2020 POLICY NOTE **ON ASIA**

SMART CITIES AS ENGINES FOR GROWTH

INVESTMENT
SMART CITIES *DIGITALISATION*
INFRASTRUCTURE INNOVATION
SUSTAINABILITY *NEW TECHNOLOGIES*
REGIONAL INTEGRATION MARKETS
SKILLS REGULATIONS *TRADE*
PRODUCTIVITY
INDUSTRIALISATION
COMPETITIVENESS

OECD DEVELOPMENT CENTRE

EM net
OECD EMERGING MARKETS NETWORK

Smart cities as engines for growth in Asia

This Policy Note provides insights from the private sector on the opportunities for growth that smart cities can offer in Asian economies. The analysis builds on discussions which took place at the "Global Challenges for Business in Emerging Markets" meeting organised by the OECD Development Centre's Emerging Markets Network (EMnet) at the OECD headquarters on 28 March 2019, as well as desk research and bilateral conversations with multinationals operating in emerging markets. Growth in 2020-24 was expected at 5.7% on average, but the region's projections have been slashed to just over 2% for 2020.

Key messages include:

- Urbanisation is increasing rapidly in Asia, where the population of cities grew from 936 million in 2000 to 1.6 billion in 2017.
- Urban sprawl presents a number of downsides. The rapid rate of urbanisation has led to infrastructure challenges, increased traffic congestion, rising air pollution levels and higher energy demand.
- Government-led smart city initiatives provide solutions to the challenges arising from rapid urbanisation and catalyse private investment by, amongst others, real estate developers, technology firms, telecom, utilities and transport companies.
- Companies increasingly contribute to improving the quality of urban transportation systems, by upgrading information and communications infrastructure and providing new technologies, such as intelligent traffic management systems.
- For the success of smart city initiatives, the private sector has emphasised the importance of policies that aim to facilitate innovation and competition in order to close the infrastructure gap.
- Companies view a lack of digital access, as well as digital skills and literacy as major constraints to doing business in Asia.
- Companies note the need to uphold privacy, while allowing companies to access public data that are necessary to develop new products and technologies.
- Companies note an infrastructure gap that must be addressed across the region in order to unlock the potential of smart cities and address environmental concerns.
- Collaborative ecosystems that promote public-private partnerships and co-operation across different levels of government are essential in order to harmonise financing schemes, increase private investment, promote data sharing and encourage the adoption of smart technologies.

OECD DEVELOPMENT CENTRE

The Development Centre of the Organisation for Economic Co-operation and Development (OECD) was established in 1962 and comprises 56 member countries, of which 27 are OECD members and 29 are developing and emerging economies. The European Union also takes part in the work of the Centre.

The Development Centre occupies a unique place within the OECD and in the international community. It provides a platform where developing and emerging economies interact on an equal footing with OECD members to promote knowledge sharing and peer learning on sustainable and inclusive development. The Centre combines multidisciplinary analysis with policy dialogue activities to help governments formulate innovative policy solutions to the global challenges of development. Hence, the Centre plays a key role in the OECD's engagement efforts with non-member countries.

To increase the impact and legitimacy of its work, the Centre adopts an inclusive approach and engages with a variety of governmental and non-governmental stakeholders. It works closely with experts and institutions from its member countries, has established partnerships with key international and regional organisations and hosts networks of private-sector enterprises, think tanks and foundations working for development. The results of its work are discussed in experts' meetings as well as in policy dialogues and high-level meetings, and are published in a range of high-quality publications and papers for the research and policy communities. For more information on the Centre, please visit www.oecd.org/dev.

OECD EMERGING MARKETS NETWORK

Emerging Markets Network (EMnet) is an OECD-sponsored initiative dedicated to the private sector. Managed by the OECD Development Centre, the Network fosters dialogue and analysis on emerging economies and their impact on global economic and social issues.

EMnet gathers top executives (chief executive officers, vice-presidents, managing directors, chief financial officers, heads of strategy, chief economists) of multinational companies from diverse sectors, willing to engage in debates with high-level policy makers, including heads of state and ministers, and OECD experts.

EMnet events are closed to the public and media and operate under Chatham House rule to encourage open and dynamic discussions on doing business in Africa, Asia and Latin America. To learn more about EMnet, please consult www.oecd.org/dev/oecdemnet.htm.

ACKNOWLEDGEMENTS

This Policy Note was written under the guidance of Bathylle Missika and Lorenzo Pavone, Head and Deputy Head respectively of the Networks, Partnerships and Gender Division, and Melanie Vilarasau Slade, EMnet Co-ordinator. The report was prepared by Robbert van Eerd, Policy Analyst, and Jaya Jain, EMnet trainee, of the OECD Development Centre's Emerging Markets Network. The first chapter of the report was prepared by Leah Zinonos, MBA student at the INSEAD business school, under the guidance of Robbert van Eerd.

The analysis in this Policy Note is based on discussions held at the EMnet meeting on 28 March 2019 at the OECD headquarters in Paris, as well as on bilateral discussions with EMnet members and contacts, and desk research.

Insights from Kensuke Tanaka, Head of the Asia Desk, and Prasiwi Ibrahim, Economist at the OECD Development Centre Asia Desk, helped to refine this note. The report also benefitted from comments by representatives of Schréder and from Elias Miles, Senior Manager at Schneider Electric, which further sharpened the analysis.

Finally, special thanks go to Bréanne Mallat, Sonja Märki and Carolina García Valencia (OECD Development Centre) for their valuable assistance throughout the drafting and publishing process. The team is also grateful to the OECD Development Centre's Communications and Publications Unit, especially Delphine Grandieux, as well as to the copy-editor, Brenda O'Hanlon.

TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
ASCN	Association of Southeast Asian Nations Smart Cities Network
ASEAN	Association of Southeast Asian Nations
CAB	Current Account Balance
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CLM	Cambodia, Lao PDR and Myanmar
CLMV	Cambodia, Lao PDR, Myanmar and Viet Nam
EDB	Economic Development Board (of Singapore)
EMnet	Emerging Markets Network
EU	European Union
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GDPR	General Data Protection Regulation
GFDRR	Global Facility for Disaster Reduction and Recovery
GPS	Global Positioning System
GSMA	Global System for Mobile Communications Association
GWh	Gigawatt hours
ICT	Information and Communications Technology
IDA	Infocomm Development Authority of Singapore
IEA	International Energy Agency
IMF	International Monetary Fund
IoT	Internet of Things
IPv4	Internet Protocol version 4
ITS	Intelligent Transportation System
ITU	International Telecommunication Union
IUCN	International Union for Conservation of Nature
KNOMAD	Global Knowledge Partnership on Migration and Development
Mbps	Megabits per second

MPAC	Master Plan on ASEAN Connectivity
MPF	Medium-term Projection Framework
MSME	Micro, Small and Medium-sized Enterprise
Mtoe	Million tonnes of oil equivalent
OECD	Organisation for Economic Co-operation and Development
OICA	*Organisation Internationale des Constructeurs d'Automobiles* (International Organization of Motor Vehicle Manufacturers)
PPP	Public-Private Partnership
SDG	Sustainable Development Goal
SME	Small and Medium-sized Enterprise
STRI	Services Trade Restrictiveness Index
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNEP	United Nations Environment Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
USD	United States dollar
WHO	World Health Organization

ASIA'S ECONOMIC AND BUSINESS OVERVIEW

Emerging Asian[1] nations continued to experience strong economic growth, supported by a resilience of private consumption, inbound foreign direct investment (FDI) and, in certain cases, remittances. Growth in Emerging Asia for 2020-24 was expected at 5.7% on average, according to the OECD *Economic Outlook for Southeast Asia, China and India 2020*, but recent projections show GDP to grow at just over 2% in 2020 (Sawada, 2020). This chapter covers the period before 2020, and neither it nor the data cited in it take into account the effects of the Coronavirus pandemic. The virus is resulting in significant economic disruption from quarantines, restrictions on travel, factory closures and a sharp decline in many service sector activities. As a result, the world economy is expected to be in its most precarious position since the financial crisis and experiencing a sharp slowdown (OECD, 2020). See also Box 1.

Box 1. The Coronavirus crisis in Emerging Asia

This Coronavirus (COVID-19) crisis is resulting in significant economic disruption from quarantines, restrictions on travel, factory closures and a sharp decline in many service sector activities. Growth prospects in Emerging Asia have been slashed, as a consequence of the important economic and social costs of combatting the disease through lockdowns (Tanaka and Pezzini, 2020).

COVID-19 originated in the People's Republic of China (hereafter: 'China'), a country that accounts for 17% of global GDP, 11% of global trade, and 34% of the MSCI EM index. China's increased economic weight means that the effects of disruption cause large ripple effects on both demand and supply in other economies, in particular those strongly linked with the Chinese economy such as Thailand and Viet Nam (Pezzini, 2020; OECD, forthcoming). Preliminary data shows that China's industrial production contracted by 13.5% and its services by 13% during January and February (National Bureau of Statistics, 2020). The associated supply and demand shock is reverberating across the rest of Asia, as many of its economies are strongly interwoven with Chinese supply chains. Exports continue to weaken (OECD, forthcoming). Reduced manufacturing exports is also a major concern, for example in the garment industry which has seen many orders postponed or cancelled. In addition, many countries have strongly restricted travel, which will have an important impact on economies that draw heavily on tourism such as Indonesia, the Philippines or Thailand (ADB, 2020).

Countries in Asia have been cutting benchmark rates to provide more liquidity, and many countries have also announced a stimulus package to boost demand or support faltering industries such as tourism, travel, or transportation, or cheap loans to SMEs. To support corporates in the region, authorities have pledged their support with measures ranging from direct provision of funding to corporate bond purchases (OECD, forthcoming). Rating agencies have slashed growth forecasts as yields on corporate bonds have tightened. In the case of India, Moody's noted that a general lack of social safety nets, weak ability to provide adequate support to businesses and households, and inherent weaknesses in many major emerging market countries will amplify the effects of the virus-induced shock (Moody's, 2020).

For the latest information on impacts and consequences of the COVID-19 pandemic, please visit www.oecd.org/coronavirus.

Economic growth in Emerging Asia, while still high, is showing signs of moderating

Global uncertainty and reduced trade and investment growth have contributed to signs of decelerating economic performance across Emerging Asia, which encompasses China, India and the ten countries of the Association of Southeast Asian Nations (ASEAN). Prior to the outbreak of the Coronavirus pandemic, real gross domestic product (GDP) for the region was expected to grow by 5.6% in 2020, which was already a slight reduction from 2018 and 2019 (OECD, 2019a).

As inflation eases, central banks in the region have lowered their interest rates

Inflation remained steady at 2.8% on average across Emerging Asia in 2019, with significant falls in headline and core inflation to 1.6% in the Philippines and 1.9% in Malaysia (IMF, 2019). This was driven by the fall in global oil prices since late 2018, and by local currencies stabilising as a result of tighter monetary policy and capital controls, while food inflation remains mixed (OECD, 2019b). Consequently, central banks are increasingly using monetary policy tools to reduce local economic and financial risks, such as lower private sector demand and risk-taking in property markets (OECD, 2019b). The reserve banks of Malaysia and the Philippines recently reduced their interest rates by 25 basis points to 3.0% and 4.0%, respectively, in order to manage downside risks around global growth and trade (Bank Negara Malaysia, 2019; Bangko Sentral ng Pilipinas, 2019a). Similarly, the Reserve Bank of India has continued to reduce its benchmark interest rate as economic growth tapers (Reserve Bank of India, 2019). China's central bank, however, has maintained a mostly neutral monetary policy position (People's Bank of China, 2019), as it manages both high food inflation and softening export demand (China Bureau of Statistics, 2019; OECD, 2019b).

Current account balances weakened, although balance of payment positions remained steady

Most ASEAN member states, as well as China and India, saw their current account balances (CABs) as a proportion of GDP decline, largely due to lower export growth (OECD, 2019b). This is the result of a combination of increased imports as trade export growth decreased, which was not necessarily offset by transfer outflows (OECD, 2019b). In particular, Viet Nam's CAB has declined, reaching a slight deficit in June 2019, due to lower growth in exports (State Bank of Vietnam, 2019). By contrast, Thailand was the only ASEAN-5[2] country to have maintained a healthy current account surplus in 2019, as its currency remained strong, reducing growth in exports (Bank of Thailand, 2019). China has seen its CAB surplus narrow slightly in 2019 as its economy increasingly rebalances towards reliance on domestic consumption (World Bank, 2019a). Broadly speaking, there is the potential for improvement in the balance of payments if trade exports improve across Emerging Asia.

Investment flows, including FDI and remittances, continue to support economic growth

FDI continues to be robust across Asia. FDI grew by 4% in 2018 to USD 512 billion (United States dollars) (UNCTAD, 2019), even as global FDI flows fell by 13% due to tax reforms hampering outbound FDI from the United States (UNCTAD, 2019). Emerging Asia remains the largest recipient of FDI globally (40% of all flows), with the United States, China and Japan remaining the top investors in the region through greenfield projects and cross-border acquisitions

(UNCTAD, 2019). China received the second-highest investment flows across developed and developing nations, and saw its inbound investment grow by 4% in 2018 to USD 139 billion (UNCTAD, 2019). Flows to the manufacturing sector – both from across Emerging Asia and from Europe – increased sharply after deregulation in foreign ownership laws (UNCTAD, 2019). India's growth of 6% in 2018 was also supported by cross-border acquisitions (UNCTAD, 2019). FDI also grew significantly across many ASEAN member states. Thailand and Indonesia experienced growth of 6.2% and 7%, respectively, as intra-regional investment from China, Japan and Hong Kong, China helped regional value chains in manufacturing industries to develop (UNCTAD, 2019). CLMV economies (Cambodia, Lao PDR, Myanmar and Viet Nam) also experienced growth in FDI from other Asian nations, with China in particular supporting their infrastructure development (UNCTAD, 2019).

Despite strong inbound FDI, outward flows of funds from Asia decreased by 3% in 2018 to USD 401 billion (UNCTAD, 2019). This was driven by a fall in China's overall outbound flows, as capital controls were imposed to limit overseas investment. However, China's investment in Emerging Asian nations increased throughout 2018, driven by mergers and acquisitions across Singapore.

Inflows of remittances continue to strengthen purchasing power

Overseas remittances continue to be an important contributor to private consumption for some Asian economies: India, China and the Philippines represented three of the top four largest recipients of remittances globally (KNOMAD, 2019), and the Philippines, Cambodia and China saw their flows increase. Except for China, remittance flows have exceeded FDI in low- and middle-income countries since 2015 (KNOMAD, 2019). Remittances into South and East Asia are expected to continue to grow moderately into 2021, with direct transfers boosting consumption and savings while also raising living standards (KNOMAD, 2019). In India, remittances increased by 14% in 2019, potentially due to flooding in Kerala and growth inflows from the United States (KNOMAD, 2019). In the Philippines, personal remittances grew 6.3% in 2019 from the previous year to USD 2.6 billion, largely from land-based overseas Filipinos with work contracts of 1 year or longer (Bangko Sentral Ng Pilipinas, 2019b). The largest sources of its remittances were the United States, Saudi Arabia and Singapore, contributing 9.7% of the Philippines' GDP in 2018 (Bangko Sentral Ng Pilipinas, 2019c). As remittances increase globally, the Organisation for Economic Co-operation and Development (OECD) has identified opportunities for financial technology (Fintech) firms to foster greater financial inclusion through lower-cost platforms for sending money internationally in order to lower fees (OECD, 2018a), in line with the United Nations' Sustainable Development Goal (SDG) of reducing the transaction costs of migrant remittances to less than 3% (UN, 2019).

Trade tensions and growing trade barriers can reduce trade in Asia in the short term

Increased trade tensions between the United States and China have weakened Chinese net exports, which grew by only 1.1% in 2019 (OECD, 2019c). The trade conflict between the United States and China has seen tariff rates of up to 25% imposed on USD 200 billion of Chinese imports to the United States and USD 60 billion of US imports to China (ADB, 2019). Asian countries will be impacted differently, offering some economies the opportunity to take advantage of trade

diversion and re-allocation (OECD, 2019b). Malaysia, Singapore and Thailand experienced a slowdown in exports in the first quarter of 2019 (OECD, 2019b), but were stable for the remainder of the year (OECD, 2019a). Viet Nam, on the other hand, experienced strong export growth in 2019. Its exports to the United States, its largest export partner, grew 28% in the first 5 months of 2019, suggesting a shift in import sourcing (ADB, 2019). With current tariff trends set to continue, trade redirection can provide benefits to economies such as Malaysia, the Philippines and Thailand (ADB, 2019).

Slowing Chinese imports are impacting other Southeast Asian economies

China's goods imports from ASEAN countries and India have slowed and, in some cases, contracted in 2019 (OECD, 2019a) due to reduced trade flows with the United States. Malaysia and Viet Nam are two Asian economies with relatively higher shares of exports to China, and both these economies have already experienced a noticeable decline in exports of goods to China since mid-2018 (OECD, 2019b). Asian countries can continue to grow their exports through diversification, but the success of this strategy varies depending on the types of goods they can offer (OECD, 2019b). As China remains Southeast Asia's largest trading partner, ASEAN countries and India should reduce the risks associated with future tariffs and changes in import sourcing. Already, Thailand and Viet Nam have diversified away from food and live animal exports towards machinery and equipment, although CLM nations' exports remain more concentrated in agriculture products, textiles and garments (OECD, 2019b). In addition, better regional linkages through improved physical infrastructure (transport and energy) can be a way of improving the ease of trading across Emerging Asian nations (OECD, 2019b).

Digitalisation is having an impact on productivity growth

Digitalisation across Asia-Pacific is increasing. Smartphone penetration, a proxy for digitalisation, is estimated to have increased from 61% of all mobile connections in 2015 to 83% in 2018 (GSMA, 2019). The digital transformation of societies is altering how citizens work, communicate and live through the advent of Artificial Intelligence, robotics and information technologies (OECD, 2019d). It presents an opportunity to increase the productivity of labour and to upskill workers. Yet, automation and increased inequalities due to an increasing digital divide also pose risks. One example of digitalisation, on line job platforms, has facilitated significant self-employment throughout Asian economies (OECD, 2019d). Within Asia, Singapore, through its Smart Nation initiative, has taken a leading role in the implementation of digitalisation policies across delivery of government services, digital infrastructure and building digital capabilities among small and medium-sized enterprises (SMEs) (OECD, 2018b). Many middle-income countries in Asia rely on labour-intensive industries that are exposed to automation. For these economies – e.g. the Philippines, with its growing information technology industry – responding to the threat of automation is critical to their continued economic prosperity (OECD, 2018b).

Natural disasters and climate change adaption remain key risks in Asia

Extreme weather conditions and natural disasters pose material economic and human risks and increased institutional and human capacity may be required in order to respond to threats (OECD, 2018b). Currently, Emerging Asian countries are over-represented in the Global Climate Risk Index

on factors relating to natural disaster exposure, including vulnerability and susceptibility, with Viet Nam and Thailand ranked sixth and tenth on the Index, respectively – the highest in the region (Germanwatch, 2019). The increasing occurrence of natural disasters and extreme weather are having ongoing economic impacts in Asia, with heatwaves and flooding associated with climate change being key sources of concern (Germanwatch, 2019; IMF, 2018), partly driven by the high number of low-lying and highly populated coastal cities (IUCN, 2019). As the region continues to experience high economic growth, it can engage in economic diversification away from weather-vulnerable industries such as agriculture, while developing resilience-building policies in order to reduce the future effects of extreme weather. For example, Viet Nam is working towards ex ante risk reduction through a dedicated disaster risk management agenda that integrates disaster risk into development planning, promotes risk-financing mechanisms for mitigation, and invests in disaster risk management in order to strengthen its urban resilience (GFDRR, 2019a). Similarly, China is developing early warning systems for hydrological hazards such as earthquakes, floods and storms, supporting the USD 300 million disaster-resilient infrastructure project in earthquake-prone Sichuan (GFDRR, 2019b). This approach will be supported at a global level by multilateral treaties, such as the Paris Agreement, as governments shift towards a risk management approach to extreme weather (UN, 2015).

SMART CITIES AS ENGINES FOR GROWTH

From 2000 to 2017, the population of Asian cities grew from 936 million to 1.6 billion (OECD, 2018b). Sixty cities in the region were among the world's 300 largest metropolitan economies in 2013-14 (WEF, 2018). The ten fastest-growing cities in the world are in India (WEF, 2018). By 2025, China alone will have 221 cities with more than 1 million inhabitants (EIU and Siemens AG, 2011). The urban population of Southeast Asia[3] is expected to grow by more than 150 million people by 2040 (IEA, 2017).

Smart cities[4] are an important component of urban development. Cities and countries can use smart services and smart technologies to build more efficient and liveable urban environments, boost economic growth, foster well-being and facilitate citizen engagement (OECD, 2018b). A denser concentration of the population and new technologies have enabled innovations in service provision, for example in banking, telecommunications, e-commerce and e-health, which are becoming increasingly available to Asia's urban populations. The speed of urbanisation, however, has outpaced planning and investments, causing a substantial gap in infrastructure. The gap presents ample investment opportunities to the private sector, as Southeast Asia alone needs USD 7 trillion in infrastructure, housing and real estate investments in order to support sustainable urban growth (OECD, 2018b).

Cities are increasingly concerned about the downsides of rapid urbanisation, and have started investing in clean water, clean energy, mass transit systems and other measures to improve the quality of urban environments. Policy makers in the region have adopted plans to develop and promote smart city development, often with significant financial backing from governments (OECD, 2018b). They are involving the private sector as an important partner.

Smart city initiatives are spreading across Asia as a way to address urban policy challenges

Many initiatives focus on improving living standards and the competitiveness of cities, accelerating the pace of economic and social development, and providing solutions to challenges arising from rapid urbanisation (OECD, 2018b). New cities in China, India and Korea are challenging the established concept of how a city operates by running digital networks that interweave electricity, water, waste and gas systems, creating a unified matrix of urban operations and explosive growth in information sharing (Herzberg, 2017). Smart cities can offer significant opportunities for real estate developers; technology firms; and telecommunications, utility and transportation companies. Estimates for Southeast Asia show that the market for smart mobility applications could be as large as USD 70 billion, while opportunities to improve the built environment using new and advanced technologies could be worth USD 26 billion (McKinsey & Company, 2018). In India, the Smart Cities Mission was established to support the development of smart and digital solutions to address core infrastructure challenges and offer a better standard of living to citizens through a cleaner and more sustainable environment (Ministry of Housing and Urban Affairs, Government of India, 2017; WEF 2016). The Smart Cities Mission has acknowledged the importance of involving the private sector to meet the infrastructure demands of water supply, sewerage and solid waste management, for example by jointly executing projects through public-private partnerships (PPPs), joint ventures or turnkey contracts (Ministry of Housing and Urban Affairs, Government of India, 2017). Companies

participating include Mahindra, Infosys and Deloitte (Ministry of Housing and Urban Affairs, Government of India, 2018), while the government encourages further private participation, particularly in the urban water supply (Ministry of Urban Development, Government of India, 2017). In Viet Nam, the local government of Ho Chi Minh City works with US companies in the design, energy, water and waste sectors to build infrastructure and technological capabilities for the city, supported by the United States Commercial Service (EDB, 2016).

Government policies can encourage the development of smart cities by ensuring that key enabling factors are met. Several countries in Asia have a dedicated smart city strategy, including China, India, Indonesia, Malaysia, Singapore and Thailand (OECD, 2018b). Policy makers engage in efforts to make their cities "smarter" by leveraging data and digital technology, using emerging technologies such as the Internet of Things (IoT), big data analytics, Artificial Intelligence, energy-storage technologies and blockchain. Smart grids can improve energy management, smart meters and pipes can boost the quality and efficiency of the water supply, and smart sensors can improve traffic flow. Similarly, mobile applications can facilitate education, healthcare, or citizen engagement (OECD, 2018b).

The digital economy for smart cities is growing

Southeast Asia's digital market is expected to increase from USD 31 billion in 2015 to USD 200 billion by 2025. Even though ASEAN's population is increasingly embracing digital services, the adoption of such services by businesses has generally been slower, with regulatory bottlenecks and a lack of trust in electronic transactions stifling the growth of digital systems (Thomas, 2019).

ASEAN countries, aware of this gap, have undertaken multiple initiatives to encourage the adoption of digital technologies for smart cities while seeking to maintain consumer data privacy. For instance, the 2000 e-ASEAN Framework Agreement outlined regional plans to develop the information and communications technology (ICT) sector, reduce the digital divide within and among member states, promote co-operation between the public and private sectors, and promote liberalisation of trade in relevant goods and services as well as investment (OECD, 2018c). The ASEAN ICT Masterplan 2020 aimed to transform ASEAN into a digital economy by 2020, while the ASEAN Strategic Action Plan for Consumer Protection 2025 aims to develop a Common ASEAN Consumer Protection Framework that includes product liability and safety standards, as well as consumer data privacy policy (Berananda, 2016). Some companies urge governments to go further in strengthening the digital economy, and are asking governments to set up contingency plans which include backup facilities for operational centres and data centres. Disaster control provides improved resilience to fend off unforeseen system failures, as well as a better disaster response and recovery of critical digital infrastructure and services.

Smart healthcare technology offers new solutions for citizens

Rapid urbanisation has made the provision of quality healthcare a challenge for cities struggling to meet growing demand. It is estimated that smart healthcare technology has the potential to reduce the disease burden for Southeast Asia by up to 12 million disability-adjusted life years (i.e. it would not only extend overall life expectancy, but also add years of good health) (McKinsey &

Company, 2018). An integrated smart healthcare model in the city of Khon Kaen in Thailand has emerged as a result of a partnership between local healthcare service providers, government agencies and universities. It comprises smart ambulances, a preventive healthcare service, blockchain and data analytics, and aims to create a seamless emergency medical system (Matshazi, 2018).

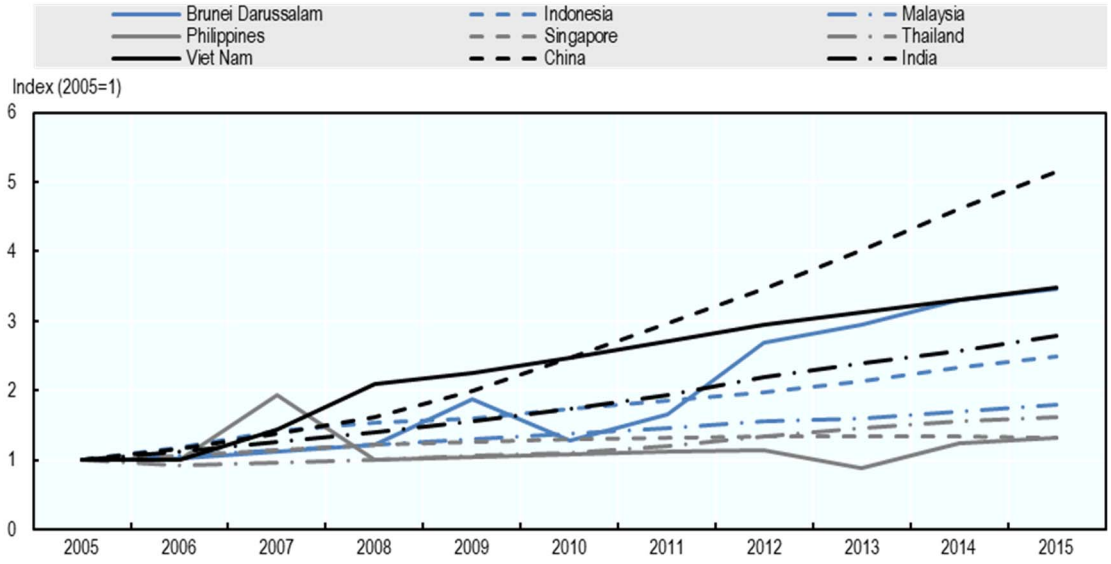
Smart cities can help address the environmental consequences of urban growth

While cities are central to national economies, and urbanisation has played a vital role in economic development in Asia (UNESCAP, 2017), urban growth has had negative side effects, such as air pollution and congestion. Economic growth will cause energy demand in Southeast Asia to grow by almost two-thirds by 2040 (IEA, 2017). Even though the supply of low-carbon and renewable energy is growing strongly, coal was still covering almost 40% of the total energy demand for Southeast Asia in 2017 (IEA, 2017). Concerns about air pollution in Asia's largest cities (Delhi and Beijing) have amplified, as fossil fuel consumption has led to a 75% increase in energy-related carbon dioxide emissions (IEA, 2017). Climate change is also affecting low-lying coastal cities such as Bangkok, Ho Chi Minh City, Jakarta and Manila, which suffer from periodic and catastrophic floods (ADB, 2012). Governments are implementing new urban policies to address these concerns and encourage more private investment in green infrastructure. For instance, Malaysia's Government Green Procurement programme aims to encourage the adoption of more green technologies, and government ministries were to attain a minimum threshold of 20% green procurement by 2020 (Malaysian Green Technology Corporation, 2020).

Embracing smart transport solutions can help reduce traffic congestion

Urban population growth, rising incomes and limited transportation alternatives have contributed to growing automobile use in Asian cities, where growth in the stock of motor vehicles and in the motorisation rate has happened at a faster rate than the average of OECD member countries (OECD, 2016). The estimated number of motor vehicles in use increased by an average of 13% per year between 2005 and 2015 (OECD, 2018b) (Figure 1). Policy solutions to improve urban transportation systems include the development of efficient public transportation, incorporating new technologies, reforming land use and improving urban planning (McKinsey & Company, 2018). Intelligent traffic and transit solutions can save up to 8 million person-years[5] in annual commuting time in Southeast Asia alone (McKinsey & Company, 2018). Multiple smart city initiatives focus on improving and facilitating urban public transportation. Examples include the Taipei IoT integration of transportation and the Smart Petepete initiative in Makassar, Indonesia, both of which aim to use real-time surveillance systems to resolve traffic congestion. Apart from improving public transportation, various companies are also developing new private transit modes such as autonomous vehicles, which have the potential to radically change urban mobility in the years to come (McKinsey & Company, 2018).

Figure 1. **Estimated total motor vehicles in use, 2005-15**



Note: Data not available for Cambodia, Lao PDR or Myanmar.
Source: OICA (2018), *World Vehicles in Use*, as cited in OECD (2018b), *Economic Outlook for Southeast Asia, China and India 2019: Towards Smart Urban Transportation*, https://doi.org/10.1787/saeo-2019-en.
StatLink https://doi.org/10.1787/888933886930.

The benefits of combining technology and data are evident in traffic management and are in line with efforts to build intelligent transportation systems (ITS) (OECD, 2018b). For instance, as part of Singapore's Smart Nation initiative, the government's Infocomm Development Authority (IDA) has been working with other government bodies and private companies to establish a network of more than 1 000 sensors to collect data in order to determine vehicle and pedestrian movements. This information will enable traffic light signalling that reacts and adjusts to real-time traffic and pedestrian patterns (Pau, J. and Qu, H. (2016).

An important requirement for smart cities is high-speed connectivity

Asian countries need to develop digital infrastructure and high-speed Internet connectivity to accompany the development of smart cities. The OECD Services Trade Restrictiveness Index (STRI)[6] illustrated that in 2018, China, India and Indonesia had more trade restrictions in telecommunications services than most other countries analysed under the STRI (OECD, 2019e). Such restrictions hold back the development of the digital economy, including through the digitalisation of the manufacturing and services sector. Furthermore, underdeveloped ICT infrastructure in Cambodia, Lao PDR, India, Indonesia and Myanmar could increase the costs that operators face in connecting end users to their networks and discourage growth of the already low Internet penetration due to the resulting higher prices (OECD, 2018c). Estimates show that Southeast Asia required approximately USD 64 billion between 2010 and 2020 to fund telecommunications infrastructure (PwC, 2015). Efforts to ensure that the existing infrastructure is

efficiently utilised are just as important as infrastructure development (OECD, 2018c). Current budget deficits suggest that the region could face a significant financing gap, which private telecommunications companies can help to fill (OECD, 2018c). Gaoqing in China has leveraged Huawei's Digital Platform to achieve smarter city administration, industry development and multiple benefits for citizens. More than 30 smart applications have been implemented to improve areas such as city governance, enterprise transformation and safe manufacturing (Huawei, 2018).

Policy makers should focus on the skills needed for the future of work

Digitalisation and technological advancement have brought about significant innovation in industries such as agriculture, manufacturing and ICT services, but digital literacy needs to be enhanced (OECD, 2018c). Automation has also created significant redundancies across low-skilled categories of workers, and will continue to do so (OECD, 2018c). A recent study suggests that 14% of jobs across 32 industrial economies, equivalent to 66 million workers, are "highly automatable" (Nedelkoska and Quintini, 2018). Furthermore, another 32% of jobs have a high risk of being significantly changed because of automation (Nedelkoska and Quintini, 2018). Regulatory reforms and policies that improve the mobility of labour and the acquisition of skills should accompany the adoption of new technologies. Incentives to strengthen digital literacy across the region are also important. The Business and Sustainable Development Commission, which was created to make a powerful case for why business leaders should work toward achieving the SDGs, expects 230 million new jobs in Asia by 2030, yet some workers will not have the skills these jobs will require (Business and Sustainable Development Commission, 2017). Consequently, educational institutions must not only cater to a rising number of students, but also to adults seeking to upskill or reskill. In China, rapidly rising wages are causing firms to embrace automation, with the country forecast to account for 30% of global robotics spending in 2020 (IDC, 2017). India, Indonesia and the Philippines have some of the youngest populations in the region, and are poised to reap a demographic dividend.[7] This has implications for digital literacy (which can improve productivity), as advanced ICT skills are often best developed through exposure from young age (OECD, 2019f).

PRIVATE SECTOR INSIGHTS ON SMART CITIES AS ENGINES FOR GROWTH

This chapter features insights from companies which participated in the Emerging Markets Network (EMnet) meeting on Asia held in Paris on 28 March 2019. It explores businesses' views on the significant opportunities offered by the possibilities of smart cities in the region, as well as on the challenges associated with their development. The chapter finishes with policy recommendations on public-private co-operation in order to unlock more private investment.

Smart cities in Asia offer significant opportunities for the private sector

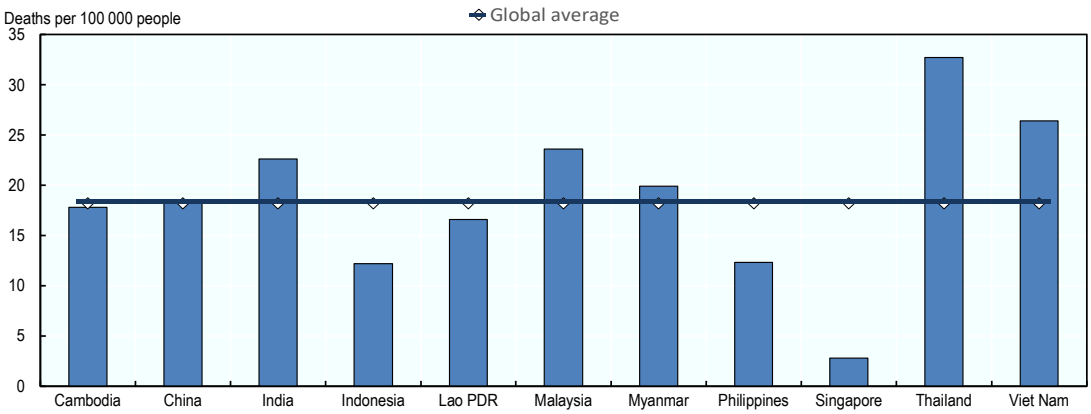
The global market size of smart cities was valued at USD 71.3 billion in 2018 and is estimated to grow at an annual rate of 18.9% between 2019 and 2025 (Grand View Research, 2019). The Asian smart city market in particular is projected to generate the most opportunities due to rapid urbanisation and the rising demand for energy, infrastructure and mobility solutions (Grand View Research, 2019). Furthermore, several Asian governments are promoting the construction of smart cities, with investments which were expected to grow from USD 55.6 billion in 2013 to USD 260 billion in 2020 (Frost and Sullivan, 2017a).

Business representatives emphasise that cities have become engines for growth in Asia, attracting investments, promoting new technologies and developing innovative solutions to improve citizens' quality of life. Multinational corporations investing in the region emphasise that smart solutions offered by the private sector can help cities solve some of the current economic, social and environmental challenges resulting from their high concentration of people and economic activities.

The private sector can take part in providing better connectivity and smart transportation

EMnet meeting participants agree that smart technologies and innovations can help solve urban transportation challenges, such as traffic congestion and fatalities generated by the increased use of private motor vehicles. In the Asia region, India, Malaysia, Myanmar, Thailand and Viet Nam have fatality rates above the global annual average of 18.2 per 100 000 people (Figure 2) (WHO, 2018). There are many possible targets for initiatives using intelligent transportation system (ITS) tools, but public transportation, vehicle and ride sharing, and logistics services are often the most important areas in which new technologies can improve efficiency (OECD, 2018b).

Figure 2. **Road traffic fatalities in Emerging Asia, 2016**



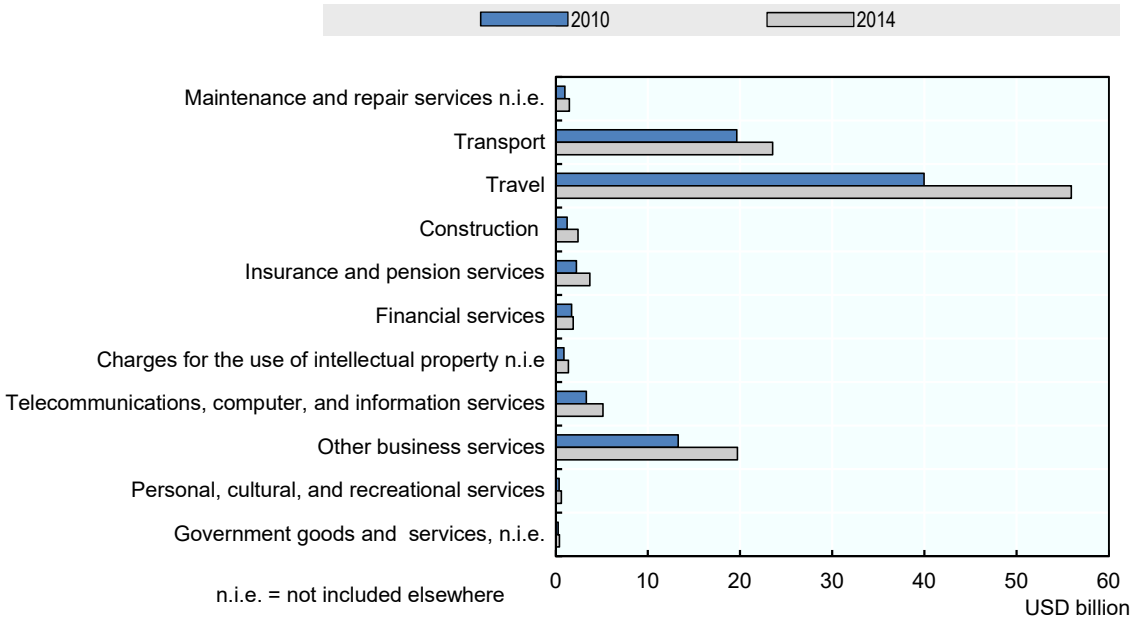
Source: Author's own graph based on WHO (2018), *Global Status Report on Road Safety 2018*, www.who.int/violence_injury_prevention/road_safety_status/2018/en.

Private solutions, such as ride-sharing mobile applications like Uber and its local competitors, are transforming urban mobility and contributing to reducing the demand for private cars (Pau and Qu, 2016). In Southeast Asia, the largest taxi application player, GrabTaxi, was undertaking almost 3.5 million rides daily across eight countries in 2018 (Iwamoto, 2018). The Chinese mobile transportation platform DiDi Chuxing, together with national authorities, launched an integrated solution for smart city traffic management called DiDi Smart Transportation Brain. Integrating anonymised traffic information with other data from local governments and business partners, this technology provides cities with instruments to design a new range of infrastructure improvements for traffic flow measurement, smart signalling and reversible lane systems (DiDi, 2018).

The private sector can be a partner in the development of innovative and smart public services

Services are a key component of smart cities. The liberalisation of trade in services in the region is progressing; Figure 3 illustrates the growth in trade in services by category (OECD, 2018b; 2017). EMnet participants highlight how the private sector can contribute to the development of innovative urban services for citizens. Smart cities in Asia are improving citizens' experiences by leveraging new technologies and innovative ways of providing key services such as healthcare, education, housing and other public services in an enhanced and efficient manner, and can thus benefit from service liberalisation.

Figure 3. **Intra-ASEAN trade in services by category in 2010 and 2014**



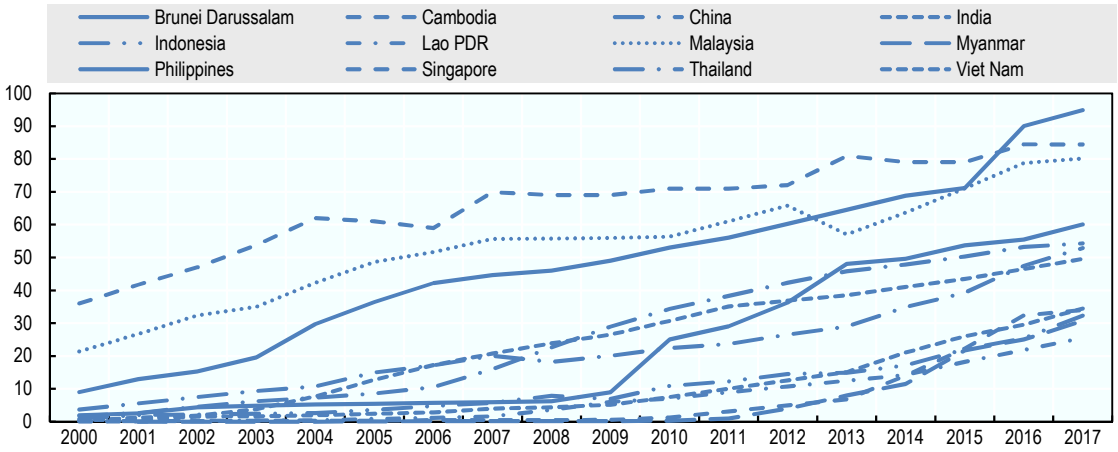
Source: ASEAN (2016), ASEAN Stats (database), http://aseanstats.asean.org, as cited in OECD (2017), *Economic Outlook for Southeast Asia, China and India 2017: Addressing Energy Challenges*, www.oecd.org/dev/asia-pacific/SAEO2017_PV.pdf.
StatLink http://dx.doi.org/10.1787/888933443547.

In Bandung, Indonesia, city operations have been enhanced thanks to an IBM command centre launched in 2015. The city uses a global positioning system (GPS) tracking system to monitor traffic and track assets such as public buses, ambulances and fire trucks. Public safety has also been improved by means of a security application called Panic Button that alerts a command centre when citizens tap on it (EDB, 2016). In 2018, the US-ASEAN Smart Cities Partnership was announced in an effort to spur investments in ASEAN's digital infrastructure by US-based technology companies. Google announced a third Singapore-based data centre and a new Google Cloud Platform in Jakarta. Similarly, Amazon plans to invest USD 924 million in Indonesia, in addition to launching its e-commerce service in Viet Nam in collaboration with local e-businesses (Tran and Natalegawa, 2018).

Bottlenecks remain with respect to digital access, literacy and skills

EMnet participants also highlight some challenges they have encountered while supporting the development and implementation of smart services in Asian cities, notably in the areas of connectivity, regulatory frameworks and digital skills (OECD, 2018c). Digital access, literacy and skills play a critical role in propelling the adoption of technology-led services and have important implications for smart city development. While more than 80% of adults in Singapore accessed the Internet in 2016, this figure was 25% or less in Lao PDR and Myanmar (Figure 4) (Pilat, 2017).

Figure 4. **Percentage of people using the Internet in Emerging Asia, 2000-17**



Note: The percentage of people using the Internet refers to the proportion of individuals who used the Internet from any location in the last 3 months. Access can be via a fixed or mobile network.
Source: Author's own graph based on ITU (2018), *World Telecommunication/ICT Indicators* (database), www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx.

Similarly, while more than 25% of Singapore's inhabitants had access to fixed broadband networks in 2016, less than 1% of the inhabitants of Cambodia, Lao PDR and Myanmar did (Pilat, 2017). With the exception of Malaysia, Singapore and Thailand, the average speeds over fixed broadband in the seven other ASEAN countries are well below the global average (World Bank, 2019b). Individuals, businesses (including SMEs) and governments need reliable, affordable and widespread access to digital networks and services in order to benefit from digital opportunities (Pilat, 2017). However, Internet speeds vary considerably across Asia and many people do not have access to high-speed broadband Internet, which is particularly crucial for data-intensive business applications. High-speed connections are especially rare in India and the Philippines, with only 42% and 39% of Internet Protocol version 4 (IPv4) addresses having speeds above 4 Megabits per second (Mbps), respectively (OECD, 2018c).

EMnet participants discuss how enhancing digital access for individuals and businesses at an affordable price would require sound policy frameworks. They call for policies in support of more investment in telecommunications, a wider diffusion of digital networks, and additional measures (such as national broadband strategies) that can help reach the underserved. Digital trade also has the potential to open up new opportunities for entrepreneurship, innovation and job creation, while digital tools can help firms (and SMEs in particular) overcome barriers to growth by facilitating payments, enabling collaboration, promoting the use of cloud-based services and generating alternative funding mechanisms (Pilat, 2017).

EMnet participants also note the shortage of digital skills in the region. For countries to be internationally competitive in the digital era, a skilled labour force is needed. Cambodia, Indonesia and Thailand in particular are facing a shortage of skilled labour and a surplus of unskilled labour (OECD, 2019a). The trends show that skills mismatch is likely to decrease in 2021, but a shortage of skilled labour will remain high in many countries. In general, the lack of skilled labour is a key challenge in the region (OECD, 2019a).

Regulatory systems should afford privacy protection while accommodating innovation

The private sector would like to see regulations that provide sufficient privacy protection to consumers without impeding innovation. The evolution of ICTs is disrupting the traditional landscape of urban infrastructure services and raising questions for existing regulatory frameworks (Finger, 2017). Governments face the challenge of managing risk with regard to securing digital assets and services as well as privacy, for example when linking initially separate datasets or when opening up government data to the public (OECD, 2019g). They are attempting to mitigate those risks through regulatory frameworks, which have sometimes been criticised for having an adverse effect on the entry of new firms, competition, innovation and technological diffusion (OECD, 2019h).

Firms indicate that the volumes of data, their heterogeneity and conflicting processing requirements pose challenges to collaboration. EMnet business meeting participants state that Emerging Asian economies looking for a global reference can take a cue from the European Union's General Data Protection Regulation (GDPR), citing it as an example of a regulatory framework aiming to facilitate innovation while maintaining data privacy. In particular, they emphasise the need for data sharing at the city level in order to enhance digital innovation and develop smart services. The OECD Going Digital project also recommends digital innovation and increased adoption of digital technologies through policy experimentation, including agile regulation and regulatory sandboxes that can promote innovation while protecting consumers (OECD, 2019g).

Challenges to improving the quality of urban environments remain

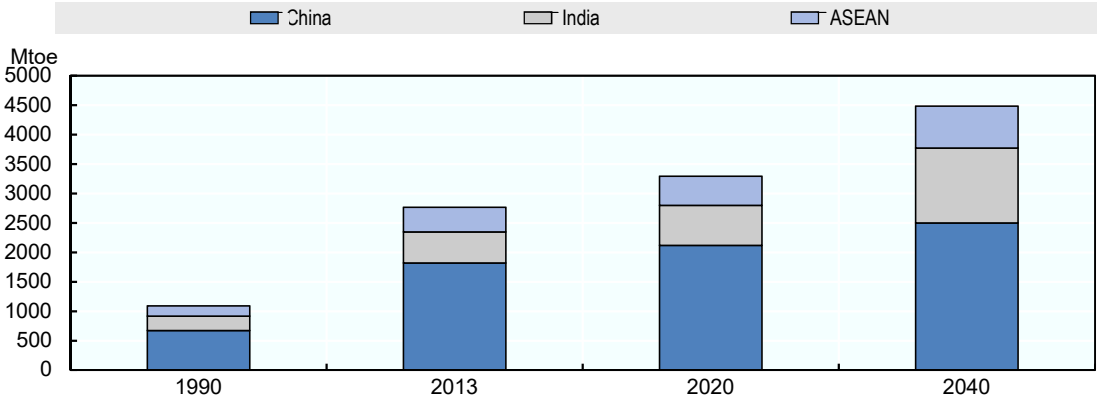
Asian cities share a common environmental challenge in ensuring the sustainability of their rapid development. EMnet business participants agree that smart technologies could help promote a low-carbon economy, improve the quality of urban areas and reduce air pollution.

Urban sprawl has created environmental challenges

EMnet business participants acknowledge the environmental challenges related to urban development and stress the opportunity to promote a low-carbon transition by harnessing smart energy solutions. Urban sprawl and congestion are the most visible consequences of rapid urbanisation in Asia. This has led to multiple environmental challenges such as high levels of air pollution and quickly rising amounts of solid waste. All major cities in the ASEAN-5 region show concentrations of particulate matter[8] above the World Health Organization's standards. In the Bandung Metropolitan Area in Indonesia, there was a 77% increase in solid waste between 2006 and 2014 (OECD, 2016). Despite the high levels of air pollution, the small share of total patenting in green innovations (e.g. air pollution abatement) remains a challenge (OECD, 2019b).

Furthermore, the region's cities are characterised by rising energy consumption and greenhouse gas emissions (IEA, 2015a). The total energy consumption in Emerging Asia is projected to increase by almost 38% between 2013 and 2040 (Figure 5) (OECD, 2017). In Viet Nam, carbon emissions increased from 103.8 million tonnes in 1994 to 246.8 million tonnes in 2010 and are projected to reach 760.5 million tonnes by 2030 (OECD, 2016).

Figure 5. **Emerging Asia's total final energy consumption by country group, 1990-2040**



Note: Million tonnes of oil equivalent (Mtoe) is a unit of measurement of energy consumption. Calculations are based on the International Energy Agency's New Policy Scenario.
Source: OECD Development Centre, based on IEA (2015a) and IEA (2015b), as cited in OECD (2017), *Economic Outlook for Southeast Asia, China and India 2017: Addressing Energy Challenges*, www.oecd.org/dev/asia-pacific/SAEO2017_PV.pdf.
StatLink http://dx.doi.org/10.1787/888933443666.

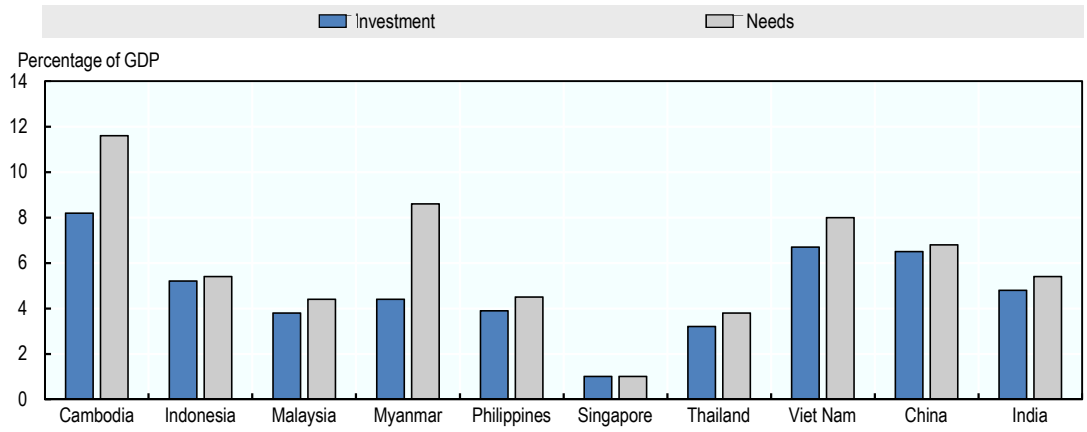
Smart cities hold the potential to build quality urban environments by leveraging technologies in order to maintain a clean environment; promote the sustainable use of ecosystems, natural resources and biodiversity; and strengthen resilience against disaster risks and potential climate change impacts. China, in particular, is increasingly adopting smart technologies such as offshore wind farms, smart grids, pollution sensors and air purifying towers with the aim of reducing its air pollution levels (Clapaud, 2018).

In 2012, the ASEAN SHINE programme was set up as a public-private partnership (PPP) focused on the promotion of highly efficient air conditioners and efficient lighting. The programme is expected to reduce ASEAN countries' annual energy consumption by 24 173 GWh[9] and to reduce their greenhouse gas emissions by 13.9 million tonnes by 2020 (EU/UNEP/ICASEA, 2017). Schneider Electric, a global specialist in energy management and automation, has been leveraging the use of the Internet of Things (IoT) and smart grids to build more efficient infrastructure around Asia, including in China and Indonesia. Schneider Electric's software, which is integrated with the grid, is able to tell factory operators to increase production when it detects higher activity from windmills. The company helped improve the efficiency of a cement manufacturer in India that uses wind energy to power some factories (Eco-Business, 2015).

Smart cities need more investment in infrastructure

Participants in the EMnet meeting agree that there is an important infrastructure gap that must be addressed in order to unlock the potential of smart cities. Across the region, the levels of infrastructure investment fall below the required levels to meet existing demand (Figure 6) (OECD, 2018d). China alone needs USD 28 trillion in investment between 2016 and 2040, representing 30% of global infrastructure investment requirements (Global Infrastructure Hub/Oxford Economics, 2017).

Figure 6. **Estimated infrastructure investment and needs in Emerging Asia, 2017**



Note: Estimates of infrastructure investment and needs are not available for Brunei Darussalam or Lao PDR.
Source: Global Infrastructure Hub/Oxford Economics (2017), *Global Infrastructure Outlook. Infrastructure investment needs 50 countries, 7 sectors to 2040,* www.oxfordeconomics.com/recent-releases/Global-Infrastructure-Outlook.
StatLink https://doi.org/10.1787/888933800214

Policy makers are increasingly supporting smart city initiatives as a way to address urban policy challenges. They are seeking more private investments and partnerships with the private sector in order to close the infrastructure investment gap. Cities can experience challenges soliciting private investments on their own, as such investments require long-term financial instruments that are available only through national governments. In order to bypass this problem, participants in the EMnet meeting recommend that cities proceed with comprehensive work in one sector rather than in many sectors, working vertically rather than horizontally. The ASEAN Smart Cities Network (ASCN) encourages industries and businesses in ASEAN countries to capitalise on new technologies, using innovation as a catalyst to build smart cities. Comprising 26 cities, including Bangkok, Kuala Lumpur, Manila and Singapore, the ASCN helps cities connect with the private sector in order to identify and launch practical and commercially viable projects (CLC; Ministry of Foreign Affairs, Singapore, 2018). For instance, the Amata Smart City project in Thailand will work with the Yokohama Urban Solution Alliance to build smart energy management systems for efficient electricity management, and to reduce carbon footprints and energy costs in industrial estates (Amata Corporation Public Company Limited, 2018).

Policy reforms can encourage more private investment in infrastructure

Maximising private investment is crucial to closing the large regional infrastructure gap. From 2004 to 2018, firms invested almost USD 529 billion in infrastructure in Emerging Asia (World Bank, 2018). However, these investments can entail risks for private investors, such as cost overruns during construction, delayed completion, traffic risks,[10] currency risks and political risks generated by future changes in policy direction (Tanaka and Ibrahim, 2017; World Bank, 2016). In order to address these risks and encourage further private investment, EMnet participants emphasise the

need for policy reforms that encourage co-operation between the public and private sectors, collaboration between different levels of government, and the harmonisation of financing schemes. In their view, it remains key to align the interests of all parties while maintaining a level of value for the private sector.

Policy makers in Asia could look at diversifying financing methods in order to accelerate private investment by using a wide range of fiscal instruments, including revenues from carbon taxes and petroleum taxes, earmarking special funds for smart city development, and public sector borrowing through bond issuance (Tanaka and Ibrahim, 2017). Local governments in particular could generate revenue from fees and charges. In 2016, fees and charges accounted for only 2% of the total revenue of the Bangkok Metropolitan Administration (Thailand) and 6% of Metro Cebu (Philippines), compared with an average of 14.9% for subnational governments in OECD member countries (OECD, 2016).

Moreover, even though financing the required infrastructure for smart cities remains a major concern for city governments across the region, the EMnet meeting underline the differences in the state of infrastructure development across Asia. As a consequence, a "one-size-fits-all" solution for the region is not viable, as the return on investment for one country might be very different from another. For example, in the case of India, even though the nation has technological capabilities for deploying smart cars, many of its cities lack the road infrastructure required for them to operate.

National and local governments should improve co-ordination and alignment

A lack of co-ordination across different levels of government can lead to difficulties in creating a specific and detailed strategy for a smart city. Cities often rely on a narrow revenue base that does not create sufficient fiscal space for investment in large-scale urban infrastructure. As a result, the financial resources required to fund smart cities can be onerous for municipal authorities (Gouldson et al., 2015). India's city governments and municipalities, for example, record revenues in the range of 1-2% of GDP (OECD/UCLG, 2016). National governments in Southeast Asia are often the central decision makers; they exert various degrees of influence over the main opportunity areas for smart city development though their financial power and policy, and their legal authority (OECD, 2016). In some cases, national governments have retained direct management of certain urban utilities, such as within the Bangkok Metropolitan Region; the Metropolitan Electricity Authority, the Metropolitan Waterworks Authority, and the Bangkok Mass Transit Authority are all state-owned corporate entities (OECD, 2015). While decentralisation trends in the region have progressively transferred some responsibilities to local governments, a lack of formal and informal forms of policy alignment and co-ordination across levels of government remains (OECD, 2015). As many of the smart city initiatives are dependent on regulations from the national government, this lack of co-ordination across different levels of government can lead to difficulties in creating a specific and detailed strategy for a smart city. For instance, smart electricity or water meters can create real-time, dynamic pricing of energy and water consumption at the household or local government level, instead of traditional metering based on installed capacity of supply networks. Thus, without support from the national government, a local initiative such as smart metering can be challenging to implement. Local initiatives could also be hindered, because there is little incentive to be an early adopter of new smart city technologies due to the high risk involved (OECD, 2019b). With limited investment scope, subnational governments may not choose to invest in research and

development. The Smart City Strategy developed in the Bandung (Indonesia) 2015 ICT Master Plan, for example, has no similar counterpart in Indonesia's national or provincial governments. Smart cities can be well supported if city-level governments encourage the adoption of metropolitan-wide development and smart city plans into the constituting local governments' annual planning and budgeting cycle, and encourage the support of national governments (OECD, 2019b).

Public-private co-operation can promote the adoption of smart technologies

EMnet participants place particular importance on creating collaborative ecosystems for smart city development and promoting co-operation between the public and private sectors in order to further enhance private investment and the adoption of smart technologies. Companies stress that successful PPPs require an ecosystem that cultivates opportunities for businesses and encourages innovation, as well as involving non-governmental organisations that enlist citizens, universities and research centres. From 2004 to 2018, 2 289 out of the 2 397 infrastructure projects undertaken by the private sector in Emerging Asia were PPPs (World Bank, 2018). They play a crucial role in introducing competition and innovation in the smart city market and in closing the infrastructure investment gap (Tanaka and Ibrahim, 2017). For instance, PPPs are playing a significant role in India's Smart Cities Mission, with one-quarter of the smart city funds being sourced through this instrument (Frost and Sullivan, 2017b).

Asia laid the legal and administrative groundwork for PPPs in the early 1990s but institutional weakness, inadequate capital markets and a lack of technical expertise initially detracted from the attractiveness of such deals (OECD, 2018d). However, over the past decade, governments in the region have been more aggressive in creating suitable conditions for PPPs (OECD, 2018d). ASCN member cities are benefitting from a collaboration between international banks, private developers and governments in public-private financing partnerships. The Keppel Corporation, a Singapore-based engineering and construction firm, has set up Keppel Urban Solutions to focus on building large-scale smart developments. Its flagship project was the Saigon Sports City, a smart township in Ho Chi Minh City, Viet Nam (CLC; Ministry of Foreign Affairs, Singapore, 2018).

PPPs can also play a crucial role in the efficient management of public transportation systems. In many countries in the region, and in Southeast Asia in particular, public transport organisations and local authorities lack sufficient capacity to effectively manage urban transportation issues (OECD, 2018b). Private sector expertise and funding can therefore help develop, upgrade and expand smart urban transportation systems. For instance, one of the aims of the Master Plan on ASEAN Connectivity 2025 (MPAC 2025) is to increase public and private infrastructure investment and the deployment of smart urbanisation models across ASEAN countries. Initiatives to enhance micro, small and medium enterprises' (MSMEs') technology platforms, develop digital financial inclusion in the region and advance sustainable strategies in ASEAN cities are being undertaken in order to achieve the MPAC 2025 objectives (ASEAN Secretariat, 2016).

In order to ensure the development of smart infrastructure in Asian cities, companies indicate that it is essential to break silos within municipalities by sharing infrastructure and by co-investing with the private sector. Aligning different stakeholders can be spurred by thinking across sectors and concrete collaboration. An important element in this is the communication between different systems and their technical interoperability. EMnet participants stress the importance of

interoperability between networks and devices in realising the potential of smart cities. In an example of concrete co-operation for interoperability and interchangeability between IoT devices from various suppliers, companies such as Schréder (a leading outdoor lighting solution provider) and others have teamed up with cities and utilities in a non-profit alliance with the aim of unlocking smart city and utility markets by promoting the adoption of smart technologies (uCIFI, n.d.).

Subnational governments in the region can develop the capabilities to optimise the use of PPPs for smart cities. Local governments in particular often lack the expertise to implement PPPs effectively and in a short period of time, as they require complex procurement, administrative and legal procedures and capacity (OECD, 2016). Moreover, companies in different jurisdictions must navigate a wide variety of rules and regulations around PPPs, which adds to the challenge on their side. Firms recommend further sharing of expertise on PPPs among Asian smart cities, combining global best practices with local knowledge. Governments, in turn, find it difficult to present the private sector with a compelling business case for sectors with a lack of cost recovery. For example, it is challenging for urban PPPs operating in the transport, solid waste, and water sectors, as these sectors present high upfront infrastructure costs but low returns on investment due to low fees, charges and tariffs (OECD, 2016).

CONCLUSION

Smart cities have become engines for growth in Asia, attracting investments, promoting new technologies and developing innovative solutions to improve their citizens' quality of life. The private sector can play a significant role in the development of smart cities. Rapid urbanisation and the rising demand for energy, infrastructure and mobility solutions present important opportunities for smart city initiatives. However, EMnet meeting participants highlight several challenges: there is an infrastructure investment gap; a lack of formal and informal forms of policy alignment and co-ordination across levels of government; inadequate levels of digital skills and literacy; and a lack of appropriate and comprehensive regulatory frameworks that facilitate innovation while maintaining consumer data privacy. It can also be a challenge for public sector officials to stay on course with the long-term pace of smart city processes, which are often liable to setbacks, suspensions, or other unforeseen events.

The region needs sound policy frameworks that create collaborative ecosystems for smart city development, promote co-operation between the public and private sectors, enhance private investment, and encourage data sharing and the adoption of smart technologies. Regulatory policies encouraging the entry of new firms, competition, innovation and technological diffusion while protecting consumer data privacy need to be put in place. Contingency plans can boost the resilience of smart cities in case of disaster. Finally, the private sector is a key partner in the smart city ecosystem; companies stand ready to inform and support smart city initiatives, and their recommendations and participation can ensure that policy initiatives in support of smart cities work for citizens.

Notes

[1] Emerging Asia encompasses the People's Republic of China (hereafter "China"), India and the ten ASEAN member states: Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic (hereafter: Lao PDR), Malaysia, Myanmar, the Philippines, Singapore, Thailand and Viet Nam.

[2] ASEAN-5 includes Indonesia, Malaysia, the Philippines, Singapore and Thailand.

[3] Southeast Asia in this publication refers to the ten member countries of ASEAN.

[4] This Policy Note defines smart cities as "initiatives or approaches that effectively leverage digitalisation to boost citizen well-being and deliver more efficient, sustainable and inclusive urban services and environments as part of a collaborative, multi-stakeholder process" (OECD, 2019h).

[5] Person-years (or man-years) is a unit of measurement for the amount of work done by an individual throughout the year, expressed in number of hours.

[6] The STRI helps to identify which policy measures restrict trade. The STRI database is based on regulations currently in force. STRI indices take the value from 0 to 1, where 0 is completely open and 1 is completely closed. They are calculated on the basis of information provided in the STRI database.

[7] The United Nations Population Fund states that countries with the greatest demographic opportunity for development are those entering a period in which the working-age population has good health, quality education, decent employment and a lower proportion of young dependents. Smaller numbers of children per household generally lead to larger investments per child, more freedom for women to enter the formal workforce and more household savings for old age. When this happens, the national economic payoff can be substantial. This is a "demographic dividend."

[8] Particulate matter, also known as particle pollution or PM, is a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulphates), organic chemicals, metals, and soil or dust particles.

[9] Gigawatt hours, abbreviated as GWh, is a unit of energy representing 1 billion (1 000 000 000) watt hours and is equivalent to 1 million kilowatt hours. Gigawatt hours are often used as a measure of the output of large electricity power stations.

[10] Traffic risk refers to the risk of the actual traffic being lower (or higher) than forecast, and to the inaccuracy of traffic forecasts, often due to an optimism bias. Inadequate traffic forecasts have caused financial problems for numerous toll roads, as toll revenues were significantly lower than initially forecast.

References

ADB (2020), *The Economic Impact of the COVID-19 Outbreak on Developing Asia*, Manila, www.adb.org/what-we-do/covid19-coronavirus.

ADB (2019), *Asian Development Outlook Supplement 2019*, Asian Development Bank, Mandaluyong, www.adb.org/sites/default/files/publication/513146/ado-supplement-july-2019.pdf (accessed 30 November 2019).

ADB (2012), *Key Indicators for Asia and Pacific 2012,* Asian Development Bank, Mandaluyong, www.adb.org/sites/default/files/publication/29940/ki2012.pdf.

Amata Corporation Public Company Limited (2018), *Amata: Sustainable Development Report 2018,* AMATA Corporation Public Company Limited, Thailand, https://issuu.com/ar.amata.thai/docs/20190322-amata-sdr2018-en.

ASEAN (2016), ASEAN Stats (database), http://aseanstats.asean.org (accessed on 8 December 2016).

ASEAN Secretariat (2016), *Master Plan on ASEAN Connectivity 2025,* The ASEAN Secretariat, Jakarta, https://asean.org/storage/2016/09/Master-Plan-on-ASEAN-Connectivity-20251.pdf.

Bangko Sentral Ng Pilipinas (2019a), "Monetary Policy Decisions", www.bsp.gov.ph/monetary/monetary.asp (accessed 22 November 2019).

Bangko Sentral Ng Pilipinas (2019b), "Media Releases", www.bsp.gov.ph/publications/media.asp?id=5205 (accessed 30 November 2019).

Bangko Sentral Ng Pilipinas (2019c), "Media Releases", www.bsp.gov.ph/publications/media.asp?id=4940&yr=2019 (accessed 30 November 2019).

Bank Negara Malaysia (2019), "Monetary Policy Statement", www.bnm.gov.my/index.php?ch=en_press&pg=en_press&ac=4850&lang=en (accessed 22 November 2019).

Bank of Thailand (2019), "Balance of Payments", www.bot.or.th/App/BTWS_STAT/statistics/BOTWEBSTAT.aspx?reportID=646&language=eng (accessed 30 November 2019).

Berananda, U. (2016), "E-commerce and Development: An ASEAN Perspective.", World Trade Organization, Geneva, www.wto.org/english/tratop_e/ecom_e/s3usanabernanda_asean.pdf (accessed 5 July 2019).

Business and Sustainable Development Commission (2017), *Better Business Better World,* London, http://report.businesscommission.org/uploads/BetterBiz-BetterWorld.pdf.

Clapaud, A. (2018), "Smart Cities: China Awakens.", webpage, L'Atelier BNP Paribas, https://atelier.bnpparibas/en/smart-city/article/smart-cities-china-awakes (accessed 3 July 2019).

CLC; Ministry of Foreign Affairs, Singapore (2018), *ASEAN Smart Cities Network,* Centre for Liveable Cities, Singapore.

China Bureau of Statistics (2019), Producer Price Indices for Farmers, http://data.stats.gov.cn/english/easyquery.htm?cn=B01 (accessed 30 November 2019).

DiDi (2018), "DiDi introduces smart transportation solution for traffic management", www.didiglobal.com/news/newsDetail?id=186&type=news (accessed 1 June 2019).

Eco-Business (2015), "Schneider's big bet on smart energy", www.eco-business.com/news/schneiders-big-bet-on-smart-energy (accessed 1 June 2019).

EDB (20 October 2016), "The business of creating Asia's smart cities", webpage, www.edb.gov.sg/en/news-and-events/insights/innovation/the-business-of-creating-asia-s-smart-cities.html (accessed 11 February 2019).

EIU and Siemens AG (2011), *Asian Green City Index,* Siemens AG, http://sg.siemens.com/city_of_the_future/_docs/Asian-Green-City-Index.pdf.

EU/UNEP/ICASEA (2017), *Promoting highly efficient air conditioners in the ASEAN region to reduce energy consumption,* International Copper Association Southeast Asia, Bangkok, www.aseanshine.org/news-activities/d/promoting-highly-efficient-air-conditioners-in-the-asean-region-to-reduce-energy-consumption.

Finger, M. (2017), *Network Industries Quarterly*, Vol 19: Issue 3, Lausanne, https://cadmus.eui.eu/bitstream/handle/1814/48008/NIQ_2017_Vol%2019_No3.pdf?sequence=1&isAllowed=y.

Frost & Sullivan (2017a), "10 Cities in Asia-Pacific Poised to be Smart Cities by 2025", press release, 29 August, https://ww2.frost.com/news/press-releases/10-cities-asia-pacific-poised-be-smart-cities-2025/, (accessed 1 June 2019).

Frost & Sullivan (2017b), *Smart Cities of India, 2016-2021,* Frost & Sullivan, https://store.frost.com/smart-cities-of-india-2016-2021.html.

Germanwatch (2019), *Global Climate Risk Index 2019: Who Suffers Most From Extreme Weather Events? Weather-related Loss Events in 2017 and 1998 to 2017*, Germanwatch, Bonn, https://germanwatch.org/sites/germanwatch.org/files/Global%20Climate%20Risk%20Index%202019_2.pdf (accessed 30 November 2019).

GFDRR (2019a), Vietnam, Global Facility for Disaster Reduction and Recovery, www.gfdrr.org/en/vietnam (accessed 30 November 2019).

GFDRR (2019b), China, Global Facility for Disaster Reduction and Recovery, www.gfdrr.org/en/china (accessed 30 November 2019).

Global Infrastructure Hub/Oxford Economics (2017), *Global Infrastructure Outlook. Infrastructure investment needs 50 countries, 7 sectors to 2040,* Global Infrastructure Hub, Australia www.oxfordeconomics.com/recent-releases/Global-Infrastructure-Outlook.

Gouldson, A., et al. (2015), *Accelerating Low-Carbon Development in the World's Cities,* Working Paper, The New Climate Economy, London and Washington, D.C., https://newclimateeconomy.report/2015/wp-content/uploads/sites/3/2015/09/NCE2015_workingpaper_cities_final_web.pdf.

Grand View Research (2019), *Smart Cities Market Analysis Report By Application (Governance, Buildings, Utilities, Transportation, Healthcare, Environmental Solution), By Region, And Segment Forecasts, 2019 - 2025,* Grand View Research, San Francisco, www.grandviewresearch.com/industry-analysis/smart-cities-market.

GSMA (2019), *The Mobile Economy Asia 2019*, GSM Association, London, www.gsmaintelligence.com/research/?file=fe8735424e3058f98c3a83bc57bc2af5&download (accessed 30 November 2019).

Herzberg, C. (2017), *Smart Cities, Digital Nations: Building Smart Cities in Emerging Countries and Beyond,* Roundtree Press, California, United States of America.

Matshazi, N. (2018), "Thai City, Khon Kaen Launches Innovative Smart Health Solutions", webpage, Healthcare Weekly, https://healthcareweekly.com/khon-kaen-launches-innovative-smart-health-solutions (accessed 27 April 2020).

Huawei (2018), "Huawei Customers Recognized for Smart City Achievements at Smart City Expo World Congress 2018", webpage, https://forum.huawei.com/enterprise/en/Huawei-Customers-Recognized-for-Smart-City-Achievements-at-Smart-City-Expo-World-Congress-2018/thread/477029-943#pid2803847 (accessed 12 February 2019).

IDC (2017), "Fast Growing China Spending on Robotics to Reach $59.4 Billion in 2020, According to IDC", IDC Media Center, www.idc.com/getdoc.jsp?containerId=prAP42444817 (accessed 26 March 2019).

IEA (2017), *Southeast Asia Energy Outlook 2017*, International Energy Agency, Paris, https://doi.org/10.1787/9789264285576-en.

IEA (2015a), *World Energy Outlook 2015: Special Report on Southeast Asia*, International Energy Agency, Paris, https://webstore.iea.org/weo-2015-special-report-southeast-asia-energy-outlook.

IEA (2015b), *World Energy Outlook 2015*, International Energy Agency, Paris, http://dx.doi.org/10.1787/weo-2015-en.

IMF (2019), DataMapper: Inflation rate, end of period consumer prices (database), www.imf.org/external/datamapper/PCPIEPCH@WEO/MYS/PHL/DA (accessed 25 November 2019).

IMF (2018), "The Impact of Climate Change in Southeast Asia" in *Finance & Development September 2018*, International Monetary Fund, Washington, D.C., www.imf.org/external/pubs/ft/fandd/2018/09/pdf/southeast-asia-climate-change-and-greenhouse-gas-emissions-prakash.pdf (accessed 30 November 2019).

ITU (2018), *World Telecommunication/ICT Indicators* (database), International Telecommunication Union, Geneva, www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx.

IUCN (2019), Climate Change in Asia, International Union for Conservation of Nature, Gland, www.iucn.org/regions/asia/our-work/climate-change-asia (accessed 30 November 2019).

Iwamoto, K. (2018) "Grab aims to stay on top with evolution into 'everyday superapp'.", Nikkei Asian Review, https://asia.nikkei.com/Business/Company-in-focus/Grab-aims-to-stay-on-top-with-evolution-into-everyday-superapp (accessed 5 July 2019).

KNOMAD (2019), *Migration and Development Brief 31 2019*, The Global Knowledge Partnership on Migration and Development, Washington, D.C., www.knomad.org/sites/default/files/2019-04/Migrationanddevelopmentbrief31.pdf (accessed 30 November 2019).

For more information about the OECD Emerging Markets Network, contact the Secretariat:

dev.emnet@oecd.org

www.oecd.org/dev/oecdemnet.htm

EM»net
OECD EMERGING MARKETS NETWORK

OECD dev
DEVELOPMENT CENTRE