Chapter 2

The Future of Technology: Opportunities for ASEAN in the Digital Economy

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2.1. Introduction

The digital age is now a reality in many economies. Governments, businesses and individuals are migrating their activities to the Internet at an increasing pace and the uptake of digital technologies is reaching new levels. More households in developing countries own mobile phones than have access to electricity or clean water, and nearly 70% of the bottom fifth of the population in developing countries own a mobile phone (World Bank, 2016).[2] In this environment, data and digital technologies are becoming increasingly essential for participation in the global economy.

Digital technologies including the Internet, cloud computing, data analytics and the Internet of Things (IoT), have facilitated commerce by making it easier for suppliers to connect with customers and improve logistics control. Technology is now making it possible to complete transactions, deliver products and services, and make payments faster, more efficiently and at lower prices. For example, new Information and Communications Technology (ICT) tools can facilitate cross-border e-commerce and participation in global markets for smaller and newer firms (e.g. Skype, WhatsApp or Viber for communications, Google and Dropbox for file sharing, LinkedIn for finding talent, PayPal for transactions and eBay, Tokopedia, Amazon and increasingly Facebook, for sales). They have boosted the abilities of firms of all sizes and origin to find a niche in global value chains (GVCs) and gain access to new markets. The Internet provides a platform on which entrepreneurs can construct new businesses and commercialise their ideas, lowering entry barriers and freeing up resources for innovative activity.

At the macroeconomic level, these trends hold the potential for new sources of productivity and economic growth. Evidence continues to show the positive returns on investment in digital technologies, especially when combined with investment in complementary assets such as human capital and organisational change (for a recent overview, see OECD 2017). These gains are not automatic however, with country-level

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[2] Although the extent to which these mobile phones have data plans (Internet access) might vary considerably.

differences pointing to the importance of infrastructure and institutions, and the need for attentive policy-making, especially to ensure that the gains are inclusive.

ASEAN economies are embracing digital technologies to varying degrees and leveraging them for economic and social advancement. The uptake and use of the Internet for example, as a basic digital technology, significantly increased between 2000 and 2015 (Figure 2.1). From essentially zero uptake in the early 2000's, fixed broadband subscriptions are now heading towards 10% penetration in Malaysia, Thailand and Viet Nam. More than 80% of individuals use the Internet in Singapore, and over 70% in Malaysia and Brunei, although the figure is still below 20% in Lao People's Democratic Republic and Cambodia. Digital technology continues to spread rapidly, due in large part to the important role of mobile technologies, i.e. smartphones. However, as Figure 2.1 also shows, there are wide gaps, both between ASEAN members and with regional Asian neighbours. There is also typically a gap between small and large firms in the use of the Internet, with a larger share of large firms operating websites, selling online and accessing broadband technologies than for small firms, regardless of a country's level of income (World Bank, 2016).

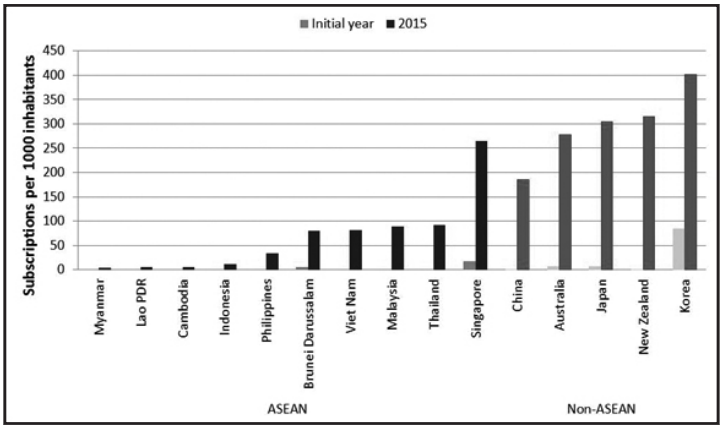
There is a clear challenge for ASEAN economies to harness the promise of digital technologies as they pursue growth and prosperity, including via their regional integration agenda. In doing so, they will face many of the same challenges faced by other developed and developing economies - boosting uptake of technologies across all firms and individuals, ensuring people have the skills to make the best use of them, and putting in place the right infrastructure, macroeconomic and regulatory conditions to enable their economies to adapt to and benefit from the new digital reality.

Recent ASEAN strategy documents clearly recognise these challenges and are seeking to position ASEAN to transition towards a digital economy. The AEC Blueprint 2025 (ASEAN, 2015a), which charts the direction of ASEAN's economic integration from 2016 to 2025, has an element on electronic commerce under the main characteristic of Enhanced Connectivity and Sectoral Cooperation, which makes reference to the following strategic measures: harmonised consumer rights and protection laws; harmonised legal framework for online dispute resolution, taking into account available international standards; inter-operable, mutually recognised, secure, reliable and user friendly e-identification and authorisation (electronic signature) schemes; and coherent and comprehensive framework for personal data protection. To operationalise these strategic measures, at the time of writing, the ASEAN Work Programme on Electronic Commerce is now at the finalisation stage, following the establishment of the ASEAN Coordinating Committee on Electronic Commerce. The ASEAN ICT Masterplan 2020

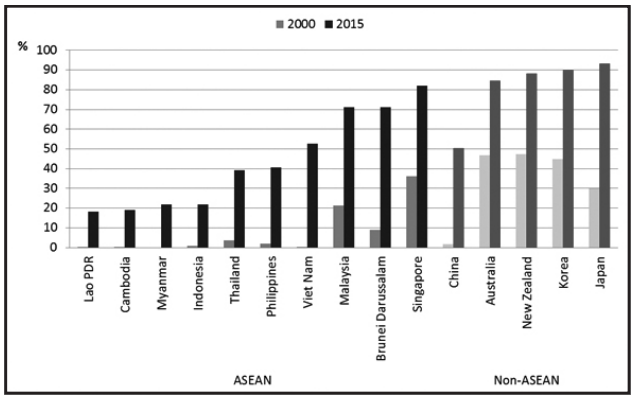
(ASEAN, 2015b), which is the sectoral e-commerce work plan, points to the role of ICT in supporting regional integration and connectivity, as well as the increasing centrality of the Internet in socio-economic growth and development, and sets out actions to achieve a digitally-enabled economy that is secure and sustainable. The Masterplan on ASEAN Connectivity 2025 (ASEAN, 2016a) identifies digital innovation as one of five strategic areas to achieve a seamlessly connected ASEAN, as well as a significant potential source of economic activity, and points to the need for backbone infrastructure, regulatory frameworks for new digital services, support for sharing best practice on open data, and equipping micro-, small- and medium-sized enterprises with capabilities to access new technologies.

This chapter looks at some of the key technological trends emerging in the digital arena and takes a close look at how these trends will change the trade environment for ASEAN economies, with a particular focus on the rise of new forms of trade. It then discusses the key enabling factors that will determine whether these trends can be seized as a driving force for economic and social advancement by ASEAN economies. The chapter concludes with potential policy directions for ASEAN economies as they pursue their regional integration agenda in the digital world.

Figure 2.1
Panel A: Fixed Internet Broadband Subscriptions, per 1000 Inhabitants, 2015



Panel B: Percentage of Individuals Using the Internet, 2000 and 2015



Note: Initial year in Panel A is 2000, except for Australia (2001), Brunei Darussalam (2001), Cambodia (2002), Lao PDR (2003), Malaysia (2001), Myanmar (2005), Philippines (2001), Thailand (2001) and Viet Nam (2002).

Sources: Panel A: Asian Development Bank (2016); Panel B: ITU, World Telecommunication/ICT Indicators Database.

2.2. Paradigm-changing Developments

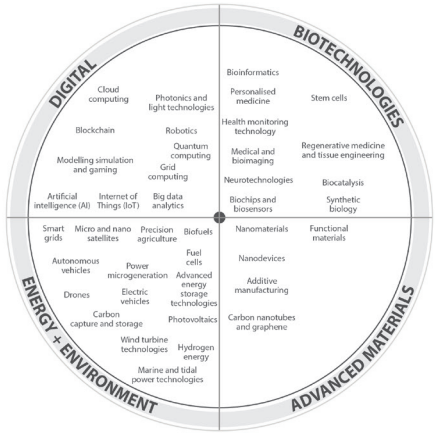
Technological change can be regarded as a significant megatrend in its own right and its direction is a subject of intense interest to governments and the business sector. The impact of technology change on economies and societies is complex - its scope is broad and the applications of technology are wide and often hard to predict. So as to better understand the possible trajectories of technological change, governments, research bodies and businesses sometimes turn to methods of technology forecasting and technology foresight. The foresight approach often uses scenarios to capture the inherent uncertainty of technology change, and offers a way of identifying key technologies worthy of further investment and policy attention.[3]

The results of technology foresight exercises carried out between 2012-2015 in Canada, Finland, Germany, the Russian Federation, and the United Kingdom, and by the European Commission, identified well over 100 key or emerging technologies between them, with a large chunk of these being digital technologies (OECD, 2016a) (Figure 2.2). These exercises provide insights into the potential technological drivers of economic and social change over the next 10-15 years, and are relevant for all policy makers seeking to build resilient and forward-looking policies. Individually, none of the innovations

[3] See Chapter 6 for more discussion of foresight exercises.

is revolutionary, but taken collectively they indicate the world is entering a period of technologically-induced structural change, just as it once traversed the agrarian and industrial revolutions. The digital transformation is however, at an early stage, and handling the changes adeptly will be essential for harnessing the benefits for ASEAN firms, individuals and governments.

Figure 2.2: Forty Key and Emerging Technologies for the Future



Note: This diagram depicts some of the most commonly-identified technologies from the foresight exercises examined for the OECD's Science, Technology and Innovation Outlook 2016. For ease of analysis, they have been mapped into quadrants that represent broad (and complementary) technological areas.

Source: OECD (2016a).

As a backdrop to the remainder of the chapter, below is an overview of five interconnected digital technology trends that are likely to impact on ASEAN economies, in particular through their effects on production and subsequent industrial structure and trade patterns. These five trends are the Internet of Things, big data analytics, artificial intelligence, additive manufacturing, and blockchain. They are described below and discussed at greater length in sections 2.4 and 2.5.

As ASEAN countries prepare for the digital age, albeit from different starting points and with different degrees of progression, different policies will need to be prioritised to manage change. However, in all cases, promoting digital readiness, through greater investment in digital infrastructure, hard and soft, and the uptake of digital solutions, both by firms and consumers, will be a precondition for access to the benefits offered by new technologies.

Internet of Things: In broad terms, the IoT comprises devices and objects whose state can be altered via the Internet, with or without the active involvement of individuals

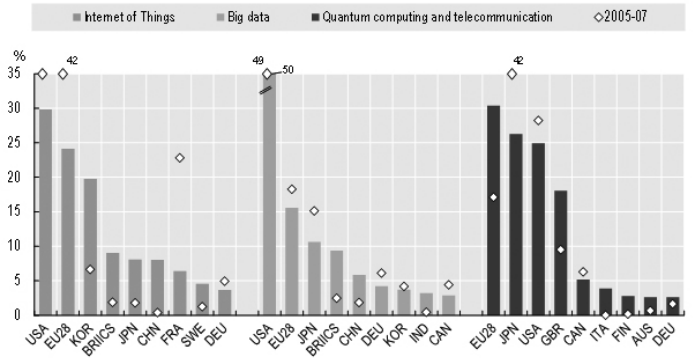
(OECD, 2015a). It encompasses not only familiar devices connected to the Internet, such as laptop computers and smartphones, but also a myriad of sensors and objects that sit in workplaces, public spaces and homes. These objects collect data and take action based on specific rules; for instance, a sensor in a parking space might assess whether a car is parked there, providing information not only for real-time traffic management, but also for longer-term road infrastructure decisions.

The IoT's evolution will be underpinned by advances in big data analytics (see below), as well as cloud computing (essentially, remote data storage and processing), machine-to-machine (M2M) communication and sensor technology. By 2030, it is estimated that 8 billion people and perhaps 25 billion active "smart" devices will be interconnected and interwoven in one huge information network (OECD, 2015b). This offers incredible opportunities in health care, manufacturing, energy and transport, as well as in the delivery of public services. In manufacturing for example, the IoT could radically improve factory operations and logistics, boost supply chain intelligence and reduce waste and loss. The IoT can also help improve the delivery of public services from transportation (using GPS tracking devices to manage public transport), to health (using sensors for real-time monitoring and more tailored care packages) and administration (using biometrics to prevent identity theft) (see Deloitte, 2015; OECD 2016b). Data-driven innovations based on the IoT hold great promise also for increasing the efficiency of urban systems and urban governance (OECD, 2015b).

Big data analytics: These are the 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, 2015b). Data alone have limited value - it is by putting them into context, examining their structure and finding patterns that data become a source of competitive advantage, productivity and innovation. Making sense of data enables firms, governments and individuals to monitor and optimise their operations, and to inform real-time decision-making. It also allows entities to refine products and services to better serve the needs of their customers. Coupled with artificial intelligence, big data analytics has already transformed the finance industry, with algorithms now conducting more trades autonomously than humans in the United States (see OECD 2015b, p. 156). The wealth of potential market applications is reflected in the growing investment in big data analytics, as well as the IoT and quantum computing and telecommunication (Figure 2.3).

Figure 2.3: Top Players in IoT, Big Data and Quantum Computing Technologies, 2005-07 and 2010-2012

Economies' share of IP5 patent families filed at USPTO and EPO, selected ICT technologies



Note: Quantum technologies harness quantum physics to acquire functionalities or improve the performance of existing technologies (e.g. microprocessors). Quantum computation technologies are information-processing methods that promote more effective computation. Quantum telecommunications technologies offer secure communication channels and lead to patents related to encryption, as well as transmission systems and components.

Source: OECD calculations based on IPO (2014), Eight Great Technologies: the Patent Landscapes, United Kingdom and STI Micro-data Lab: Intellectual Property Database, http://oe.cd/ipstats, June 2015. See OECD 2015c, http://dx.doi.org/10.1787/888933273495.

Artificial intelligence: Artificial intelligence (AI) is defined as the ability of machines and systems to acquire and apply knowledge and to carry out intelligent behaviour (OECD, 2016a). This means performing cognitive tasks such as sensing, reasoning, learning and making decisions, as well as moving and manipulating objects. It relies heavily on data analysis, with machine learning allowing machines to make decisions based on past experience as well as an underlying set of information and rules. Coupled with advances in engineering, AI is revolutionising the role of robots, so that they can adapt to working environments and learn autonomously (OECD 2016c). The number of robots being utilised is increasing rapidly (Figure 2.4), and with IoT technology also in play, fully automated production processes may be close at hand. On the factory floor, AI may not only lead to better inventory management and resource optimisation, but also to improved safety and enhanced decision-making in hazardous environments. The service sector will also be reshaped by AI - for instance, recommendation-engines used to power Amazon, Netflix and Spotify are all based on machine learning technologies.

Figure 2.4: Rise in Annual Supply of Industrial Robots (thousand)

Source: International Federation of Robotics (2015), reproduced for OECD (2016a).

Additive manufacturing: In contrast to traditional manufacturing processes where products are built by taking materials and removing pieces or reshaping them to form the ultimate item, additive manufacturing makes products by building up material in layers (OECD, 2016a). This technique, more popularly known as 3D printing, typically uses computer-aided design software and can create items made of plastic, metal, ceramic and glass, as well as an increasing number of composite materials. Originally, additive manufacturing was primarily used to create prototypes, but with improvements to materials and manufacturing machinery, the technique is now allowing firms and individuals to create highly complex and customised products (such as hearing aids or crowns for dentistry to name but a few examples). While additive manufacturing is unlikely to replace mass manufacturing methods in the near term, it does offer new opportunities for firms to speed up design processes, potentially reduce the number of steps in production, and explore new market niches and levels of customisation that were previously not financially viable. Manufacturing could also become possible in geographically dispersed areas, as micro-scale manufacturing becomes a viable economic proposition.

Blockchain: Blockchain is a distributed (decentralised) database that acts as an open, shared and trusted public ledger that is tamper-proof and able to be inspected by everyone (OECD, 2016a).[4] It allows value to be transferred within computer networks, and the protocols underlying how the ledger is maintained and updated provide the conditions for trust in the transactions taking place, without the need for a central institution. The technology offers the potential for lower transaction costs and while the initial application has been in digital currencies, there is a large scope for blockchain technology in financial transactions more broadly, as well as record and

[4] The information held in the database is distributed across multiple (physical or digital) locations or nodes; since there is no central repository, all nodes carry an updated copy of the entirety of the database making it more resilient and less prone to tampering.

verification systems and smart contracts. For example, cross-border remittances could be revolutionised, cutting the typically high transaction costs relative to the remittance amount. Registration of land and proof of ownership of assets could become more transparent and accessible via blockchain technology, and it could also further ensure the integrity of other government records and services, including tax collection.

The technologies described above will clearly have far-reaching consequences for productivity and growth, not to mention skills, income distribution, well-being and the environment. Numerous studies point to the productivity gains from the "next production revolution" (also known as Industrie 4.0), in which digital technologies are integrated in industrial production to enable new and more efficient processes, and in some cases, create new goods and services. The IoT, for instance, reduces costs among industrial adopters by 18% on average, and the OECD's work suggests that the technologies in question, from ICTs and robots to new materials, have more to contribute to productivity than they currently do (OECD, 2016c). Often, their use is predominantly in larger firms. And even in larger firms, many potential applications are underused. Unexploited opportunities exist throughout manufacturing. In addition to their immediate impacts on production processes and underlying systems, these emerging digital technology trends are also changing the way we trade.

2.3. Trade in the Digital Era

The 21st century has ushered in the information era of bundled goods, services and ideas delivered across borders by businesses and consumers through physical devices connected to digital platforms. These digital infrastructures were conceived to be global, and while they offer new opportunities for scale, particularly for small- and medium-sized enterprises (SMEs), and preference matching for consumers, they also raise key challenges for domestic and trade policy making in a world where borders between countries remain. This section puts digital trade in the context of different waves of globalisation and discusses how the digital transformation changes how, and what, we trade.

1) A New Era of Globalisation

Much like the reduction in transport and coordination costs enabled the fragmentation of production along GVCs, falling costs of sharing information have powered the digital trade revolution. Services can now more easily be fragmented, bundled and delivered via digital platforms through physical devices. At the same time, falling informational barriers, arising from growing digital connectivity, are enabling more physical, or traditional, trade to take place.

Globalisation's "first unbundling" (Baldwin, 2011) mainly concerned trade in final goods and the "second unbundling" trade in intermediate products; trade in the 21st century is increasingly about cross-border transit of smaller packages; bundled goods and services; and flows of information (or data) all of which are enabled through digital means.

Table 2.1 Characteristics, Drivers and Trade Policy Issues Across the Different Waves of Globalisation

Type	Characteristics	Driver	Trade policy issues
"Traditional" trade	- Separation of production and consumption across international borders - Trade in final goods	- Reductions in transportation costs	- Market Access
GVC trade	- Unpacking of factories across international borders - Trade in intermediate goods	- Reductions in transport and coordination costs	- Trade-investment-service-knowledge nexus - Trade facilitation, domestic, behind-the-border NTMs
Digital trade	- Unpacking of production, logistics and consumption: age of hyperconnectivity - Trade in smaller quantities of physical goods and digital services - Changing tradable nature of services. - Bundling of goods and services	- Reductions in transport, coordination and mainly costs of sharing information - Digitalisation	- Data flows - Digital connectivity - Interoperability

Source: OECD (2016d)

At its most basic, 21st century trade is underpinned by the transfer of bits and bytes across borders. Online platforms and networks deliver information facilitating, or enabling, the production and sale of goods and services across borders. Data connects businesses (e.g. through service links), machines (e.g. the IoT) and individuals (i.e. peer-2-peer or social networking) to each other.

With this changing environment, new trade policy priorities arise. Market access, trade facilitation and behind-the-border measures (such as non-tariff measures) remain important, but new technologies raise new issues such as digital connectivity, data flows and interoperability (Table 2.1).[5]

2) Changing How We Trade (but not why we trade)

Digitalisation and new technologies change what and how we trade, but not the economic fundamentals of why we trade. That is, trade is still subject to comparative advantage, informational asymmetries and barriers to trade both at-the-border and behind-the-border.[6] However, new technologies which are reducing the cost of sharing ideas across borders and connecting different actors along the value chain, help overcome some of the constraints associated with engaging with international markets and may shift sources of comparative advantage.

Digital platforms are increasingly replacing intermediaries to connect supply with demand.[7] They can help reduce informational asymmetries and search costs, helping firms, and particularly SMEs, upscale production and meet the costs associated with exporting, and also allowing individuals to more directly engage in international trade, both as buyers and sellers, and find better matches to their preferences.

E-tail activities—retail business conducted online via platforms such as eBay, Alibaba or Tokopedia, are growing fast and resulting in a rising number of small packages crossing international borders. Small value products are particularly sensitive to trade costs, from shipping costs to at-the-border and to-the-border costs, because they represent a larger share of the value of the shipped product. The trade policy environment they face depends on the *de minimis* provisions of the receiving country, which indicate the minimum value of goods below which no tariffs or taxes are collected at the border.

In ASEAN, *de minimis* provisions range between US$28 in Viet Nam to US$296 in Singapore (Table 2.2). Too low a threshold can unnecessarily raise the cost borne by importers and exporters; increase delivery times; and overburden customs authorities having to clear more packages. However, too high a threshold might in turn result in

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[5] For example, cross-country technical interoperability of systems such as e-payments may condition digitally enabled trade in goods via digital marketplaces. Data flow regulation may affect the way global value chains are coordinated, and restrictions on the cross-border supply of telecoms services which reduce competition may condition access to digital infrastructures which underpin digital trade.

[6] Many of these economic constraints have been well established for many years: i.e. informational asymmetries (Akerlof, 1970) or hold-ups in trade (Grossman and Hart, 1986).

[7] Intermediaries arose to solve issues related to search frictions (Bernard et al. 2011); digital platforms provide a more efficient way of reducing these.

lost tariff revenue. While an optimal *de minimis* level is hard to define, differences in *de minimis* provisions within an integrated region can unnecessarily impede regional e-tail trade affecting regional SME internationalisation.

Table 2.2 De Minimis Provisions in ASEAN Countries in April 2016

Member State	Amount	Types of Taxes Exempted	Commodity	Modes of Transport
Brunei Darussalam	BND 400 (US$295)	Import duty	All dutiable goods	Air (courier service)
Cambodia	US$50	Duty and tax	All	All
Indonesia	US$50	Import duty and taxes	All	Air express and postal
Lao PDR	US$50 (of goods value)	Import duty and tax	All	All
Malaysia	RM 500 (USD$128)	Import duty	Except tobacco, cigarette and liquor	Air (courier service) and postal
Myanmar	US$500	Duty and tax	All	All
The Philippines	PHP 10,000 (US$200)	Duty and tax	Except tobacco goods, wines and spirits	All
Singapore	SGD 400 (US$296)	Goods and services tax	Exclude liquor and tobacco	Air and Post
Thailand	THB 1,500 (US$40)	Import duty and VAT	Except prohibited and restricted goods	All
Viet Nam	VND 1,000,000 (US$28)	Import duty and taxes	All	All

Note: Myanmar Customs implemented the US$50 de minimis on 1 April 2017. However, this is only applicable to express consignment cargo. Goods valued at US$ 500 and below (except restricted goods) are not subject to import licensing.

Source: ASEAN Secretariat (figures from April 2016)

Other technologies, such as distributed ledgers, or Blockchain, have the potential to further reduce transaction costs by making contracts more transparent and enforceable, reducing hold-ups in trade. In turn, AI and big data can be useful in managing the coordination of global value chains and to deploy innovative service solutions to consumers and other businesses.

As firms adopt new technologies, they are likely to move towards more knowledge-intensive processes of production, giving rise to new sources of comparative advantage. Intangible assets and access to knowledge-based capital (KBC), will impact the allocation of factors of production both within the firm and across GVCs. For example, automation has the potential to reduce the role of labour abundance or skills in determining

comparative advantage for traditional goods from agriculture to manufacturing. But changing sources of comparative advantage will also lead to greater trade in new products.

3) And What We Trade

It is not just how we trade that is changing, 21st century trade increasingly involves: new 'information industries'; bundled goods and services; and trade in data.

New information industries

New technologies and digitalisation are giving rise to new 'information industries' such as 'big data' analytics, cybersecurity solutions or at-a-distance computing services increasingly being traded across borders. At the same time, digitalisation is changing the tradability of already established service industries. For instance, transport services have traditionally not been tradable across borders and have required domestic presence, but digitalisation is changing the nature and delivery of such services. This is not only a potential source of disruption in the domestic economy and a challenge for regulators, as has been seen in the case of growing accommodation-sharing or ride-sharing services, it also has implications for current and future liberalisation schedules, since many commitments were negotiated before these disruptive players entered the marketplace.

Trade in bundled goods

Digitalisation and new technologies are also enabling a greater bundling of goods and services (and further blurring the lines between manufacturing and service activities). This matters because international trade commitments, be it at the multilateral or at the regional level, are negotiated with a relatively clear distinction between goods and services. Bundled products can complicate identifying the rules and provisions that apply in cross-border transactions.

Bundling can occur at the product level, when physical devices are used as conduits for the delivery of bespoke services, such as in the IoT, or at the production level, where goods embody service inputs sourced from abroad such as design, research and development and marketing within a GVC.

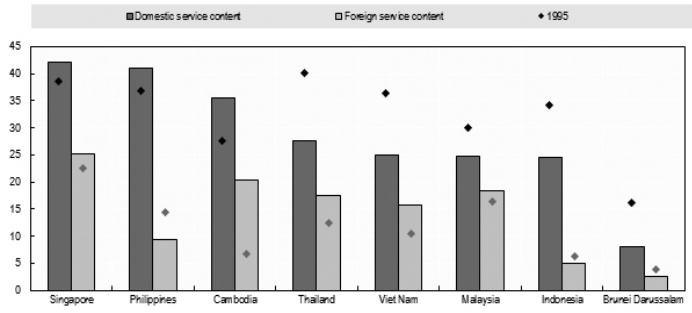
Although hard to separate, the OECD-WTO Trade in Value-Added database offers preliminary insights into this phenomenon. Services represent around 20 to 25% of gross exports, but in value added terms (taking into account the service value added content embodied in products), the figure is close to 50%. Nearly half of all service exports are

'delivered' through goods.[8]

The uptake of new technologies is partly responsible and has led to an increase in the domestic and foreign service content of exports in many OECD countries. However, in ASEAN, the evidence is mixed (Figure 2.5). While Singapore has seen its service value added content of gross exports rise, other ASEAN countries have seen overall reductions. The driving factors are uncertain, and in some countries might reflect changes in commodity prices or different levels of development. Nevertheless, reductions might also be symptomatic of the policy environment and will require further consideration as governments and businesses look to modernise economic structures for 21st century trade.

In the case of additive manufacturing, the lines separating traded goods and services are even more blurred. When a computer-aided design (CAD) file is sent across the border this is a digital design service, but when it reaches the consumer it becomes a good, raising challenges for regulators and trade rules alike.

Figure 2.5: Service Content of Exports in ASEAN in 2011 (%)



Note: 1995 figures identify the values of the domestic and foreign service content of exports in 1995. Data not available for Lao PDR and Myanmar.

Source: Adapted from Lopez-Gonzalez (2016).

[8] The service content of exports captures only part of the story; goods that are sold can subsequently enable further sales of services. For example, digital devices can facilitate the delivery of further audiovisual services which are not embodied in the digital device itself.

Data transfers

The movement of data across borders is an essential component of new and rapidly growing ways of supplying services such as cloud computing, the IoT and additive manufacturing. Data is also used as an input into production across all business activities within the firm, facilitating the allocation of resources and increasing competitiveness. Data connects firms and consumers across countries and enables management of global production networks. Enhanced connectivity, through data flows, also increases the efficiency of moving goods across borders: paperless trading, on-line registration of information, e-certification and on-line payment of customs duties contribute to further reducing trade costs and speeding-up clearance at the border.

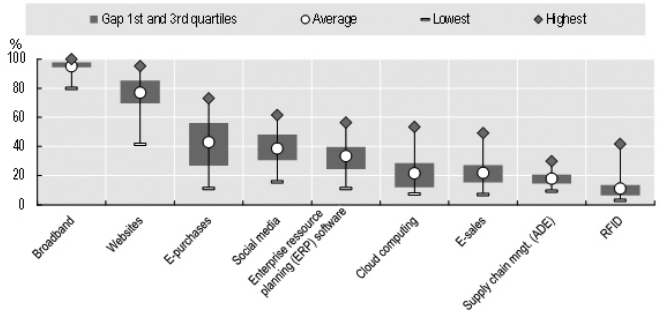
The ubiquitous exchange of data across borders however, has led to concerns about digital security, audit and protection of individual privacy, particularly in the context of different regulatory approaches across countries. This has given rise to increased data-flow regulation. Two types of measures are emerging: restrictions on cross-border transfers of data, mainly to protect privacy; and local storage requirements, either to protect privacy or for audit reach. Both aim to tackle genuine policy concerns but may have important economic consequences, now and particularly in the future, for the diffusion of new technologies and adoption of new business models. Ongoing OECD analysis reveals that in ASEAN Member States the use of such measures is growing (see also ITIF, 2017). Affording the right level of protection and security to citizens while maintaining Internet openness will be important to make the most out of globalisation while, at the same time, mitigating some of the negative effects associated with rising interconnectedness.

2.4. New Policy Challenges

There are some common challenges to the development of the technologies described in this chapter and the ability of economies to take advantage of their benefits for trade, jobs and growth. A fundamental challenge is access to, uptake, and use of technology. Broadband networks can be viewed as essential infrastructure, providing the backbone of the digital economy, but access to broadband is only the first step to effective use of digital technologies by firms, individuals and governments. Even in more developed economies, the diffusion of selected ICT tools and activities in enterprises varies widely, both across countries and across different technologies (Figure 2.6), and within countries, large firms typically use digital technologies more intensively. Small enterprises lag in their adoption of even basic digital technologies - with the costs of ICT adoption, a lack of adequate financing, a reluctance to change, and an inability to change due to skills deficiencies being some of the potential hurdles. Engaging more SMEs in the digital economy would likely yield significant benefits in terms of productivity, not to mention opportunities for new firms and employment to emerge.

Figure 2.6: Diffusion of Selected ICT Tools and Activities in Enterprises, 2015

As a percentage of enterprises with ten or more persons employed



Note: The data used to construct this figure includes 31 OECD economies and the EU28.
Source: OECD, ICT Database; Eurostat, Information Society Statistics Database and national sources, April 2016.

The growing use of AI and digitisation more generally may raise concerns over job replacement through automation, which may go beyond even the lower-skilled jobs. These new opportunities also present new challenges for those failing to catch up, both in the public and private sectors. Addressing the skills needs of the digital economy is therefore key in boosting uptake and use of digital technologies. Economies will increasingly need ICT specialist skills to drive innovation and support ICT infrastructure. However, they will also need workers with both foundation ICT skills and complementary skills that will help them continuously adapt to new standards and technologies (OECD, 2016e).

Estimates from the OECD's Survey of Adult Skills (PIAAC) suggest that more than 50% of the adult population on average in 28 OECD countries have no ICT skills or have only the skills necessary to fulfil the simplest set of tasks in a technology-rich environment (OECD, 2013a). Only around a third of workers have the more advanced ICT and cognitive skills that enable them to evaluate problems and solutions. As such, many workers use ICTs regularly without having the skills to use them effectively (OECD, 2016e). The ASEAN ICT Masterplan (ASEAN, 2015b) rightly includes human capital development as one of its eight strategic thrusts, aiming to equip ASEAN citizens to be digital-literate participants in the digital economy. Likewise, the forthcoming ASEAN Work programme on Electronic Commerce is expected to feature education and technology competency element.

Another common issue is that economies are not all equally well equipped to deal with the privacy and security challenges that digital technologies can pose, resulting in lower adoption of these technologies, especially amongst SMEs. Firms are not always aware of the security risks around the use of digital technology, yet as digital technology becomes

more important for a firm, security becomes not just a technical issue, but a core strategic and economic issue. Furthermore, firms that collect and use data from individuals will increasingly be confronted with questions of privacy and how they manage and ensure that privacy. Creating trust in digital activities is a key challenge for both firms and policy makers. Again, the ASEAN ICT Masterplan (ASEAN, 2015) rightly places emphasis on building a trusted digital ecosystem, so that transactions and information exchanges will be safe, secure and trustworthy. The forthcoming ASEAN Work Programme on Electronic Commerce is also expected to feature elements on consumer protection, security of electronic transactions and payment systems.

The overall use of digital technologies can also be affected by a slow pace of structural change, especially if there are impediments to efficient reallocation of resources from firms that use little ICT to more ICT-intensive firms. For new job opportunities to emerge, new markets have to be developed, assets and resources transferred across sectors, business know-how built up and new skills developed. Enabling structural adjustment is essential, both in terms of ensuring that business dynamics can operate and in allowing the subsequent labour market adjustment to occur. Nevertheless, greater labour market churn and potential job-losses in some industries naturally creates tensions between so-called "winners" and "losers" from globalisation or technological change, as has been seen in some countries. This underscores the need for a whole-of-government policy approach (Box 2.1) that takes into consideration the distributional aspects of technology change.

This issue may be particularly pertinent for some ASEAN economies, where the transition from agriculture to manufacturing to services that was followed by many countries in the past, including Japan, Korea and China, may be altered by the rise of digital technologies. Digitalisation and new production technologies may radically change the landscape of the manufacturing industry, which has typically provided mass employment opportunities for workers shifting from lower-productivity agricultural activities in developing countries. If the manufacturing sector becomes less of a job-creation machine for developing countries (what has been referred to as "premature deindustrialisation" by some commentators[9]), then this may necessitate a greater role for the services sector. Adjustment can be disruptive, and it is not easy to predict the specific types of work brought by new technology or how new technologies might transform existing jobs (see OECD, forthcoming). Policy-makers must be prepared to proactively address the structural and labour market shifts that this disruption implies.

[9] See, for instance, Rodrik (2015)

Box 2.1: Whole-of-government Approaches to Digital Economy Policy Making

Many countries are seeking ways to best formulate a whole-of-government approach to digital economy policy- making. With technology moving much faster than typical policy cycles, and the breadth of issues raised by digital transformation spanning almost the entirety of government policy responsibilities, this challenge has never been more critical.

A recent effort by the OECD and Inter-American Development Bank sought to provide guidelines - a "Toolkit" - for a whole-of-government approach to broadband policy, to help countries in the Latin American and Caribbean region enhance their digital prospects (OECD and IDB, 2016). Successful broadband policies, designed to improve social inclusion, productivity and governance, can be a catalyst for expanding the "digital dividends" which stem from broadband access and use. As outlined in that report, policymakers and regulators have a variety of instruments at their disposal to stimulate and encourage investment, competition and network deployment. They can also assist in making services more affordable, relevant, usable and safer for individuals and businesses.

The Toolkit spans regulatory frameworks and digital strategies, spectrum policy, competition and infrastructure, affordability and digital inclusion, convergence, skills and jobs, business uptake, e-health, digital government, consumer protection, digital security risk management, and privacy protection. The aim is to tackle supply-side and demand-side issues that hamper the uptake and usage of broadband. It highlights that a holistic and multi-stakeholder approach is necessary for success, and also highlights the importance of regional co-operation agreements that can allow experience-sharing as well as more efficient deployment of infrastructure and better services for consumers.

Source: OECD and IDB (2016).

2.5. Preparing to Seize the Opportunities - Policy Directions

ASEAN economies are at different stages of readiness for the digital age (as suggested by differences in broadband uptake and Internet users across member states - Figure 2.1). They therefore face different policy challenges and priorities, at least in the short term. Those lagging behind may need to prioritise ensuring basic access but they should not neglect beginning to adapt regulatory frameworks to help face forthcoming challenges. Different levels of development are an opportunity to leapfrog or to move ahead in policies less constrained by legacy systems. Below are some considerations for ASEAN economies when trying to make the most out of the new opportunities while mitigating possible challenges.

Improving access to digital technologies in ASEAN economies requires sound regulatory frameworks, comprehensive digital strategies, strong competition in the provision of digital infrastructure,[10] and – where necessary – national broadband strategies to ensure

[10] The importance of competition in telecommunications markets cannot be underestimated. A 2012 review of telecommunication policy and regulation in Mexico concluded that a lack of competition had led to inefficient telecommunications markets that imposed significant costs on the Mexican economy and burdened the welfare of its population (OECD, 2012). The sector at that time was characterised by high prices and a lack of competition, resulting in poor market penetration rates and low infrastructure development. The Mexican government has since passed several reforms, and the telecommunication market has experienced significant changes in foreign investment, as well as prices and consumer access.

that all parts of the country and all firms, even in remote areas, are connected. In addition, policy makers can take specific actions to encourage firms to use ICTs and integrate them in their business processes. Taking e-commerce as an example, it is important to have sound frameworks for electronic payments and settlements when more firms are starting to use e-commerce (see Asian Trade centre, 2016) as well as sound consumer protection frameworks. Governments might also play a role in awareness-raising, test beds and demonstration facilities, which are especially important for SMEs and start-ups with good ideas but no experience of production with new digital technologies.

From a trade perspective, at the national level, access to and benefits from, regional integration and the new wave of globalisation will require a greater focus on cross-country digital connectivity (connecting citizens and firms to the global community) and interoperability. Continued support for leveraging new technologies in support of traditional trade enhancing instruments should not be neglected. For example, recent OECD work suggests that full implementation of the WTO Trade Facilitation Agreement could reduce trade costs by an average of 16.9% in ASEAN countries (OECD, 2015e). Continued progress in implementation, through a greater adoption of digital technologies for information sharing or automation of customs procedures, should help further reduce trade costs, increasing goods trade and promoting cross-border e-commerce. Likewise the adoption of the ASEAN Trade Facilitation Framework in 2016 (ASEAN, 2016b), which will address broader trade facilitation issues beyond customs and transit, is an important step forward, and should be followed through with effective implementation. Private sector participation in the revamped ASEAN Trade Facilitation Joint Consultative Committee, the working body that plays a key role in coordinating implementation of the Framework, should further contribute to ensuring responsiveness to changing business concerns.

While much focus will need to be placed at the national level, a shared regional understanding on the policy responses needed to make the most out of digital will be important in moving towards "a highly integrated and cohesive economy", "competitive, innovative and dynamic ASEAN" and "enhanced connectivity and sectoral cooperation" as set out in the ASEAN Economic Community Blueprint 2025. For example, regional cooperation through a common understanding on the degree and importance of intellectual property protection and approaches to consumer protection, connectivity and e-payments as well as a common e-commerce framework would go a long way in increasing regional digital trade. Effective implementation of the forthcoming ASEAN Work Programme on Electronic Commerce, will be critical to achieve this objective.

Greater focus is also needed at the multilateral level. The current rules that govern international trade were devised to govern physical trade in the context of simpler trade

relations. And while these were designed to be technologically neutral, the breakneck speed of technological change may increase the need for greater clarifications to adapt to changing realities.

ASEAN economies also need to ensure their populations have the appropriate skills to implement and use digital technologies. This is a large challenge in all countries and requires comprehensive education and skills strategies that encompass both technological competencies and the broader skill set required by digital economies. Initial education can equip students with solid literacy, numeracy and problem-solving skills as well as some ICT and complementary skills. However, education and training systems also need to evolve to foster resilience, flexibility and adaptability to help people adjust in a rapidly changing world. Training systems need to help up-skill and re-skill workers as needed, all along their working lives. A challenge for developing countries is that new production technologies stemming from digital advances could erode low wage advantages, leading to shifts in competitiveness along GVCs. Rapidly declining costs of many technologies and improved knowledge diffusion may mitigate this, but ASEAN governments must also ensure their service sectors can strengthen and expand, to add value and jobs to production.

This underscores the important role of ASEAN governments in promoting competition, reducing labour market rigidities, supporting up-skilling and removing barriers to growth for firms. New firms are often those which adopt or introduce new technologies and the basic framework settings within countries need to embrace business dynamism. At the same time, governments must provide adequate transition assistance for workers and regions that find themselves on the losing side of technological change.

Finally, attention needs to go to digital security and privacy, as core strategic and economic issues. Data is becoming a key source of innovation and competitive advantage, but at the same time, all stakeholders have a role to play in ensuring its appropriate use. Governments should look to promote appropriate re-use and sharing of data (e.g. sensors in cars may not only provide valuable input for the ongoing development of automotive technology, but also for public transportation systems and environmental considerations) but also set up robust frameworks for digital security and privacy.

The OECD's 2015 Recommendation on Digital Security Risk Management points to the role of government in providing leadership, so that digital security is approached with a risk management approach that builds trust and takes advantage of an open digital environment (OECD, 2015d). In broad, digital security measures should be designed in a way that take into account the interests of others, are appropriate to and commensurate with the risks faced, are least trade distorting and do not undermine the economic and

social activity they aim to protect. The OECD's 2013 Privacy Guidelines take a similar stance, underscoring the importance of a focus on the practical implementation of privacy protection through an approach grounded in risk management (OECD, 2013b). The Guidelines, which address the protection of privacy and trans-border flows of personal data, can provide useful principles to help meet the challenges of increasingly data-driven economies and ensure that legitimate public policy goals can be pursued in a way that is least distortive to trade.

At the regional level, encouraging dialogue and cooperation aiming at interoperability of digital security and privacy frameworks across countries can go a long way to ensuring that national preferences are met while also benefitting from the vast opportunities brought by the digital economy. International arrangements that promote effective privacy and data protection across jurisdictions, including through the development of national privacy strategies that foster interoperability among frameworks, could help provide a whole-of-society perspective that adjudicates across competing priorities while providing the flexibility needed to take advantage of digital technologies for the benefit of all (OECD, 2017). As an example, the Asian-Pacific Economic Cooperation (APEC) has also developed some rules aimed at helping firms meet different privacy regulations across jurisdictions (see www.cbprs.org). Greater shared understanding will help countries meet important public policy objectives, such as consumer privacy and digital security, while maintaining the benefits from free flows of data.

Pulling all these policy considerations into a whole-of-government and society approach will be essential for a successful ASEAN transition to the digital age. The digital transformation will leave no policy area untouched and without a holistic approach there is a high risk that policies in one area will have unintended, and possibly adverse, effects on another. Many OECD countries are struggling to update their "analogue" policy environment to harness the digital transformation;[11] ASEAN countries should aim to leapfrog this and get policy right in the first instance.

By taking a proactive approach to policy, ASEAN economies can shape the digital revolution to bring economic and social prosperity to their populations. The future is bright, and the time for action is now.

[11] For this reason, the OECD is beginning a multi-disciplinary, cross-cutting project on "Going Digital" that aims to guide policy makers as they rethink their policy environments. See www.oecd.org/going-digital

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