

Background note

OECD SOUTHEAST ASIA REGIONAL FORUM



Opportunities and Policy Challenges of Digitalisation in Southeast Asia

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SUMMARY AND KEY MESSAGES FOR THE SEA REGIONAL FORUM

The digital transformation: Opportunities and challenges

The world is in the midst of a digital transformation, with 40% of the world population now connected to networks, up from 4% in 1995. In Southeast Asia too, the uptake of digital technologies has grown rapidly, with over 80% of adults now connected to the Internet in Singapore, and around 20% in Lao PDR and Cambodia. The rapid diffusion of mobile broadband, in particular, is enabling more people to connect to digital networks and digital services.

The digital transformation can spur innovation and productivity growth across many activities, transform public services, and improve well-being as information, knowledge and data become more widely available. In Southeast Asia, it can help in changing the development paradigm towards growth driven less on the demand side by exports and more on the supply side by productivity increases, enabling countries to “move up the value-chain”. Moreover, it can help in addressing policy challenges such as the meeting of future energy, food and water needs, or improving the delivery of health and education services.

These potential benefits go hand-in-hand with challenges to jobs and skills, to privacy and security, to markets and taxation, and to public institutions and social interactions. In Southeast Asia, there are concerns, for example, about the possible reshoring of manufacturing activities to advanced economies, enabled by automation, and about premature deindustrialisation more generally.

To ensure that policies harness the benefits while mitigating the challenges, policy makers in Southeast Asia need to be pro-active and act now. Many policies, across the whole spectrum of government policy, are the legacy of an analogue era and ill-adapted to today's digital era. This gap between “Technology 4.0” and “Policy 1.0” needs to be closed.

Making the digital transformation work will require inclusive, coherent and well-coordinated policies, reflecting a multi-stakeholder and whole-of-government approach to policy making, that proactively consider those who will benefit and those who risk being left behind.

Fostering access and effective use

Fully benefitting from the opportunities linked to digitalisation will require that all individuals, businesses and governments have reliable and affordable access to digital networks and services. This requires effective telecommunications policies, based on sound competition, that reflect the need for a wide diffusion of digital networks, and targeted measures for disadvantaged people, firms (e.g. certain small and medium-sized enterprises [SMEs]) and regions. However, in several Southeast Asian countries, prices to access digital networks are still too high, limiting access.

But mere access to digital networks does not ensure effective use. Policy will also need to help equip workers and citizens with appropriate skills to use the technology; enable complementary investments in organisational change and process innovation; and foster competition and sound firm dynamics. This implies that new digital firms can easily enter new markets, grow and reach scale, and incumbents are not protected from competitive forces.

SMEs face challenges in the use of information and communication technology (ICT) but also have important opportunities, such as global e-commerce, to access new markets and improve their performance. Improving their access to finance is particularly important, as are policies that can help diffuse digital technologies to SMEs, such as efficient technology extension services. SMEs account for a large share of firms and jobs in Southeast Asia, making it particularly important for countries in the region to meet this challenge.

Digital trade is creating new economic opportunities, allowing firms to access new markets, and bringing new goods and services to consumers globally. To seize the opportunities, governments in Southeast Asia need to work together to facilitate digital trade across borders, whether digitally or physically delivered, address existing cross-border barriers, and avoid unnecessary new restrictions. This can also help ensure a continued strong performance of Southeast Asian countries in global value chains (GVCs) and enable growth of innovative firms within the region.

Trust is fundamental to the success of the digital transformation. Coherent strategies for digital security and privacy, and the implementation of security and privacy risk management frameworks, are essential, as is the protection of consumers engaged in online activities. The development of such strategies can benefit from international co-operation among countries in Southeast Asia.

Facilitating adjustment and supporting inclusive growth

The digital transformation will provide new job opportunities for many but raises challenges for others, with the risk of growing inequalities in access to jobs. Sound labour, skills and social policies can make it easier for workers to grasp the new opportunities. Workers displaced by the digital transformation should be assisted in finding new jobs and supported when they lose a job.

Strengthening ICT skills for all workers and citizens is important, but will not be enough to thrive in the digital economy. Good literacy and numeracy skills are essential, while other complementary skills need to be developed, including socio-emotional skills to work collaboratively. OECD indicators of educational performance in Southeast Asia point to important gaps in outcomes within and across Southeast Asian economies, including between advantaged and disadvantaged groups.

Digital technologies can also foster social inclusion by strengthening access to health care, financial services and skills development, and by helping disadvantaged groups connect to such services. Digital technologies can also support the implementation of more “inclusive innovation policies” – a specific set of innovation policies that aim to boost the innovation capacities and opportunities of individuals and social groups that are underrepresented in innovation, research and entrepreneurship activities.

Governments can leverage digital technologies to re-invent policy design and experimentation, implementation, monitoring and evaluation, and better serve the needs of citizens, e.g. in fostering smart cities. To enable more evidence-based policies, better measurement and analysis of the digital transformation and its impacts are urgently needed.

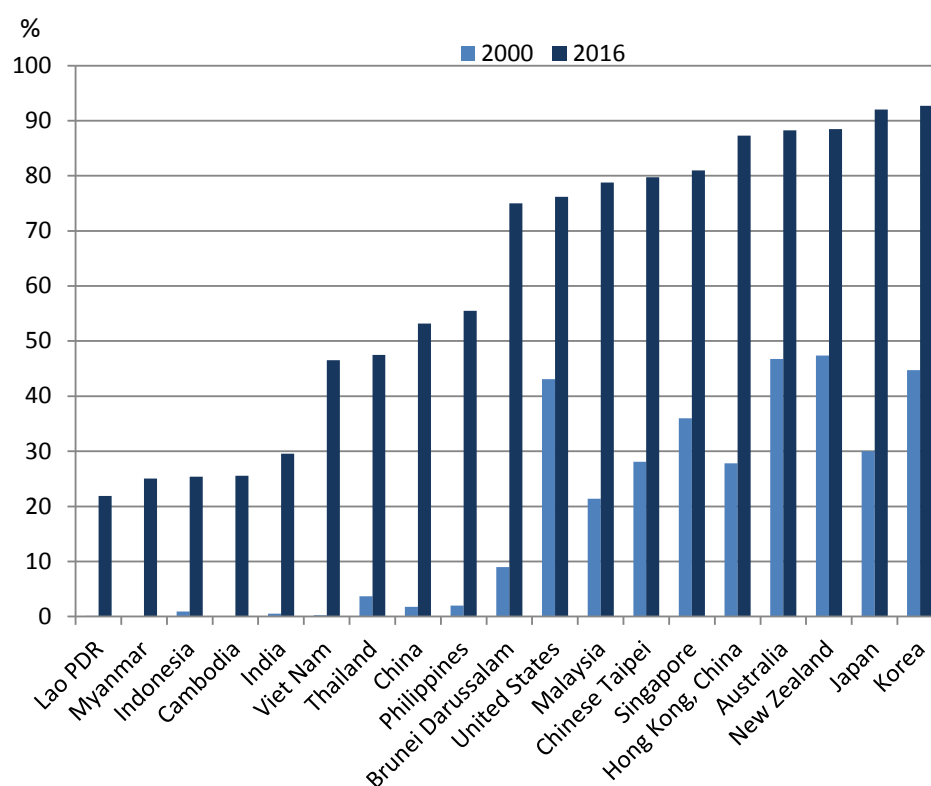
OPPORTUNITIES AND POLICY CHALLENGES OF DIGITALISATION IN SOUTHEAST ASIA

The digital transformation of economy and society

The world is in the midst of the transition towards a digital economy and society. Although underway for nearly half a century, the pace of the digital transformation has quickened in recent years. Digital infrastructures are now nearly fully deployed in many advanced Asian economies and growing quickly beyond (Figure 1), and smart phones provide ubiquitous connectivity and computing to many. Internet access has grown, from 4% to 40% of the world's population in 20 years and emerging and developing economies are increasingly using digital technologies to forge ahead in areas like e-commerce, banking and health.

Figure 1. Internet users in key economies in Asia and the Pacific

As a percentage of total individuals



Source: OECD, based on ITU (2017).

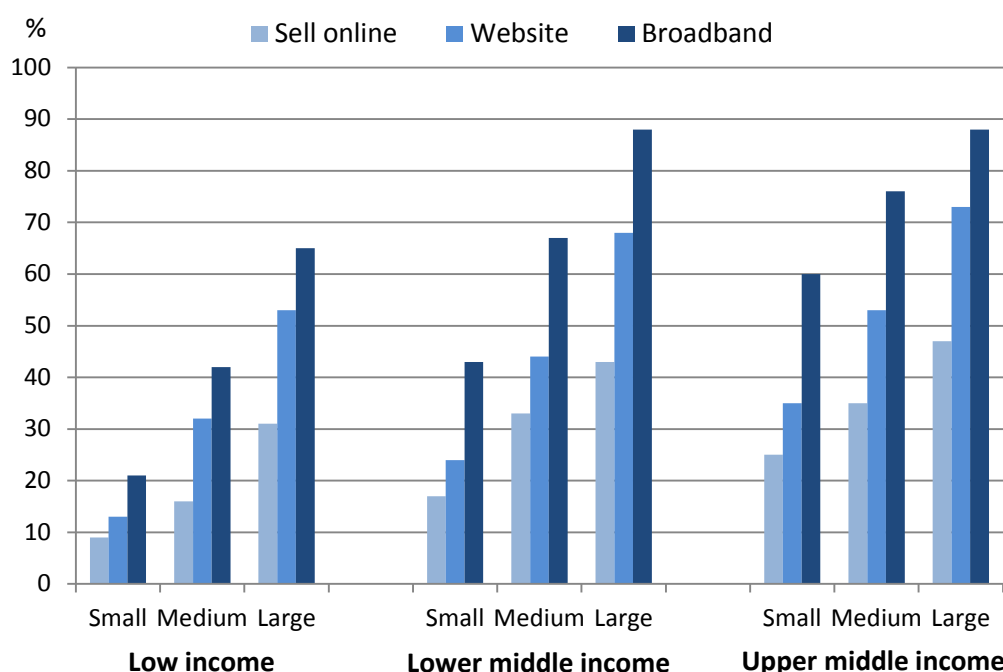
As more people and things become connected through networks, torrents of data are generated, new technologies like blockchain emerge and breakthroughs occur in artificial intelligence (AI), *it is clear that the digital transformation is still only at an early stage*. While many firms now have access to broadband networks, the use of more advanced digital tools and applications within firms still differs greatly across countries, even among the most advanced economies. Moreover, there are important differences between firms within countries, with SMEs lagging at all levels of economic development (Figure 2).

The ongoing digital transformation *has the potential to spur innovation, enhance productivity across a wide range of activities, and improve well-being* as information, knowledge and data become more widely available. For the ASEAN region, the digital transformation can be part of the response to the slowdown in productivity growth that has occurred across much of the region (Figure 3), helping to ensure higher incomes and stronger competitiveness in global markets.

These potential benefits go hand-in-hand with challenges to the nature and structure of organisations, markets, and social interactions. The digital transformation raises challenges for jobs and skills, market entry and competition, taxation, and invites new thinking on how to preserve fundamentals such as privacy and security, and on how to ensure that the transformation is socially inclusive and sound.

Across countries, including in Southeast Asia, the *policy response to the digital transformation has been mixed*. Some are developing a strategic and pro-active approach to leveraging its benefits, working across the full range of government policies, while others have made piecemeal decisions to contain or roll back the consequences of specific incidents (e.g. security breaches) or the impacts of new technologies, applications or business models. In several cases, governments have been caught off-guard – be it by embedded code programmed to evade emission tests, the inherent lack of security in the “Internet of Things” (IoT), or tax policy challenges of the digital economy.

Figure 2. Larger firms use the Internet more than small firms

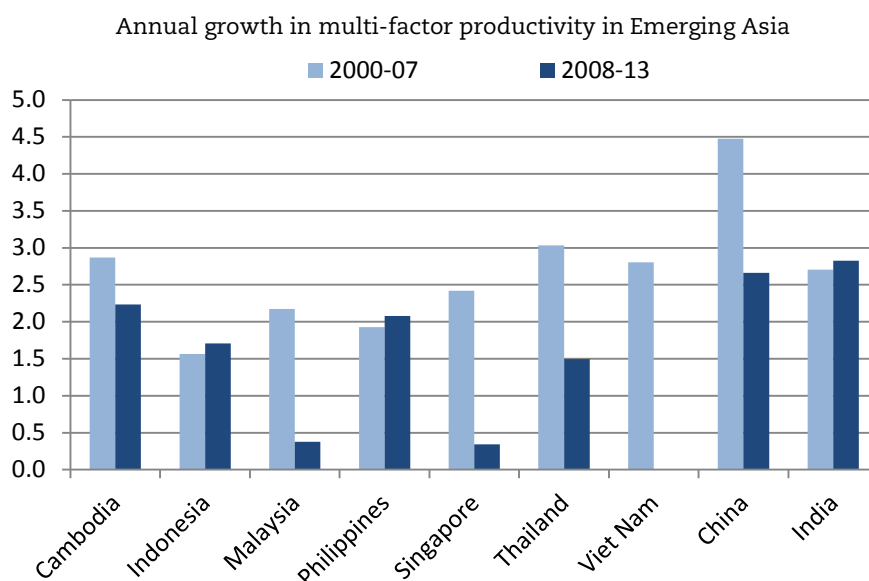


Source: Hussain (2015), in World Bank (2016).

This gap between “Technology 4.0” and “Policy 1.0” needs to be closed. Many policies, and public sectors’ internal processes and dynamics, are a legacy of an analogue era that assumed a physical context and are ill-adapted to the digital era. Likewise, policy makers sometimes lack an understanding of the changes underway and *seek to make small, incremental changes to existing policies instead of proactively developing new approaches, more adapted to the digital future.*

In the global and interconnected digital environment, the lack of an integrated, whole-of-government approach increases the risk that policies in one area will have unintended, possibly adverse, impacts on another, or that opportunities for synergies that enhance positive effects are missed.

With the ongoing development of big data analytics, machine learning, AI and other new technologies, *policy makers must work to ensure that the opportunity offered by the digital transformation is used to improve the well-being of all citizens.* This requires understanding the challenges, working collectively to learn from each other and devising policies that help workers, including civil servants, and society as a whole in adjusting to the transition. The window for action is now, so as to have effective measures and strategies in place when they are needed.

Figure 3. Productivity growth has slowed across much of the region


Note: Multi-factor productivity data not available for Brunei Darussalam, Lao PDR or Myanmar. Annual growth in multi-factor productivity in Viet Nam for the period 2008-13 averaged zero.

Source: OECD (2017b), based on APO (2015), *APO Productivity Database 2015*, www.apo-tokyo.org/wedo/measurement.

Catching up with the rapid pace of the digital transformation will also contribute to a **new and better growth narrative that focuses on improving well-being in increasingly open and digitalised economies**. This will allow preserving the benefits of globalisation and digitalisation while addressing their shortcomings and fostering inclusive growth.

Going Digital: The scope of the transformation

Digitisation is the conversion of an analogue signal conveying information (e.g. sound, image, printed text) to binary bits.¹ Once digitised, information can be represented in a universal manner, all microprocessors can process these bits, and it can be stored as data. Once in this form, data can be used – processed, stored, filtered, tracked, identified, duplicated and transmitted – infinitely by digital devices without degradation, at very high speeds, and at negligible marginal cost. The Internet allows this to occur globally. In contrast, processing analogue information is slow and the variety of formats (e.g. paper, film reel, magnetic tapes, etc.) severely limits links, combinations and replication. In short, digitisation reduces physical constraints to data collection and exploitation and enables the infinite use of the non-scarce and non-rivalrous properties of information, which are inherent to its intangible nature (see e.g. OECD, 2015a).

Digital technologies have come a long way since the invention of the first computer during World War II and the emergence of the Internet in the 1990s. Some of the key technologies and applications that are driving the digital transformation today include (OECD, 2016a):

- *The smartphone*: The introduction of the smartphone in 2007 transformed computing by enabling constant mobile connectivity and providing individuals with access to a wide range of new applications and services. It has also enabled the development of the “platform” economy.
- *The IoT*: The IoT comprises devices and objects whose state can be altered via the Internet, with or without the active involvement of individuals (OECD, 2015a). The networked sensors in the IoT serve to monitor the health, location and activities of people and animals and the state of production processes and the natural environment, among other applications (OECD, 2016b).

- *Big data analytics*: Big data analytics is defined as a set of techniques and tools used to process and interpret large volumes of data that are generated by the increasing digitisation of content, the greater monitoring of human activities and the spread of the IoT (OECD, 2015a). Firms, governments and individuals are increasingly able to access unprecedented volumes of data that help inform real-time decision making.
- *AI*: AI is defined as the ability of machines and systems to acquire and apply knowledge and to carry out intelligent tasks, e.g. sensing, processing oral language, reasoning, learning, making decisions and demonstrating an ability to move and manipulate objects accordingly. AI is making devices and systems smart and empowering new kinds of software and robots that increasingly act as self-governing agents, operating much more independently from the decisions of their human creators than previously.
- *Blockchain or distributed ledger technology (DLT)*: Blockchain or DLT enables protocols for value exchange, legal contracts and similar applications. It is a distributed database that acts as an open, shared and trusted public ledger that cannot be tampered with and that everyone can inspect. The technology offers the potential for lower transaction costs by removing the necessity of trustworthy intermediaries to conduct sufficiently secure value, legal or other transfers.

Many other technologies underpin the digital transformation that is currently underway, including open-source software like Hadoop, 5G, robotics, grid and neural computing, virtual reality, quantum computing, etc. Some of these have applications in almost all sectors of the economy and can be considered true “general-purpose” technologies. Others have more narrow applications in specific sectors. But together, they underpin a wide-ranging and rapid digital transformation of economy and society, and increasingly of governments, in many areas that is leading to shifts in markets and economic behaviour that are fundamentally different from the analogue era that we are used to.

Going Digital: Policies to shape the transformation

The digital transformation is *challenging almost every aspect of economy and society*, which implies that many different policy areas need to be considered in a whole-of-government response. It requires governments to reach across traditional policy silos and across different levels of government to develop a whole-of-government approach to policymaking. While many policies need to be considered, some key building blocks can be usefully distinguished, namely:

- *Policies that help in building the foundations for the digital transformation*. This includes policies that affect the broad enabling environment (notably market openness) for the digital transformation, as well as policies that foster accessible and affordable digital infrastructures and services.
- *Policies that help make the digital transformation work for the economy and society*. This focuses on policies that enable the effective use of digital technologies by people, firms and governments, and policies that foster the application of digital technologies in specific activities and policy areas. It also includes policies to foster trust and acceptance, and policies that can help all individuals, including citizens, workers and consumers, as well as society as a whole to adjust to the digital transformation, including by ensuring that all people have the skills they need to adapt to and excel in an increasingly digital world. Moreover, it includes policies aimed at the use of digital tools to enhance well-being, including by providing more equitable access to public services.
- *Policy coherence and strategy development*, which involves co-ordination among ministries and other bodies at all levels of government, as well as actively involving all key stakeholders in the policymaking process to ensure that all policies are mutually reinforcing and aligned with one coherent and strategic national digital agenda. Moreover, collective action will be needed in several areas to seize the opportunities and tackle the evolving challenges of the digital economy.

Countries differ substantially in their starting conditions for the digital transformation, such as the level of economic development, the structural make-up and trade specialisation of the economy, and geography, but also in their institutional characteristics and approaches to policy, e.g. in regard to the role of government and different private and public actors in the economy. As a result, they face different constraints under which policy responses to their challenges and opportunities need to be developed and different barriers that provide a rationale for policy action. Nevertheless, countries around the world are faced with the ongoing digital transformation and will therefore need to explore policies that can help seize its benefits and mitigate the challenges.

Table 1. SDGs and ICTs

	<p>Target 1.4: By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services [...], appropriate new technology and financial services, including microfinance.”</p>		<p>Target 9.c: Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in the least developed countries by 2020.</p>
	<p>Target 2.a: Increase investment [...] in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks [...].”</p> <p>Target 2.c: Adopt measures to ensure the proper functioning of food commodity markets [...] and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility.</p>		<p>ICTs, especially through mobile-based services, can help reduce inequality by drastically expanding access to information, contributing to individual empowerment and social inclusion of individuals who used to fall outside the reach of traditional services. (*)</p>
	<p>The use of ICTs in the health sector can result in higher quality health care that is safer and more responsive to patients’ needs. E-health can be particularly important in rural and remote areas, facilitating innovative models of care delivery, such as telemedicine and mobile health. (*)</p>		<p>ICTs can be leveraged to organise cities and communities more efficiently. Smart cities use ICTs and big data to improve public service delivery and to advance broad policy outcomes such as energy savings, safety, urban mobility and sustainable development. (*)</p>
	<p>Target 4.b: By 2020, substantially expand globally the number of scholarships available to developing countries [...] for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programmes, in developed countries and other developing countries.</p>		<p>ICTs, and especially broadband, have directly connected consumers and producers and given rise to “on demand” markets of products that can be customised and localised, which can save time, reduce transport costs and contribute to more efficient and sustainable consumption. (*)</p>
	<p>Target 5.b: Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women.</p>		<p>Use of the Internet of Things can help make monitoring the environment cheaper, faster and more convenient. (*)</p>
	<p>Target 7: Affordable and clean energy</p> <p>ICTs can contribute to improving water and energy access by using mobile solutions, smart grids and meters to advance efficiency, manage demand and develop new ways to expand access. (*)</p>		<p>The use of ICTs in the public sector can improve the range and uptake of digital government services; strengthen the performance of public institutions and enhance transparency and the participation of all citizens. (*)</p>
	<p>Target 8.2: Achieve higher levels of economic productivity through diversification, technological upgrading and innovation.</p> <p>Target 8.3: Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalisation and growth of micro-, small and medium-sized enterprises, including through access to financial services.</p>		<p>Target 17.8: Fully operationalise the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology.</p>
			

Note: Not all SDGs had an ICT component officially included in a corresponding target by the UN. In those cases, identified by (*), examples were identified by the OECD to depict how ICT could contribute to that particular goal.

Source: OECD (2016), *Broadband Policies for Latin America and the Caribbean*, www.oecd-ilibrary.org/science-and-technology/broadband-policies-for-latin-america-and-the-caribbean_9789264251823-en, based on United Nations General Assembly (2015), “Transforming our world: the 2030 Agenda for Sustainable Development”, <https://sustainabledevelopment.un.org/post2015/transformingourworld>.

The implications for emerging and developing economies are potentially important. Following the rapid spread of digital networks across the world, a large body of evidence is now emerging that shows that digitalisation does not only contribute to productivity and efficiency, but also to broader socio-economic development. It can give rise to a more inclusive society and better governance arrangements; enhance access to key services such as health, education and banking; improve the quality and coverage of public services and political participation; expand the way that individuals collaborate and create content; and enable them to benefit from a greater diversity and choice in products and from lower prices.

The role of digital networks as an accelerator of development has been recognised globally, and due to its critical importance to the three pillars of development – economic development, social inclusion and environmental protection – the task of making the Internet universal and affordable was approved as a target (Target 9.c) of the Sustainable Development Goals (SDGs), echoing the objective already elaborated by the United Nation’s Broadband Commission for Sustainable Development. Policies that explore the full potential of ICTs can therefore accelerate progress towards the attainment of the SDGs. Table 1 summarises the ICT components already set as targets in the SDGs and includes other possible ICTs components that can contribute to the remaining goals.

The precise nature of the approaches and set of policies needed therefore depends on the stage of development of each country, its economic structure, the capabilities of firms, etc. Moreover, the specific choice and combination of policies will need to be aligned with the capabilities of each country in terms of policy making and policy implementation.

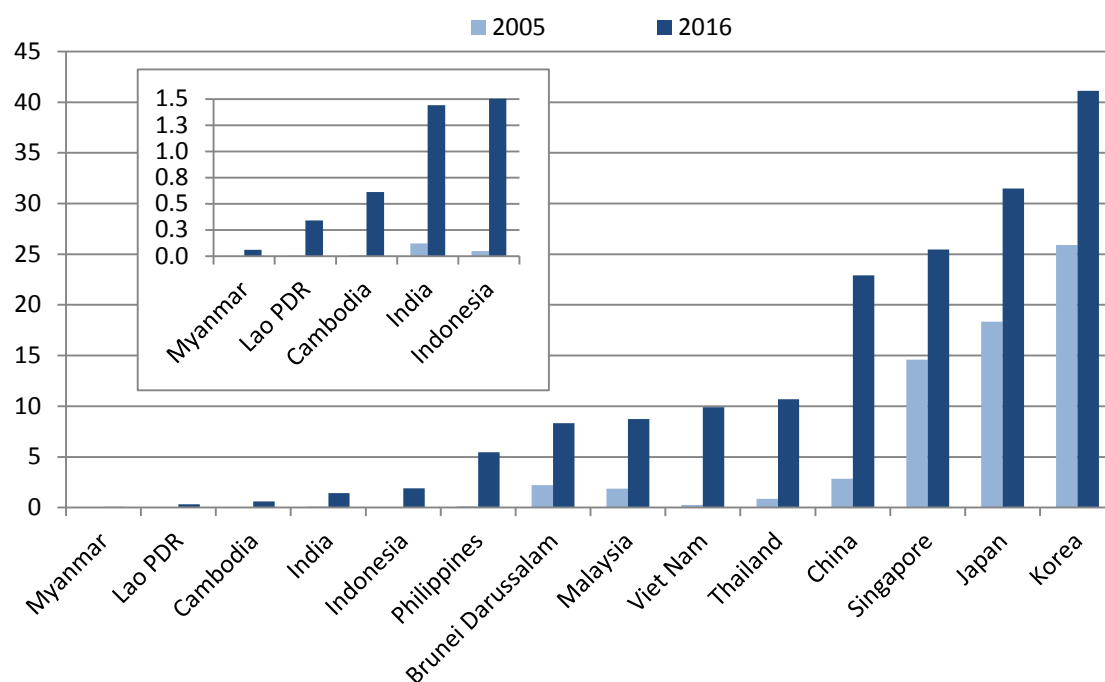
Ensuring infrastructure and access for all

The first building block for the digital transformation is about ensuring access for all. Digital infrastructures, including efficient, reliable and widely accessible broadband communication networks, data, software, hardware, as well as the services that are provided over the networks, are the foundations on which the digital economy is based. It is essential that governments promote investment in digital infrastructures and competition in the provision of high-speed networks and services, such as fibre networks, and ensure that key complementary enablers are in place (e.g. fibre optic back-haul, sufficient spectrum and increasing uptake of IPv6 Internet addresses).

Individuals, businesses (including SMEs), and governments need reliable, affordable and widespread access to digital networks and services to benefit from digital opportunities and boost growth and well-being. As noted above, while over 80% of adults in Singapore accessed the Internet in 2016, this figure was 25% or less in Lao PDR and Myanmar (Figure 1). But while over 25% of inhabitants had access to fixed broadband networks in Singapore in 2016, less than 1% did so in Myanmar, Lao PDR and Cambodia (Figure 4). Access to digital networks through mobile networks is much more widespread, however, with 43% of Asia-Pacific inhabitants possessing a mobile broadband subscription (ITU, 2016). Apart from Lao PDR and Myanmar, all ASEAN countries had – on average – more than 1 mobile cellular subscription per inhabitant in 2016 (Figure 5), with a very rapid increase since 2005 in all countries in the region.

Differences within countries in the uptake of digital networks are also linked to age and education, though income levels play a more important role in explaining differences across the region. Moreover, regional differences within countries can be large, with rural areas lagging urban areas (World Bank, 2016). Gender differences can also play a role, with women typically lagging men in their use of digital technologies. Providing access for all would help people in Southeast Asia, those in rural areas and lagging and disadvantaged groups, in benefitting from the education, employment and health opportunities enabled by digital networks. At the same time, ensuring access is not enough, as further discussed below.

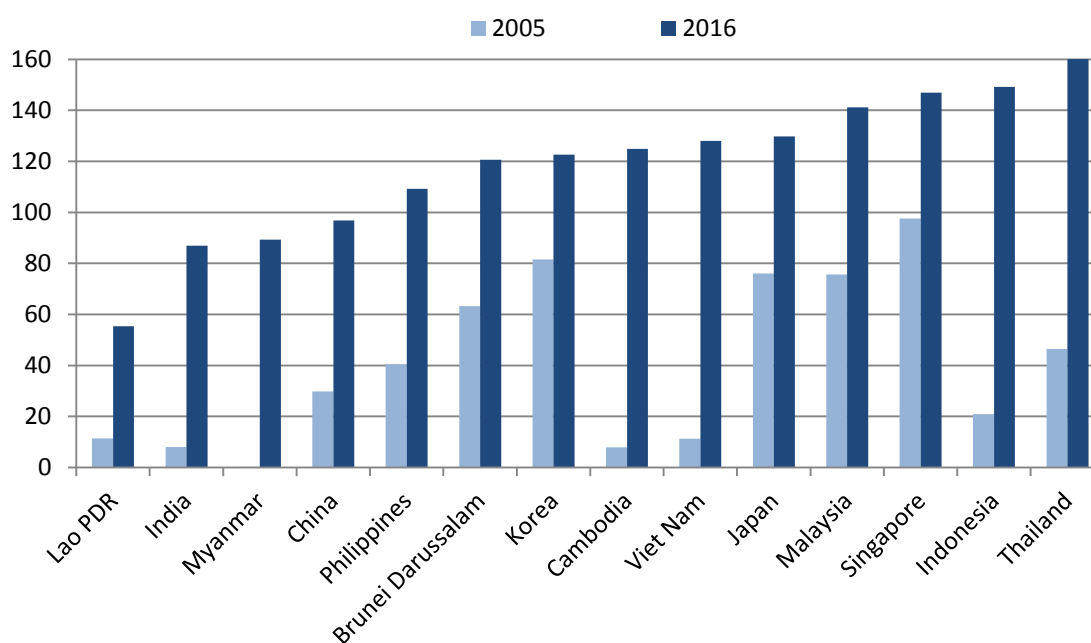
Figure 4. Fixed broadband subscriptions per 100 inhabitants



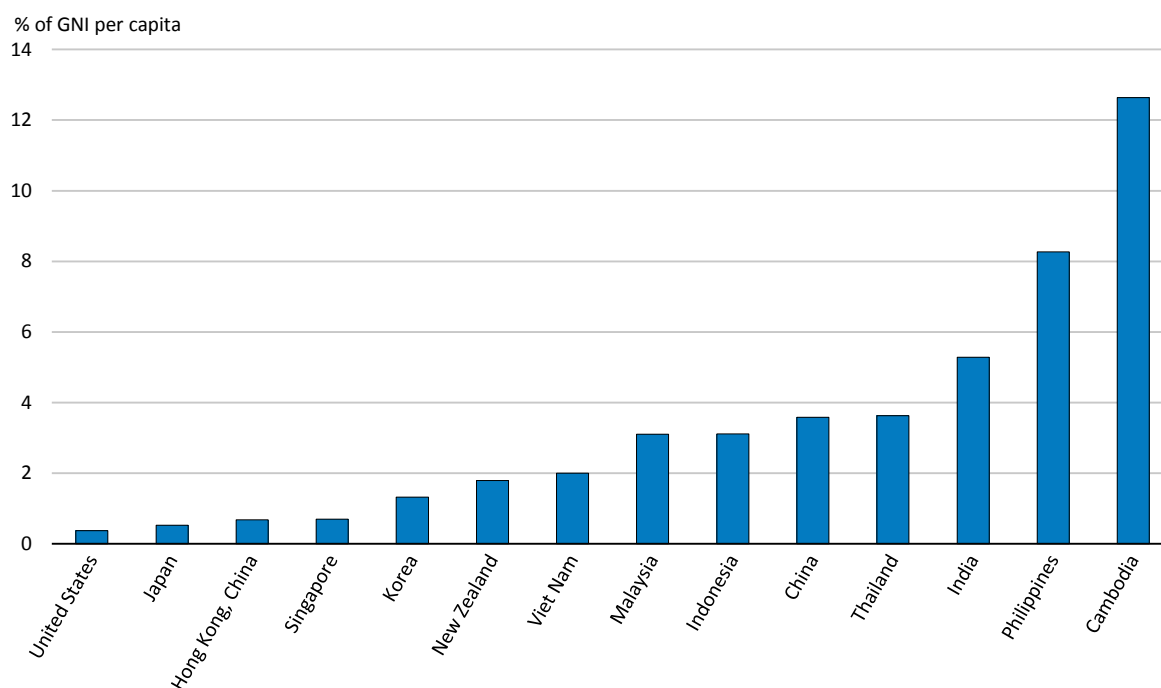
Source: OECD, based on ITU (2017).

Businesses also increasingly access and use the Internet. In OECD countries, almost no business today is run without ICTs and most businesses in advanced economies now have access to the Internet and have developed a web page. Outside OECD countries, business uptake is still much lower, however. Moreover, the use of more sophisticated applications, such as cloud computing, has a much higher variation across countries, with small business lagging significantly in many.

Figure 5. Mobile cellular subscriptions per 100 inhabitants



Source: OECD, based on ITU (2017).

Figure 6. Fixed broadband subscription prices relative to gross national income per capita


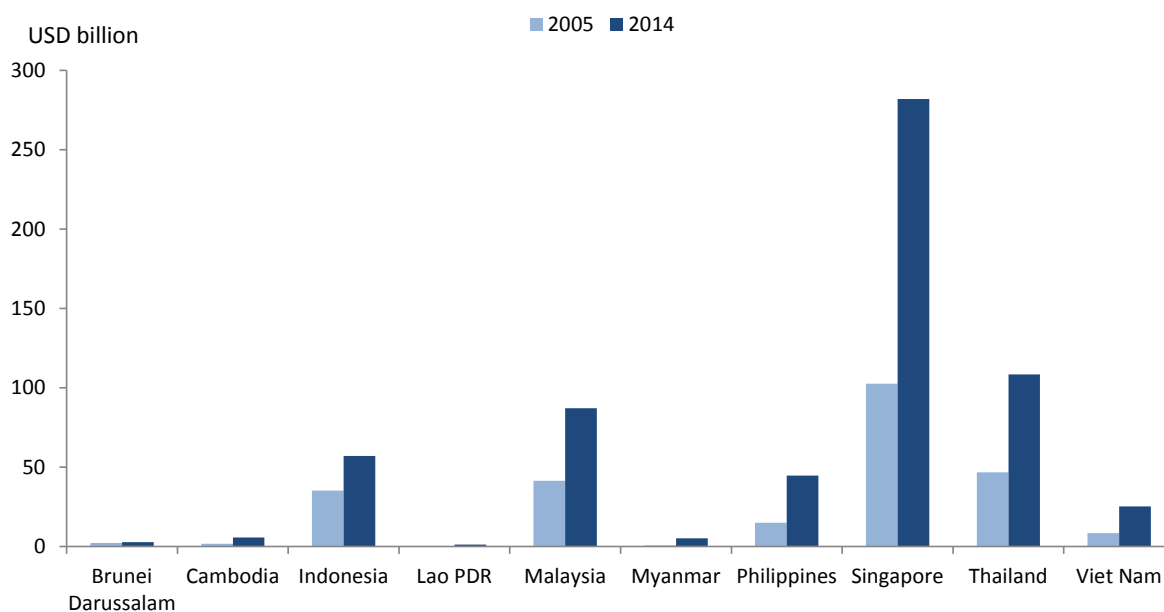
Source: OECD (2016c).

Enhancing access for all individuals and businesses at an affordable price requires sound framework policies, effective telecommunications policies that reflect the need for a wide diffusion of digital networks, and additional measures, such as national broadband strategies, that can help reach disadvantaged groups, firms and rural or remote areas. Ensuring sound competition, including through market openness, is key in this respect. For example, recent telecommunications reforms in Mexico have contributed to lower prices and enhanced access for many households and firms (OECD, forthcoming). In several Southeast Asian economies, and notably in the Philippines and Cambodia, broadband prices remain high, however, limiting access (OECD, 2016c; ITU, 2015) (Figure 6).

Fostering digital trade and ensuring market openness

Another important foundation for the digital transformation rests on market openness. Digitalisation is creating new economic opportunities, allowing firms to access new markets, and bringing new products and services to consumers. It can help reduce transaction costs and enable more goods and services to be delivered remotely. Moreover, enhanced productivity of enterprises thanks to greater ICT use helps them to succeed better in domestic and foreign markets. Digital trade also opens opportunities for entrepreneurship, innovation and job creation, and digital tools can help firms (SMEs in particular) overcome barriers to their growth, by facilitating payments, enabling collaboration, avoiding investment in fixed assets through the use of cloud-based services, and using alternative funding mechanisms (e.g. crowdfunding).

The digital transformation is already having a profound impact on international trade: changing how countries trade, altering how products are made and delivered, and also what they trade, including greater bundling of goods and services. In the ASEAN region, trade in services has grown rapidly in recent years, partially enabled by digital technologies (Figure 7). Traditional measures affecting market openness remain important; digital trade still involves traditional goods and services crossing borders, and therefore tariffs, trade facilitation and services commitments continue to matter. But how and what we trade is also changing, even exacerbating, the impact of some traditional measures, and new measures are emerging that affect the way digital trade takes place.

Figure 7. ASEAN trade in services with the rest of the world


Source: OECD (2017b), based on ASEAN (2016), *ASEAN Stats*, <http://aseanstats.asean.org/>.

Market openness underpins the potential benefits from digital trade,² starting with the potential role of foreign suppliers in improving the availability and quality of digital trade enablers, such as digital infrastructure services or IT products. Digital platforms selling goods in global markets are affected by traditional trade facilitation issues (e.g., processes at the border), as well as by the competitiveness and reliability of the transport and logistics sector. The costs of handling of much greater volumes of small packages compared to foregone revenues may also raise issues for governments with the level of the *de minimis* threshold for tariffs. Moreover, the blurring of the lines between goods and services can mean that, if part of the value of a traded good relies on its embedded service, then measures impacting the supply of this service may be as important as measures impacting trade in goods. Similarly, 3D printing is likely to impact trade in goods, but arguably will be affected by market access in the related service. Even where a transaction itself might not seem to be affected by any kind of measures, the disruption of a supporting service can prevent the transaction from occurring (e.g. restrictions on e-payment services for goods trade via digital marketplaces).

Lastly, with data flows underpinning digitally enabled trade in goods and services, as well as trade facilitation and the ability of companies to organise production globally through GVCs (with a resulting trade in intermediate goods), policies regarding data flows can have important implications for market openness in the digital era. Data flows are increasingly a means of production, as well as an asset that can themselves be traded. Policy design needs to facilitate the movement of data across borders and avoid measures that unduly restrict its movement while respecting the need for privacy and data protection. Trade policy should therefore focus on continuing to ensure that appropriate safeguards are available for pursuing legitimate public policy goals while preserving the significant benefits from an open digital environment.

Implications for global value chains

Going beyond trade as such, there are also important implications of the digital transformation on GVCs, that could directly affect Southeast Asia (OECD, 2017a). Recent decades have seen growing international integration of markets for capital, intermediate inputs, final goods, services and people. The increased partitioning of production in GVCs has drawn policy makers' attention to the economic consequences of occupying different parts of a GVC (OECD, 2013a). GVCs are constantly evolving. Recent OECD work finds little evidence at this time of the reshoring of manufacturing from emerging to advanced economies as the result of automation, cost-saving

technological change or other conditions (De Backer et al., 2016). However, evidence suggests that European companies which intensively use robots are less likely to locate production abroad. Features of some technologies, such as 3D printing, could lead to some production being brought closer to developed-country markets.

Successful absorption of new technologies in emerging and developing countries could help to achieve productivity, structural transformation and environmental goals. Indeed, some new production technologies are well suited to economic conditions in many emerging economies. For example, certain state-of-the-art robots are relatively inexpensive and do not require highly skilled operators. And low-cost drones could make some agricultural processes more efficient. With improved channels of knowledge diffusion, such as the Internet, opportunities for technological “leapfrogging” could arise, particularly in larger emerging economies. But learning to use new technologies is clearly a challenge.

Labour-intensive industries which are still important in many Southeast Asian economies, such as garments, shoes and leather, furniture, textiles and food, could be less susceptible to change, since many processes in these industries are not yet fully (or economically) automated. Other industries, such as the electrical and electronics and machinery sectors are likely to be significantly affected, particularly if wages are growing, because of their high potential for automation. In other sectors, such as automotive manufacture, adopting new production technologies is expected to be determined not so much by wages or the potential for automation, but by domestic demand and consumers’ growing desire for quality and customisation.

But technological change could quickly threaten capacity in emerging economies. For example, because of dexterity requirements, footwear manufacture has to date been labour-intensive. But Adidas recently built a shoe manufacturing facility in Germany which is fully automated, permits significant customisation, and takes just five hours for a full production cycle, compared to the current norm of several weeks (Shotter and Whipp, 2016).

Many emerging economies will therefore need to upgrade entire production systems. A challenge for firms will be their ability to upgrade the machines, factories and ICT systems required for interconnected production. The machines and ICT systems of firms in many countries are out of date, and difficult to retrofit with new technologies. Emerging production technologies operate with tolerances, technical standards and protocols with which firms are often unfamiliar. And such technologies usually require an uninterrupted source of power, which is not available in some countries.

Investments in new technologies can also require a range of complementary expenditures. Investing in robots, for example, usually entails spending of similar size on peripherals (such as safety barriers and sensors) and system implementation (such as project management, programming, installation and software). Financing such investments can require a range of financing institutions, from venture capital firms to development banks, machinery-related term lending, and specialised SME and start-up lending. Such a breadth and depth of financial services is only available in a few countries. Making the digital transformation work for firms, and enabling them to compete in GVCs, is therefore a key challenge for Southeast Asian economies, discussed further below.

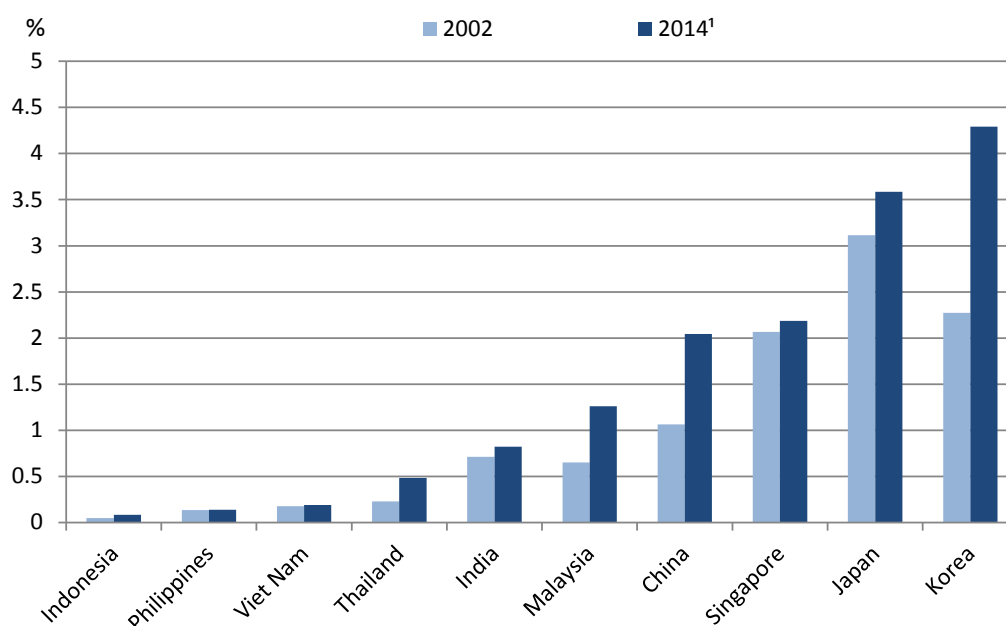
Making the digital transformation work for firms

The second main element of the framework set out above relates to policies that can help make the digital transformation work for firms and for the economy more broadly. Access to digital networks provides the foundation for the digital transformation of economy and society, but does not necessarily enable people and firms to use the technology effectively. For people, having the appropriate skills to use and benefit from the technology is key, as further discussed below. Better informing people about the opportunities offered by the digital transformation can also be valuable. For firms, notably SMEs, a wide range of factors need to be addressed, notably skills; complementary investments in knowledge-based capital, including data, organisational capital and process innovation; sound competition and firm dynamics; as well as finance, taxation and regulation.

Greater use of digital technologies requires new skills. First, the production of digital products and services requires specialist skills in ICTs to programme software, develop applications and manage networks. Second, workers across an increasing range of occupations need generic and/or advanced ICT skills to use such technologies effectively. Finally, the diffusion of digital technologies is changing how work is done, raising demand for complementary skills such as information processing, self-direction, problem solving and communication. Generic ICT skills and complementary skills are also crucial to individuals' effective use of digital technologies in their daily lives. Effective skills policies, as set out in more detail below, are therefore important to help users make the most of digital technologies and also facilitate the transition from job to job.

It is also crucial that governments enable firms to invest in other knowledge-based capital (e.g. data, organisational change, process innovation) to help them realise the full potential of the digital transformation. A range of studies have shown that effective use of digital technologies relies on the degree and scope for organisational changes and process innovation within firms and organisations, as well as sound management and leadership. Closely related is the important role that governments continue to play in supporting the digital transformation itself, notably in undertaking or financing research on the underlying technologies or on key challenges affecting the digital transformation, such as security. The capacity of economies in Southeast Asia to engage in innovation is therefore important in determining the ability of countries to benefit from the digital transformation. On one key indicator of innovation performance, investment in R&D, there has been good progress in some economies in the region, e.g. Malaysia and to a lesser extent also Thailand. However, R&D investment remains very low in several countries in the region, with the exception of Singapore (Figure 8).

Figure 8. Gross expenditure on research and development, as a percentage of GDP



1. Or latest available year, i.e. 2011 for India, Philippines and Vietnam; 2013 for Indonesia.

Source: UNESCO Institute of Statistics (2017), "Science, technology and innovation: GERD as a percentage of GDP", *UIS.Stat*, <http://data.uis.unesco.org/>.

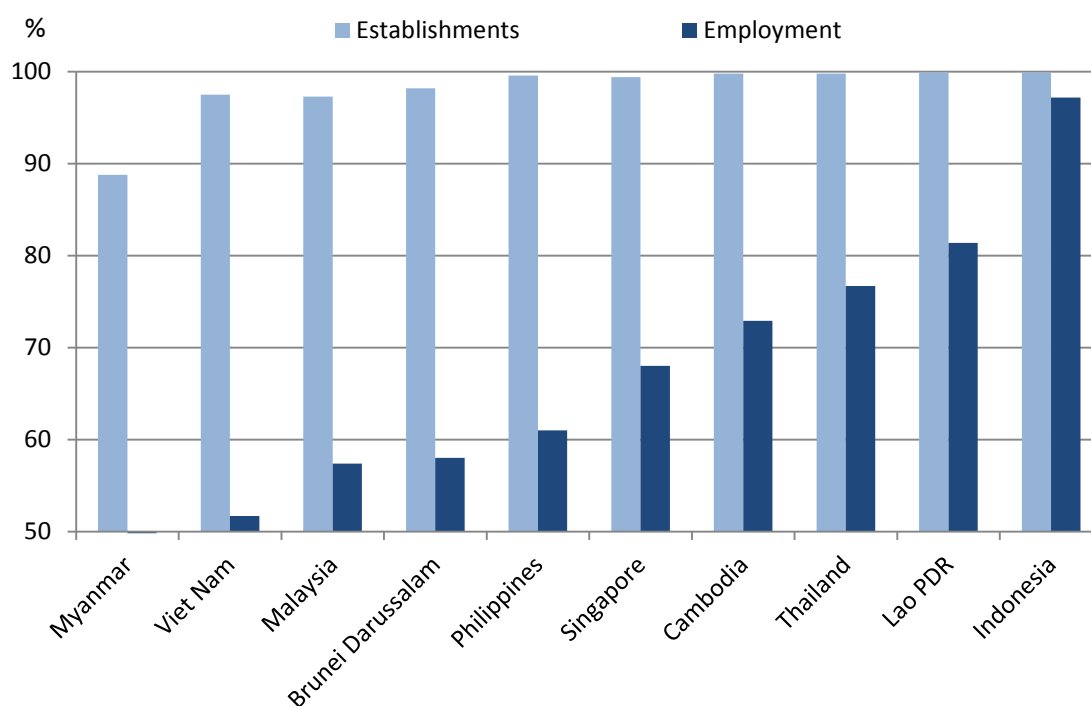
Effective use of digital technologies in an economy can also be affected by a lack of firm dynamics, which can lead to the coexistence of poorly performing firms, with very low levels of ICT use, with star performers. Costly delays and slow exit of such poorly performing firms, sometimes supported by government guarantees, and compounded by financial institutions that do not want to realise non-performing loans on their balance sheets, creates a particularly unfavourable environment for effective ICT use in an economy, and will slow down the impact of ICT on growth and productivity. Ensuring sound competition, including in digital markets, is key in allowing new firms to challenge incumbents, efficient firms to grow, and inefficient ones to exit, thus helping boost economic growth and living standards.

The digital economy has brought new business models and rapidly expanding industries. Indeed, never before have leading firms grown so large so quickly, and new businesses are challenging incumbents in novel ways (OECD, 2013b). Competition in the digital economy could be affected by many factors, including network externalities (i.e. the benefit from the network rises with the square of the number of users), which are particularly prevalent in certain markets. These externalities can lead to growing concentration and winner-take-most dynamics in such markets (Autor et al., 2017). In principle, this raises no competition problems if any resulting market power is temporary, not due to anticompetitive behaviour, and/or the resulting rents are eroded by competition, including from other firms and new business models (OECD, 2013b, 2016d).

The effective use of ICT can also be constrained by other barriers, in particular for SMEs. For example, although many ICT applications, e.g. cloud computing, have become cheap and easily accessible for SMEs, poor access to finance may still limit their scope for investments in the complementary assets and organisational changes that are required. Policies that facilitate access to finance can be useful in this regard. A poor understanding by management of the opportunities offered by digitalisation and a lack of basic digital capabilities can also play a role. Collaboration with larger firms can sometimes help address these challenges.

The competitiveness and robustness of ASEAN economies depends heavily on the competitiveness and robustness of the regions' SMEs, since they make up the majority of establishments in member countries (OECD, 2017b) (Figure 9). Indonesia and Lao PDR have a particularly high concentration of SMEs: almost 100% of establishments. Across the ASEAN countries, SMEs contribute to between 52 (Viet Nam) and 97% (Indonesia) of total employment. SMEs also contribute a 10-30% share of total exports in ASEAN (OECD, 2017b). Comprehensive national digital strategies that take into account SMEs, policies that facilitate access to finance, and SME engagement with competency centres and/or technology extension services, can be helpful for SMEs in this regard. National digital security strategies can also help address the specific needs of SMEs by providing them with practical guidance and the appropriate incentives to adopting good practices.

Figure 9. SME share of total establishments and employment in ASEAN countries, 2014



Source: OECD (2017b), based on national sources and ASEAN Strategic Plan 2016-2025.

Inadequate or outdated regulation may also limit the returns that firms can achieve from their investments in digital technologies, as it can hold them back from entering new markets or developing new products or business models. For example, recent OECD work finds that product market regulation, employment protection legislation, and ICT regulation have significant effects on the uptake of ICT hardware (DeStefano, De Backer and Mousiegt, 2017). More generally, the digital transformation is changing the world faster than many rules and regulations have evolved. Governments could benefit from mechanisms to periodically review their regulatory frameworks and, where appropriate, update them to ensure that they are well suited to the increasingly digitalised world.

Helping workers adapt

Previous major technological innovations such as the steam engine, electricity and the assembly line were economically and socially disruptive. They often resulted in substantial job losses in the short-term, even if these were more than offset in the long term by the creation of more productive and rewarding jobs, and improvements in living standards (Mokyr, Vickers and Ziebarth, 2015; OECD, 2016e).

Today, the digital transformation is already affecting workers. Some jobs are disappearing due to automation, and the skills that are needed are changing for many other jobs. In some cases, entire industries are being disrupted. Digitalisation is reducing demand for routine and manual tasks, while increasing demand for non-routine tasks and for problem-solving and interpersonal skills.

At the same time, OECD work suggests that so far, while leading to restructuring and reallocation, ICT has not led to an overall increase in technological unemployment (OECD, 2016f). This is because, if adopted successfully, i.e. if combined with organisational changes and good managerial practices (OECD, 2004), ICTs can contribute to increased productivity, which progressively translates into lower prices and/or new products, higher final demand and higher employment, thus compensating for the initial job displacement. Recent OECD work shows that technological innovation contributes to higher employment levels in both routine and non-routine jobs (Marcolin, Miroudot and Squicciarini, 2016).

However, most digital technologies require higher levels of skill than those they displace, implying a process of skill-biased technological change (SBTC). For example, in the United States, the employment share of workers in high-skill occupations increased by 11 percentage points from 26% in 1983 to 37% in 2012 (Tuzemen and Wills, 2013). However, a simple version of the SBTC hypothesis suggests that the share of low-skill jobs should have fallen. Instead, the employment share of low-skill occupations rose from 15% in 1983 to 18% in 2012 in the United States. This pattern has been mirrored in other countries and point to another possible link between technological change, productivity and employment – the “hollowing-out” or job-polarisation hypothesis.

Developments in AI, robotics, the IoT and big data, among other technological advancements may change the nature of the link between technology and employment. Some studies suggest that digitalisation makes it possible that, in the near future, a large proportion of tasks or even entire occupations currently carried out by workers could be performed by machines (Frey and Osborne, 2013). This has led to fears that computers and robots will replace some types of human labour, throwing workers into a “race against the machine” that many are bound to lose (Brynjolfsson and McAfee, 2011).

Those jobs relying on a high proportion of automatable tasks are at high risk of being substituted for by new technology, but only if these technologies are taken up by firms, or if firms that do not use the technologies exit. Computers and algorithms mainly substitute for “routine” tasks that can be easily codified, which are typically in middle-skilled jobs. “Non-routine” tasks, either at the top end (conceptual jobs) or at the bottom end (manual jobs) of the skill distribution may therefore remain in demand.

As the technology continues to evolve, this is a rapidly moving target, however, and the extent and permanence of hollowing-out remains controversial. Some authors (e.g. Frey and Osborne, 2013) suggest that a large share

of occupations is already at risk of being automated. However, such estimates have been criticised on the basis that it is specific tasks rather than occupations that are at risk (Arntz, Gregory and Zierahn, 2016). Occupations are more likely to evolve – as many have for the past century – to accommodate the penetration of technology rather than face complete substitution (Bessen, 2015). Some studies have estimated that only 9% of jobs may be at a high risk of automation, but that another 25% of jobs could undergo significant change, with between 50% and 70% of the tasks at risk of automation (Arntz, Gregory and Zierahn, 2016). Workers with the skills to adapt to changes in workplace technologies are at less risk of being left behind. Also, with the productivity gains and adoption of technology, new direct and complementary jobs are likely to be created (Autor, 2015).

While the precise impact of the digital transformation remains to be seen, and digital technologies may sometimes mainly augment and complement human capabilities, it is clear that many workers will be displaced. They should be provided with active job search and adequate income support, to speed up job finding and reduce the cost of job loss. Interventions should come early in the unemployment spell, and be coupled with retraining and requalification so that displaced workers can take advantage of new job opportunities arising elsewhere in the economy.

Digitalisation is also changing the way work is organised (OECD, 2016g). The “platform”, “sharing” or “collaborative” economy, though still small in scale, is allowing businesses to access a larger pool of potential workers and suppliers, with workers increasingly engaged as independent contract workers. This has benefits for some workers, providing them with greater flexibility, and allowing people to earn additional income and access work, sometimes for the first time. At the same time, such jobs rely mostly on non-standard work arrangements (e.g. self-employment, temporary hiring and contract work). Even though the platform “sharing” economy is creating job opportunities for people who may have no access to regular jobs, it may also offer less promising employment trajectories and lower access to social protection or training opportunities. It could also limit worker’s access to union representation and wage setting mechanisms. Policy will need to ensure sufficient social and regulatory protection for all.

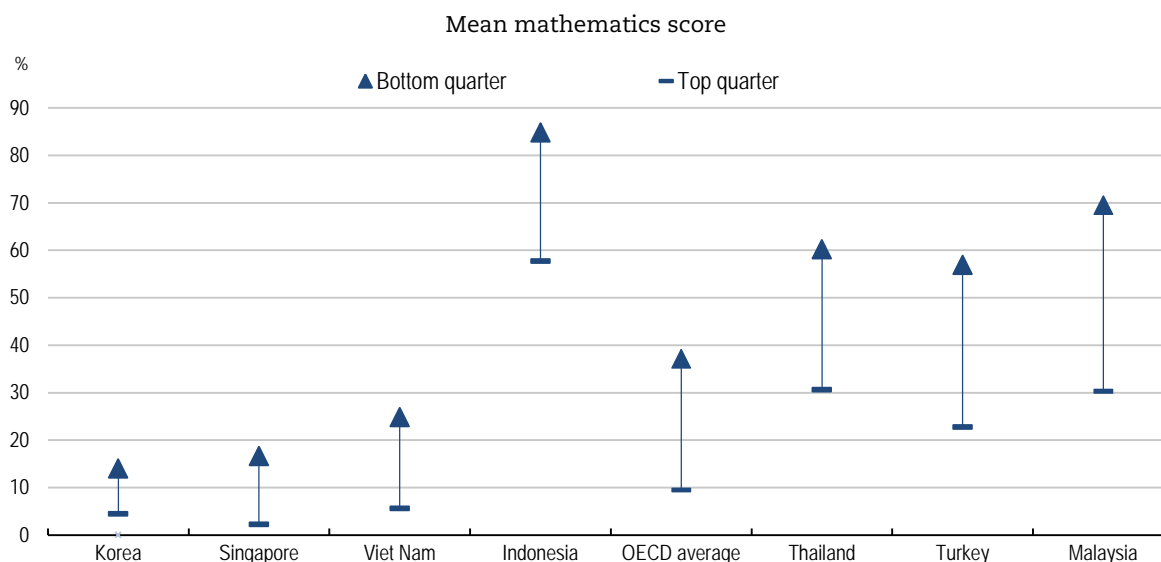
The challenge of the adjustment in the labour market will depend on the speed at which the digital transformation unfolds. Compared to earlier industrial revolutions, induced by steam and electrification, the development and international diffusion of digital technologies appears to be transpiring over a shorter time period, potentially complicating the adjustment process. However, it could take considerable time for new technologies, once invented, to diffuse throughout the economy and for their productivity effects to be fully realised. Moreover, the duration of this period is uncertain and depends on a wide range of economic, social and regulatory factors (McKinsey Global Institute, 2017). As discussed in the OECD work on the Next Production Revolution, the past has sometimes seen unrealistic expectations regarding timescales for the delivery and implementation of a number of key technologies. Better understanding and anticipating the coming developments will therefore be important.

Continuously assessing the skills needed for a digital world and adapting formal education and training systems to remain up-to-date

Independent of the size of the impact of digitalisation on jobs, it is clear that workers will need different skills, not just more skills (OECD, 2016h). Regardless of the precise number of jobs at risk of automation, continued hollowing-out will disrupt the labour market, leading to job losses in some areas and gains in others. Up-skilling will be part of the answer – the same policy priority as required to respond to SBTC. But workers will also need a different sort of skill-set. Data from the PIAAC Survey of Adult Skills show that, on average across the 22 countries that implemented the first Survey, 55% of workers lack basic problem-solving skills in technology-rich environments. This suggests weak prospects for these workers, but also for employers’ and for countries’ aiming to capitalise on the opportunities offered by a digital economy (OECD, 2013c). Younger people are better prepared for this environment than older people.

An important challenge in several Southeast Asian countries is that education outcomes are still influenced by socio-economic status. In Indonesia, some 85% of economically, socially and culturally disadvantaged students are categorised as low performers in mathematics by the Programme for International Student Assessment (PISA), and some 70% in Malaysia and 60% in Thailand are in the same situation. In Malaysia, this compares to under 30% of advantaged students, with the 40 percentage-point differential well above the gaps found in participating Southeast Asian countries and 12 percentage points higher than the OECD average (OECD 2016c) (Figure 10).

Figure 10. Socio-economic status affects student performance in mathematics



Source: OECD (2016i), *Low-Performing Students: Why They Fall Behind and How to Help Them Succeed*, <http://dx.doi.org/10.1787/9789264250246-en>.

Addressing the challenges arising in an increasingly digital world will require changes to current employment and skills policies. Governments in collaboration with stakeholders must help ensure that the digital economy yields better quality jobs and that both employers and workers have the means to take advantage of new job opportunities. There are four key priorities for skills policies to facilitate take-up of these opportunities and promote inclusive growth:

- Ensuring that initial education equips all students with solid literacy, numeracy and problem-solving skills, as well as basic ICT skills and complementary socio-emotional skills, such as teamwork, flexibility and resilience. Many of these skills are also acquired outside of education and training institutions – for instance, in the workplace – emphasising the need to recognise skills acquired outside formal channels.
- Better assess and anticipate changing skill needs and foster more responsive education and trainings providers in order to adapt programmes and pathways offered and guide students towards choices that lead to good outcomes. Big data, e.g. from the Internet, can be harnessed to complement labour market information systems and monitor changing needs (OECD, 2016j).
- Improve the use of skills across different workplace setting and working arrangements so as to achieve higher productivity and greater competitiveness.
- Offer better incentives for individuals and firms to re-skill and up-skill. This also means using the possibilities of new technologies to adapt new job tasks to the skills sets of incumbent workers. At the same time, the diffusion of “on-demand” jobs on digital platforms puts increasing responsibility on individuals to manage their own skills development (OECD, 2016j). Low- and medium-skilled adults are the least likely to participate in training, even though they may face the greatest risk of job loss.

Enhancing trust and social acceptance

Trust is fundamental to the functioning of the digital economy; without it, individuals, firms and governments won't be able to use digital technologies, and an important source of potential growth and social progress will be left unexploited. Moreover, the growing dependence of critical infrastructures on digital technologies exposes the very functioning of society to digital security risks.

Digital security risk has traditionally been approached as a technical problem but the changing nature and scale of digital security incidents is driving countries to re-evaluate their strategies and policies. In recent years, many governments and stakeholders have emphasised the importance of considering digital security risk as a strategic economic issue for organisations which needs to be addressed at the highest level of corporate governance, as recommended by the *Digital Security Risk Management for Economic and Social Prosperity: OECD Recommendation and Companion Document* (OECD, 2015c). It should be integrated in economic decision making and existing enterprise and government risk management frameworks. This requires a culture of dialogue and co-operation among all stakeholders in organisations. Co-operation is also essential between government, private sector and civil society to foster trust in the digital environment, in particular for the development and implementation of effective national strategies.

In today's data-rich environment, new privacy challenges are also emerging. The growing number of entities, such as online retailers, platforms (especially ones that are consumer-facing), Internet service providers, financial service providers (i.e. banks, credit card companies, etc.), and governments are increasingly collecting vast amounts of personal data. In addition, complementary information can be derived, by "mining" available data for patterns and correlations, many of which do not need to be personal data. Advances in data analytics now make it possible to infer sensitive information from data which may appear trivial at first, such as past individual purchase behaviour or electricity consumption. The misuse of these insights can implicate the core values and principles which privacy protection seeks to promote, such as individual autonomy, equality and free speech, and this may have a broader impact on society as a whole. At the same time, it is important to recognise that digital technologies can also enhance privacy and security.

While protection by the law is essential, privacy in an increasingly data-driven economy would benefit from a multifaceted strategy, reflecting a whole-of-society vision, and supported at the highest levels of government, as called for in *The OECD Privacy Framework (Privacy Guidelines)* (OECD, 2013d). Such strategies need to strike the right balance between the social and economic benefits of enhanced reuse and sharing of data and analytics, and individuals' and organisations' legitimate concerns about such openness, including the protection of privacy and intellectual property rights. Co-ordinated privacy strategies at the national level would enhance privacy protection in an increasingly data-driven environment.

Consumers are increasingly engaging in the digital environment where a large variety of products are available at competitive prices, within and across borders. Consumer engagement online through, for example, product ratings and reviews shapes business reputations, informs other consumers, driving innovation and competition. Continued growth may be fuelled by the emergence of new technology-driven products and markets, such as 3D printing, the IoT, and "collaborative" digital platforms (or "peer platforms"), which enable consumers to design, produce and sell products themselves.

Yet, e-commerce growth will only be possible if consumer trust in a dynamic but complex market is strengthened. In 2014, 75% of consumers accessed the Internet across the OECD, but only one out of two made an online purchase; this untapped potential is even more pronounced across borders. Concerns include the growing complexity of online transactions and related terms and conditions, as well as the uncertainty about where consumers should turn when they suffer detriment as a result of misleading or fraudulent business practices, or unsafe products. They also relate to the wealth of data that consumers' online activities generate, which, while enabling businesses to sketch rich consumer profiles, also brings risks. Policy makers need to stay current

with the evolving challenges. The 2016 Council Recommendation *Consumer Protection in E-commerce: OECD Recommendation* (OECD, 2016k) provides a blueprint for fair business practices, information disclosures, payment protections, unsafe products, dispute resolution, enforcement and education.

Using the digital transformation to foster well-being

Beyond its economic impacts, the digital transformation also has important impacts on broader well-being and can support more inclusive growth. For example, digital technologies can promote social inclusion by creating better access to quality education, offer new opportunities for skills development, enhance access to health care, or improve access to free and low-cost information, knowledge and data. Mobile telephony in particular has been used intensively in a number of inclusive innovation initiatives that aim at improving the welfare of lower-income and excluded groups in developing countries (OECD, 2015b). A famous example includes mPesa, which has provided millions of Kenyans with access to basic banking services.

More broadly, new digital platforms allow consumers to negotiate better prices for products (as well as identify better quality products). They also facilitate access to key goods and services, e.g. mobility and accommodation, sometimes avoiding consumers from making costly purchases. Digital technologies can also be a significant driver of improved services to vulnerable groups in society (Mickoleit, 2014). For example, opportunities to file taxes and apply for public support online have made application procedures more convenient, benefitting in particular individuals located in remote areas and lower-income and excluded groups who rely on public support. Social media also allows governments to reach specific groups with information most relevant to their needs, offering the potential for better citizen-government communication. Moreover, it helps disadvantaged groups connect and cooperate.

But while digital technologies can provide important benefits for broader well-being, they cannot fully overcome some of the inherent barriers that prevent certain disadvantaged group from benefitting from these technologies. For example, even though it enhances access to education, there is little evidence that more open education lowers existing inequalities in education opportunities. And older people – that could benefit most from applications in the health area – are less likely to use digital tools than younger ones.

Policy coherence and strategy development

The digital transformation affects all corners of the economy, society, and government activities. To realise its full benefits, governments need to reach across traditional policy silos and across different levels of government and develop a whole-of-government approach to policymaking. This means more co-ordination when making decisions and implementing policy measures across ministries and levels of government as well as actively involving all key stakeholders, including the business community, trade unions, civil society and Internet technical community, in the policymaking process as well as implementation and monitoring. By identifying the key policy areas affected by the digital transformation, it will be easier to link up the relevant ministries and government bodies that need to be connected and co-ordinated to ensure that all policies are mutually reinforcing and aligned with one coherent and strategic national digital agenda. The OECD's new cross-cutting work, "Going Digital", intends to support governments in this goal.³

Conclusions

This paper is intended to provide ASEAN policy makers with some key messages on the digital transformation. Two other aspects of the digital transformation are worth mentioning at this stage. First, the digital transformation will go on for some time and thus continue to disrupt the economy, society and government policy. Better anticipating trends through strategic foresight could assist policy across all policy domains. Foresight processes can also bring benefits in themselves, such as strengthened stakeholder networks. Long-term and pro-active thinking is also essential to help respond to the ongoing transformation. Leaders in business, unions, civil

society and government must be ready to examine the policy implications of the transformation and prepare for developments beyond typical election cycles. This also requires constant reflection on how policy priorities might need to evolve, for instance as a consequence of technological change itself.

Second, designing better policies for a digital economy and society not only requires better knowledge about the technological changes underway, but also further efforts to improve measurement, evidence and analysis, e.g. as regards growth and productivity. New areas, such as trust, data flows, the IoT and AI, are at the next frontier for measurement. All countries need to work together to fill the data gaps and in doing so enable better benchmarking, evidence building, policy development, and the identification and prioritisation of policy review and action. At the same time, new opportunities are emerging thanks to digital technologies, e.g. through the use of big data analytics and non-official data sources. Statistics could be enriched with timelier, more granular and less costly data.

Notes

1. Digitalisation, by contrast, refers to the adoption or increase in use of digital or computer technology by an organisation, industry, country, etc., and thus to the way digitisation is affecting economy and society.
2. There is currently no agreed definition of digital trade, but a growing consensus that it encompasses digitally enabled transactions in trade in goods and services which can be either digitally or physically delivered and which involve consumers, firms and governments.
3. See www.oecd.org/going-digital/.

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