gaps remain in areas such as improving monitoring and increasing participation via publicity. In a UNESCO study, more than half of 25 Asian countries indicated that overall participation in adult learning had increased between 2009 and 2015, in line with the world average, but 40% of the countries did not know the extent of progress (UIL, 2016b). Among the 12 Emerging Asian economies, five noted improvements during the period, while the other seven had no information on changes (UIL, 2016c).[4]

Data at the population subgroup level are even more telling. Six of the Emerging Asian economies indicated an increase in adult learning participation between 2009 and 2015 among residents of rural areas and workers in low-skilled jobs, while one indicated a deterioration. The other five countries either had no information or failed to answer (Figure 2.14). Worryingly, the number of countries noting improved participation for other target groups is lower, and the number that did not provide any information is higher. This is particularly evident regarding migrants and adults seeking recognition for prior learning.

Figure 2.14. **Change in adult learning participation rates in Emerging Asia since 2009**

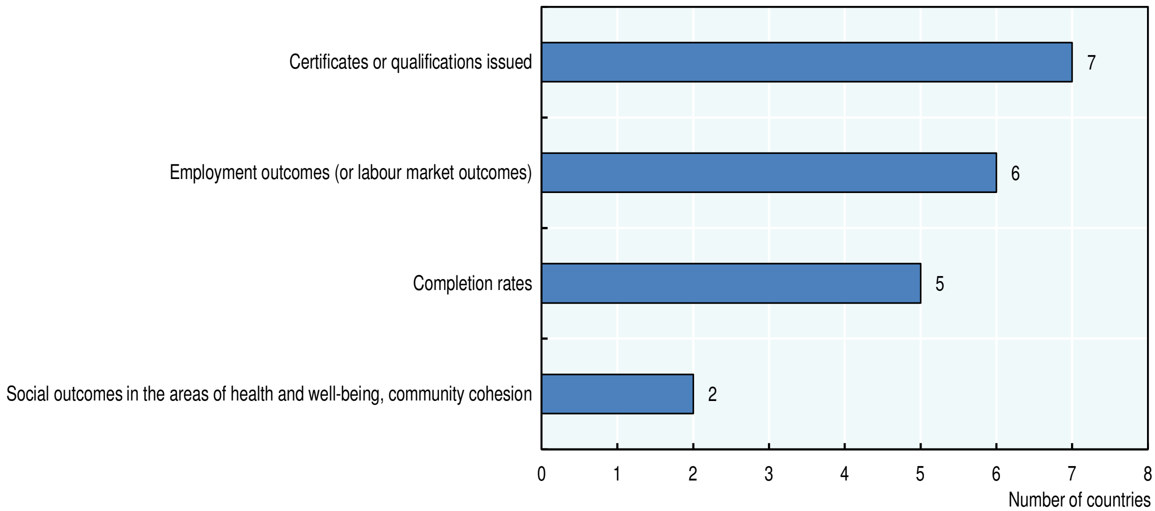


Note: GRALE 3 survey results were published in 2016 benchmarking on the GRALE 1 survey results published in 2009.
Source: OECD Development Centre calculations based on UIL (2016c), *GRALE 3* (database).
StatLink https://doi.org/10.1787/888934064183

The dearth of information on participation in adult learning, as shown in the figure above, suggests that systematic data collection is lacking in the region. Indeed, only seven

Emerging Asian countries monitor adult learning certificates, and just six monitor labour market outcomes (Figure 2.15). The number that monitor completion rates and social outcomes is even lower.

Figure 2.15. **Countries collecting information by type of outcome in Emerging Asia**



Note: GRALE 3 survey results were published in 2016 benchmarking on the GRALE 1 survey results published in 2009.
Source: OECD Development Centre calculations based on UIL (2016c), *GRALE 3* (database).
StatLink https://doi.org/10.1787/888934064202

Against this backdrop, there is a need to strengthen data collection and monitoring on adult learning, at least on the extent of participation. The addition to the monitoring framework of other dimensions of outcomes and implementation is encouraged. It cannot be overstated that formulating effective ways forward demands an extensive information base of good quality. The labour force survey is one instrument that can be exploited to gather data on this policy area with regularity.

To enhance participation, adult learning campaigns can be publicised through mass, social and other media. In many countries in the region, programme delivery is still fragmented. To address these issues, countries need a clear national plan on how to get various stakeholders involved (e.g. private-sector firms, government agencies, academia and the informal sector) and on how to connect the different learning channels, including community learning centres. Japan, Korea and the United Kingdom have established agencies that specifically deal with lifelong learning, and this has made their programmes more cohesive. Anchoring the expectations of potential participants is also crucial for the credibility of adult learning programmes. Participation can be constrained by perceptions that the programmes offer limited value (due to opportunity cost, the quality of teachers and the value of accreditation), as well as by cultural sensitivities and lack of awareness.

Digital advances open the door to massive online education

Digitalisation can facilitate lifelong learning frameworks in the region through MOOCs, open educational resources and online open university courses. It is encouraging that the use of such open and distance learning is increasing in Asia. These platforms not only widen the scope of training, but also make access to learning materials more flexible. Initiatives to make the most of mobile phone and mobile Internet penetration to promote learning opportunities through applications also carry substantial promise

(Farley and Song, 2015). However, capitalising on these developments requires an enabling environment.

First, acquiring basic digital literacy has to be incentivised through lower Internet costs and better Internet service. Emerging Asian economies have arguably advanced in this area, as suggested by the sharp growth in e-commerce, e-payments and other digital solutions. However, the level of understanding is still uneven across and within countries. Moreover, raising digital know-how should go beyond the working age or midstream population to reach older people and young children (Park, 2019). With this in mind, an effective national programme for promoting digital learning tools requires a thorough understanding of the learning preferences of people of different age groups and with different socio-economic backgrounds.

Second, deeper private-sector engagement can help scale up the use of MOOCs. Private firms can be a valuable source of insight concerning course content in relation to the evolution of skills needed in the labour market. They can also be a source of capital to expand programme coverage and can make learning platforms more sustainable by taking maintenance and the updating of materials into account. Increased capital outlay may be needed in many countries to reach digitally marginalised sectors. Programmes are currently spearheaded by governments and academia in a number of Asian countries (Kim, 2015).

Third, the integrity of the MOOC modules must be reaffirmed regularly. This can be done via a system that validates their quality following a standardised set of parameters. Multilateral forums have jumpstarted discussions to co-develop MOOC content and co-operate in information flow between countries (ASEM, 2017). They have also moved to institutionalise acceptable quality-assurance frameworks and standards to facilitate a credit transfer mechanism within the region (dela Peña Bandalaria, 2018). Bahrain, Korea and Malta are countries that have a specific quality-assurance system for adult learning modules (UIL, 2016b).

Finally, collaboration among institutions can yield significant synergy gains. Strengthening inter-scholastic ties within each country can help to broaden the network, while incorporating community learning centres into the network can bolster awareness, especially in rural areas. China provides a model on alliances among universities in exploring MOOCs as channels of learning (Wang Ying, 2015). The University Alliance Joint Platform and the Online Course Sharing Alliance are examples of such coalitions. China also opened the door for enterprises to participate in building the platform support systems that allow course accreditation, credit transfer among universities, online learning and offline examination. Collaborations between private instruction, private institutions and international MOOC platforms are likewise being harnessed in Japan and Korea (Yamada, 2015; Lee, 2015). Some international MOOCs (Coursera, EdX, Khan Academy, Udacity and Udemy) have been in the business long enough to impart critical knowledge in massive online education for people with different profiles.

Conclusion

Digitalisation and new technologies are developing rapidly, affecting businesses and the labour market. The changes brought by digitalisation present a huge opportunity while at the same time carrying significant risks. Business in the digital era will demand labour with a new set of skills. Education systems will need to adapt in order to meet this new demand. Emerging Asian countries need to address certain challenges to ensure that their education systems are ready to provide the right ICT skills to all citizens. Priorities include providing sufficient ICT infrastructure to schools, training teachers to boost their digital skills for use in the classroom and adapting curricula to include ICT to support teaching at all levels, in an all-encompassing fashion rather than for its own sake. Enhancing the role of TVET and lifelong learning is another priority area in providing education for the digital era.

Notes

1. Examples and case studies from the OECD economies were largely drawn from the *OECD Skills Outlook* (OECD, 2019a).
2. The quality of the connection is not included in this statistic, however, and it should therefore be taken with caution.
3. The coverage and cohesiveness of national policies on lifelong learning tend to vary among ASEAN economies. Some examples of regional initiatives that promote lifelong learning are the Hanoi Advocacy Brief on Promoting Lifelong Learning for All, Southeast Asian Ministers of Education Organization (SEAMEO) Southeast Asian Education Agenda 7 Priority Action Areas (2015–35) and the ASEAN Socio-Cultural Community Blueprint 2025 (UIL, 2017).
4. The data are based on the results of the GRALE 3 survey published by UIL in 2016.

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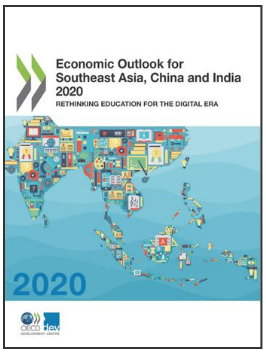

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