



CHAPTER 3



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CHAPTER 3

The future of smart & inclusive cities

3.1 The 2030 vision for smart and inclusive cities

In 2030, an Asia-Pacific mayor leads a tour of city hall for visiting dignitaries. With pride, the mayor shares how e-government practices have increased transparency, leading to better budget management and reporting efficiencies; these measures have resulted in greater staff retention and pride in their work. With the savings, the city managed to invest in an operations centre with digital maps showing real time public transport service efficiencies, transport conditions on the roads, rails and waterways. Predictive analytics enable the centre's traffic engineers to adjust speed limits, traffic lights, toll prices, reversible lanes and bus headways in order to ensure smooth transport flows. Another map shows data on piped water systems highlighting areas of stress or leakage, with an accompanying board tracking usage against water reserves.

The mayor then leads the group to the centre for citizen engagement, where several screens show summaries drawn from the city's municipal services smartphone app as everyday citizens report accidents, emergencies, utility leaks or illegal litter. These incidents are deftly dealt with by competent staff leveraging closed circuit television (CCTV) and artificial intelligence, and conveyed to the designated department or team for action. As they step outside, a department head highlights how sensors have been deployed to improve energy efficiency in street lighting, which has enabled them to extend their street lighting network to improve street safety to nearly 100 per cent coverage of the city. The group stands next to lush street greenery where children and parents are playing, oblivious of the sensors monitoring the greenery for water and nutrient needs. A nearby full waste bin initiates compression, while a signal is automatically sent to maintenance for it to be addressed.





As this anecdote shows, smart city technology that is inclusive and people-centred can be a reality for Asian and Pacific cities. Such deployments of technology and data analysis are all the more urgent given the unprecedented speed and scale of urbanization in Asian and Pacific cities, which has brought about numerous challenges, such as traffic congestion, air pollution and water shortages.

Cities are grappling with these challenges simultaneously with the onset of the “Fourth Industrial Revolution”, which brings both promises and pitfalls. Improving Internet and smartphone penetration has enabled unprecedented access to information and the ability to connect individuals. The vast amount of data generated in real time across the urban environment provides the ability to understand and respond more effectively and promptly to challenges in cities. Mobile web access for services such as ride sharing has triggered a lifestyle shift in cities. E-hailing and food delivery apps have created job opportunities with greater flexibility. These technological shifts are transforming the way people connect with one another, conduct business, provide

services and live their lives in cities. For city leaders, technological advancement offers numerous opportunities which can address urban challenges and help them make informed decisions effectively.

While the term “smart cities” has been co-opted by various interest groups to generate business, it merits a more rigorous definition and a set of guidelines among urban leaders. To that extent, the concept received significant endorsement with the establishment of official structures, such as the ASEAN Smart Cities Network (ASCN), a collaborative platform where cities from members of the Association of Southeast Asian Nations (ASEAN) work towards the common goal of smart and sustainable urban development. National Governments have also rolled out ICT and smart city blueprints, such as the India Smart Cities Mission (India, Ministry of Urban Development, 2015) and Indonesia’s plan to build 100 smart cities (Tarigan, 2017). The implementation of smart city visions, however, is not without challenges. Deploying appropriate technological innovations to solve problems at the municipal level also requires pre-emptive effort to establish the correct legal and

"The future of smart cities will be one where technologies seamlessly support more efficient work-life-play-learn opportunities for every individual in an inclusive manner, fuel greater economic growth and facilitate the creation of sustainable living environments in cities."

regulatory environment to encourage players from different sectors to contribute meaningfully towards the vision. To fully capitalize on the opportunities, Asian and Pacific cities will need to build up robust digital infrastructure, especially broadband connectivity, to support these smart solutions. A prerequisite requires cities to actively build sustainable partnerships and viable funding approaches for these solutions.

Most importantly, while smart solutions have the potential to facilitate improved urban performance, they are no panacea to all the problems that cities face. If not planned or governed well, smart solutions can cause just as many problems as they set out to address. For example, surveillance systems incorporate advanced facial recognition software and CCTV applications in an attempt to strengthen public security, optimize traffic, service city management and innovate social governance. However, the systems have generated controversy and concerns over citizen privacy (Cassiano, 2019). Consequently, smart technologies and data do not remove the need for good planning, governance, financial management and smarter use of existing data sets. These are essential safeguards to ensure that people are at the heart of smart cities.

This chapter reviews the status and defines future pathways for smart city development in the Asia-Pacific region, focusing on how technology has and can be leveraged to address urban challenges in cities. In addition to important enablers, such as funding and digital infrastructure, key institutional mechanisms are

necessary to support smart cities: a dynamic and efficient urban governance system, as well as an integrated planning and development approach with thorough implementation. It is envisioned that the future of smart cities will be one where technologies seamlessly support more efficient work-life-play-learn opportunities for every individual in an inclusive manner, fuel greater economic growth and facilitate the creation of sustainable living environments in cities.

Smart systems as urban solutions

Asian and Pacific cities vary widely in their digital readiness. As a result, applications of smart systems take a variety of forms, anchored by distinct smart city visions. India prioritizes infrastructure development in its 100 Smart Cities Mission, while the Republic of Korea wants more citizen voices to be heard in city planning and management. ASCN member cities have also prioritized different focus areas in smart city development to meet their cities' needs. For example, Makassar City, Indonesia, hopes to improve health service access via its mobile health clinic, Dottoro'ta, which is supported with a telemedicine programme (Ludher and others, 2018a). Johor Bahru, Malaysia, needs an intelligent water management system to serve 2 million people by 2030 (Ludher and others, 2018b). Phuket, Thailand, is in search of the next boost to address tourist pain points and enhance its tourism industry sustainably (Ludher and others, 2018c). Some smart city innovations involve cutting-edge breakthroughs, such as autonomous vehicles or applications of machine-

learning algorithms, while many also involve relatively simple and inexpensive digital systems in targeted applications, such as enabling data-driven traffic management or digitizing time-consuming, paper-based business licensing processes.

Built infrastructure is the foundation for a functional physical environment in cities. In particular, transportation infrastructure and services play a key role in connecting people to places where they work, live, play and learn. Emerging technologies, such as autonomous and electric vehicles, may provide unprecedented opportunities for more personalized and inclusive accessibility in the physical environment. Autonomous vehicles can potentially provide door-to-door service for city residents far from existing rapid transit lines or for people with physical disabilities, but the deployment of these new forms of mobility also warrants a rethinking of future urban forms that best support these new technologies. For example, will the proliferation of autonomous vehicles increase traffic and generate more demand for automobile-centric infrastructure? While such discussions remain theoretical, cities must plan now for the potentially disruptive arrival of autonomous vehicles on their streets, much as ride-hailing services, such as Uber, Grab and Ola, upended traditional taxi industries and caught municipal regulators off-guard. In the meantime, existing data sets made available through public transit stored-fare cards can provide insights for authorities to better plan for inclusive accessibility through collective rather than individual transport.



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As these ongoing applications prove, the term “smart cities” is no longer just a conceptual idea, and with technology operating at all scales, it is no longer a buzzword relevant only to more developed cities. Asian and Pacific cities’ experiences testify to the tangible benefits of adopting smart technologies and using big data to support decision-making. Dozens of smart solutions are available today, focused on virtually every domain of city life: mobility, social

"Many large-scale smart city projects tend to be costly and will remain only a vision without new sources of funding and a shared vision with investors."

infrastructure, built environment, utilities, security, community and economic development. Not only have these smart systems proven essential to the efficient delivery of municipal services, rich data sets gathered from networked devices that are now ubiquitous in highly developed cities have also offered unprecedented opportunities to understand, analyse and even predict how the various aspects of these types of cities function.

At the same time, many large-scale smart city projects tend to be costly and will remain only a vision without new sources of funding and a shared vision with investors. Asia-Pacific

private and public sector entities will have spent \$375.8 billion in 2019 on digital transformation, a harbinger of the enormous cost to come as part of the region's digital infrastructure investment needs (International Data Corporation, 2019). However, many cities may find it difficult to sustain large smart city projects without a strong economic backbone, proper municipal and legal measures to collect city revenues or mechanisms to spend revenue on the city's own growth. This illustrates the risks faced by cities in developing countries, which will be unable to deploy these technologies, leading to a compounded digital divide.

3.2 Smart city applications in the Asia-Pacific region

Enhancing mobility infrastructure for inclusive accessibility

Whether or not autonomous vehicles live up to their promise, most city dwellers circulate on public transport now and will continue to do so in the future. Data that reveals behavioural patterns can provide rich insights for transport planners to enhance mobility services that better serve residents' needs. For example, many Seoul residents travel the city at night, such as students, small business owners and night-shift sanitation workers (Seoul Solution, 2014). Pre-existing night bus routes, typically designed based on an empirical understanding of the desired

origins and destinations of night travellers, did not adequately serve the travel needs of these residents. Taxis were the only option, but they also charged late-night fees and sometimes refused to take passengers or illegally demanded overpriced fares in order to earn more profit. In 2012, the Seoul Metropolitan Government started to analyse cell phone data drawn from a local telecommunications provider to chart night-time travel patterns (Seoul Solution, 2014). The cell phone data were also overlaid with taxi ride data for planners to understand the pattern of traffic demands and plan the new night bus routes that best serve the travel needs of people.



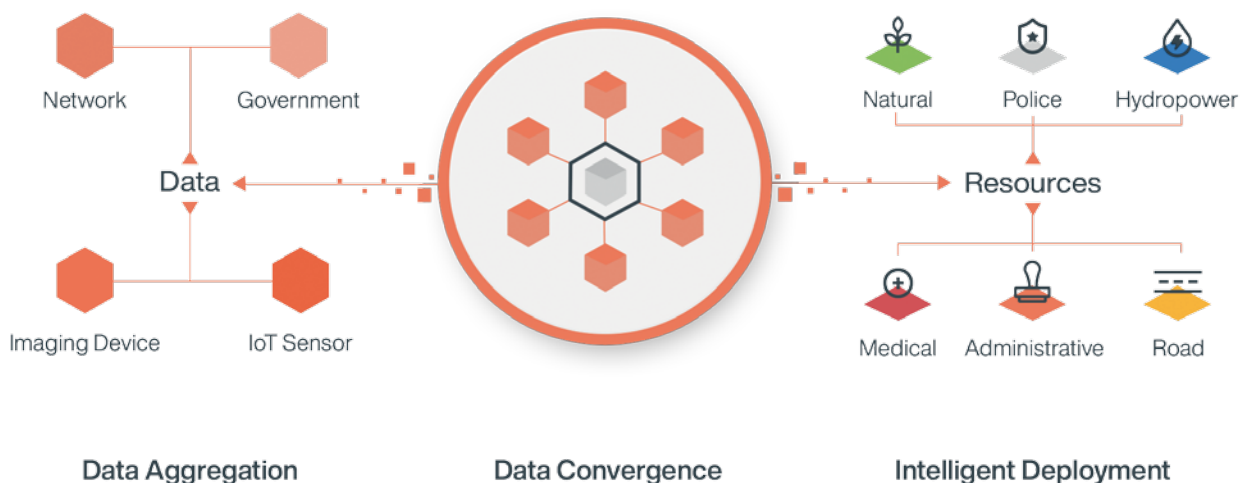
Source: Seoul Metropolitan Government, 2018. Available at <http://english.seoul.go.kr/seoul-to-operate-four-custom-year-end-owl-bus-routes-in-gangnam-and-hongdae/>.

The new night-time bus service provides a safe and affordable alternative. It has been well-received by the public, with continuous daily ridership growth – from 5,000 after launch in 2013 to more than 7,000 in 2014 (Seoul Solution, 2014). In a sign of the public's fondness for the new service, everyday citizens called for the overnight routes to have a unique name and generated the moniker "Owl Bus", which the city in turn adopted in its official signage and branding (Lee, 2018).

Real time sensors coupled with big data analysis can also prove effective traffic management tools. Cities experiencing increased private automobile ownership rates and more vehicle miles travelled find that the resultant traffic congestion slows down urban productivity and generates air pollution. Chinese e-commerce giant Alibaba developed a cloud-based system called City Brain in its headquarters city of Hangzhou. The integrated platform deploys artificial intelligence to gather traffic data from the transportation bureau, video footage from

traffic cameras, location data of buses and cars from GPS and many others to learn traffic flows at more than 1,000 locations (Toh and Erasmus, 2019). While Alibaba developed the software, the Hangzhou city government owns the data. With an arrangement in place that ensures the public sector retains ownership of citizens data, in 2016 the city permitted Alibaba to control 104 traffic signals in the Xiaoshan district (Beall, 2018). Average travel time on roads with automated traffic signal controlled by City Brain has been reduced by three minutes. With City Brain, Hangzhou has also improved from 5th to 57th place among China's most congested cities. The system has now moved beyond coordinating traffic signals and has begun to automatically detect road accidents and illegal parking, facilitating more effective municipal responses to potential gridlock triggers. The City Brain system will soon be applied in Kuala Lumpur and several other cities (Beall, 2018). By contrast, the system has also been criticized for adherence to privacy protection, leading to concerns from the public.

ET City Brain



Source: Alibaba Cloud (n.d.). "ET City Brain – Empowering cities to think with data driven governance". Available at www.alibabacloud.com/et/city.

Improving the natural environment for a high standard of living

A clean, biodiverse natural environment offers a foundation for productive and sustainable economic development, enhances quality of life through ecosystem services and reduces the risk of natural disasters. Technology and smart systems enable cities to address environmental degradation and manage environmental resources in a more responsive and integrated manner. They also provide the means to promote sustainable consumption and production through information sharing. The collective efforts of Governments, industry and citizens are critical for formulating and effectively implementing sensible policy instruments and resource management plans.

Luang Prabang is situated at the confluence of Mekong and Nam Khan rivers in the Lao People's Democratic Republic. Wetlands play an important role in its natural drainage system and for food production, but much of this fragile ecosystem suffers from pollution and illegal encroachment from urban development. Wetland degradation

threatens residents' quality of life and puts the city under tremendous risk of flooding (Ludher and others, 2018b). The city is planning to roll out a rehabilitation plan for its 183 ancient wetlands and small ponds through its membership in the ASEAN Smart Cities Network. In its upcoming Master Plan for Urban Drainage and Sewage System, Luang Prabang plans to collect extensive data through sensors and geographic information systems (GIS) to closely monitor the condition of its wetland ecology, such as water levels and extent of urban development, in order to inform planning decisions (Ludher and others, 2018b).

In Singapore, more than 80 per cent of the people live in high-density public housing, and town planners are focused on providing a liveable environment in these council estates (Singapore Housing and Development Board, n.d.b). In 2014, the Housing and Development Board (HDB) announced its Smart HDB Town Framework, which envisions how smart technologies and data can be seamlessly integrated into public housing planning, construction and management to support a more liveable, efficient, sustainable

"Predictive analytics pre-empt problems and optimize maintenance cycles."

and safe experience (Singapore Housing and Development Board, n.d.a). This vision starts from the process of planning and designing a housing estate, where micro-environmental modelling influences precinct layout and block orientation to best harness natural ventilation and solar energy-generation potential. Smart features, such as automated adjustment of lighting levels, achieve greater energy efficiency.

Predictive analytics pre-empt problems and optimize maintenance cycles. The ongoing pilot will integrate all data collected in a centralized repository with rich insights for better planning. As other cities develop council estates, Singapore's planning approach provides a model for getting important details right that will ensure the success of such housing schemes.



Source: Housing and Development Board, Singapore.



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Advancing industry and nurturing innovation

In Chinese cities, the rise of Internet innovations, such as e-commerce, cashless payment and all-in-one smartphone apps, provide unprecedented opportunities to transform and upgrade traditional industries, such as health care, education and tourism, for those who have the tools to use them. Many businesses are digitizing parts of their operations and bringing them onto these integrated platforms facilitated through QR codes and electronic payment functionality. In many places of interest, such as the Palace Museum (n.d.) in Beijing, visitors can scan a printed QR code to purchase admission tickets or rent an audio guide device. By paying with their electronic ID linked to WeChat or AliPay and subsequently scanning their tickets at the gates, visitors reduce time spent queuing for tickets and other services. Other sites of interest, such as the Mogao Caves in Shaanxi, rolled out innovative applications through WeChat in order to augment tourists' experience with 3D virtual sightseeing, thereby injecting vibrancy into a traditional industry (Tencent Technology, 2018). With the ubiquity of these apps, such tourism innovations can easily be adopted in other countries.

The story of Indonesian mobility start up Go-Jek is one where homegrown innovation can positively spill over onto other traditional industries. The company's name is a play on ojek, the Indonesian word for "motorbike taxi". Since its launch in 2011, Go-Jek has evolved from a ride-hailing app to a one-stop platform that serves many lifestyle needs, ranging from food and grocery delivery to massages. In 2018 alone, Go-Jek is estimated to have contributed more than \$3 billion (44.2 trillion Indonesian rupiah) to the country's economy, benefiting drivers, small and medium-sized enterprises (SMEs) and individual merchants, all of whom now have another channel to promote and sell their products (University of Indonesia, 2019).

Advancing civic and social development

Asian and Pacific cities enjoy a rich mix of ethnic diversity. Building a cohesive and resilient community is among the top agenda items of cities, especially in the face of rising fears of domestic violence and transnational terrorism. While social media platforms have been misused as a tool of division, spreading radical messages, they could also become a uniting

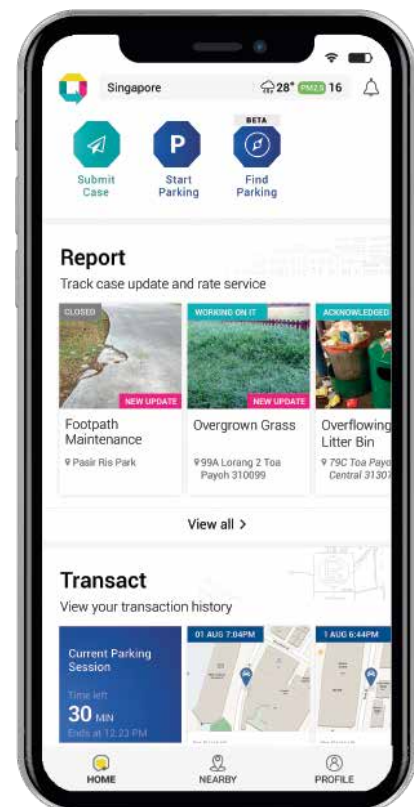
"Care must be taken, however, to ensure the security of integrated data systems to avoid eroding trust."

force that brings people together, fosters strong community ties and enables public authorities to connect with residents in order to hear feedback and address their concerns directly.

Traditionally, many government agencies and town councils oversee municipal issues, creating confusion when residents might knock on the proverbial wrong door when they wish to file feedback or make a request. Using an integrated municipal services app, Singapore has successfully re-engineered the municipal service workflow across agencies and town councils. In 2015, the OneService App was built and implemented by the Municipal Service Office, under the Ministry of National Development, to better coordinate municipal service issues. The app offers a one-stop platform for residents to provide feedback on all municipal issues, upload relevant photographs and include a geotag of their location (Smart Nation Singapore, 2019). These issues will then be automatically routed in real time by a central back-end integrated case management system to the corresponding responsible agency or town council for follow up. Residents can track the status of their reported feedback cases, fostering greater transparency and enhancing trust in the agencies' and town councils' ability to address their concerns. Usage of the OneService App has increased by almost threefold from about 4,000 cases per month in 2016 to close to 12,000 cases per month in 2018.¹⁷ Besides enabling residents to conveniently report on municipal issues, the OneService App has also integrated transaction-based functions, such as Start Parking to enable drivers to conveniently pay electronically for kerb-side, coupon-based

parking, and Find Parking for motorists to find nearby car parks and check on availability and parking rates at their destination. These municipal service apps are increasingly de rigueur in larger cities and represent a comparatively simple and straightforward smart city application that could benefit residents. Care must be taken, however, to ensure the security of integrated data systems to avoid eroding trust. The Petaling Jaya City Council provides an illustrative good practice in pioneering the development of an integrated data platform for smart city development.

© Ministry of National Development, Singapore.



¹⁷ Data obtained from the Municipal Services Office of Singapore's Ministry of National Development.

. BOX 8**PJ Smart City's data solution platform**

The PJ Smart City initiative of Petaling Jaya City Council in Malaysia is a citywide project that is aimed at creating a “smart, sustainable and resilient Petaling Jaya” by 2030. As Petaling Jaya continues to modernize and its landscape evolves, the Council wants it to develop into a smart city so that it is able to better serve its citizens.

PJ Smart City provides a total solution platform for planning, managing and monitoring Petaling Jaya City using smart approaches through storage and analysis of large integrated data sets. At the PJ Smart Centre, city managers monitor traffic, air quality and governance in a streamlined fashion across multiple agencies. With the help of GIS, the PJ Smart City initiative is also tracking several key performance indicators that are aligned with the Sustainable Development Goals: provide all single mothers with skills training; reach 90 per cent compliance with assessment tax; ensure no more than 3 per cent of the population is affected by floods; reach a more than 85 per cent level on the happiness index; plant 1 million trees; ensure 95 per cent of public toilets receive a five-star rating; and increase the outcomes of the 3R waste programme by 3 per cent every year.

Source: Case study submitted by Urbanice Malaysia, 2019.

Improving health and well-being in a smart city

Healthy lives and well-being are a priority for sustainable urban development, especially as urban populations enjoy longer life expectancies. Many cities are working to provide all residents with affordable and accessible health-care services, a goal that has typically been impeded by financial and labour constraints. With innovative, technology-aided solutions, cities have found new ways to provide a larger segment of the population with affordable care. The advent of sensors and environmental and health data enable people to understand the urban environment and their own health in new ways. Smart systems have provided unprecedented opportunities for Governments to work together with people to create a better living environment.

India is working towards making health-care services accessible for everyone. This ambitious

goal has not been an easy task, especially for remote regions hindered by natural barriers and resource constraints. Since 2012, Hewlett Packard Enterprise has partnered with state health-care departments and local health-care providers to implement cloud-computing-enabled eHealth Centres in India (Hewlett-Packard Development Company, 2014). These centres, built in refurbished shipping containers for ease of transport and assembly, are connected to a partnering hospital through cloud-computing systems (Hewlett-Packard Development Company, 2014). The centres come equipped with basic diagnostic equipment and video conferencing capability, operated by a paramedic who assists patients with basic health-care services, such as measurements of vital statistics, and facilitates remote diagnosis with doctors from nearby hospitals through teleconferencing systems. Since 2012, 94 eHealth Centres have treated 525,000 patients in 18 Indian states, complementing the existing

"Urban dwellers are also now able to receive more updated information about environmental metrics that affect their immediate health."

health-care system with accessible primary health-care services in resource-poor locations (Centre for Liveable Cities, 2018).

Smart solutions have also helped to improve patients' experience of interacting with hospitals. In China, especially in cities strained by health-care demands, the act of visiting hospitals can be a painful and time-consuming experience that involves long queues, or worse, having to queue multiple times because the person seeking care initially registered with the wrong department. Wuhan Xiehe Hospital, a renowned hospital with 5.7 million outpatients annually, has created a public account on WeChat as have many businesses and institutions in China. The WeChat account functions as both a digital registration counter and an information repository. Users can select the department for which they would like to register, or be directed to the correct department through an online questionnaire that asks about their health status and current symptoms. The public account page also serves as a one-stop portal for all activities related to the hospital: users can view and retrieve past medical records, receive push reminders for medical appointments, pay for all fees incurred and even navigate within the hospital complex with a Bluetooth way-finding system. The adoption of this digital platform has significantly enhanced patients' experience of interacting with the hospital, reduced unnecessary waiting times and consolidated essential information onto one platform to better serve patients (Wuhan Union Hospital, n.d.).

Urban dwellers are also now able to receive more updated information about environmental metrics that affect their immediate health. Air Box is an Internet of Things air quality monitoring device that publishes real time data on its cloud platform for public access through mobile phones or the Web. Air Boxes can be installed in public spaces and schools as a complement to pre-existing air quality monitoring systems, which measure less frequently. Air Box data have sparked online scientific discussions on air quality among members of the public, who started pushing for stronger air quality enforcement measures. In schools, students have learned to read air quality indices and even develop their own air quality sensors (Smart Taipei Province of China, n.d.).

Empowered by smart technologies and data, cities are striving to create safer and more secure communities. Viet Nam's Ho Chi Minh City, faces the challenge of efficient emergency response as the city gets denser (Ludher and others, 2018d). Traditionally, essential data sets on such matters as transportation, public security, health care and education are stored by individual departments in inconsistent formats that are not interoperable to facilitate emergency response. The city has committed to building an intelligent operations centre and an integrated emergency response centre (Ludher and others, 2018d). By gathering data from numerous physical and virtual touchpoints, including citywide CCTV systems and government operation centres, the operations centre will consolidate the data sets to derive real time information about the city, enabling leaders to efficiently make decisions with a comprehensive view of

"Policymakers must target the basic access barriers, such as cost and availability, in order to ensure that smart cities do not further disenfranchise marginalized populations."

what is happening in the city. The city plans to further integrate disparate existing emergency response functions, such as firefighting, search and rescue and emergency medical services, into the emergency response centre in order to coordinate greater efficiency in communication and cooperation between multiple units. In this case, integrated data platforms have significantly enhanced the city's capacity to deal with emergency incidents.

Robust digital infrastructure and applications

Fundamentally, the smooth function of smart applications relies heavily on robust, secure ICT and digital infrastructure. Digital infrastructure, such as fibre-optic broadband and data centres, ensures basic virtual connectivity between people, companies and organizations. It enables delivery of solutions to remote and even resource-poor locations that are traditionally hindered by poor accessibility.

Asia-Pacific countries are investing heavily in telecommunications, broadband, data centres and other supporting infrastructure for economic and social development, with ample progress having been made thus far. The region has more than 2 billion Internet users, producing an Internet penetration rate of almost 52 per cent (Kemp, 2019). Japan and the Republic of Korea are leading the march with 95 per cent and 94 per cent Internet penetration rates respectively (Kemp, 2019). At the same time, of 18 ESCAP member countries with less than 2

per cent fixed broadband subscriptions as of 2016, 8 were Pacific island countries (ESCAP, 2018a). At current Internet access rates, smart city technologies are beyond the reach of many of the largest cities in the ESCAP region. It is therefore probable that the deployment of these applications will empower those who already have connectivity, while widening the gap with those furthest behind. Policymakers must target the basic access barriers, such as cost and availability, in order to ensure that smart cities do not further disenfranchise marginalized populations. In order to accomplish this, significant additional investment in digital infrastructure is still necessary to close the digital divide in the region.

User-centric applications and robust digital infrastructure can be the means through which services and solutions are channelled. Increasingly, mobile applications are evolving and agglomerating to become all-in-one digital platforms where services can be accessed and integrated. Super apps, such as WeChat in China, host online "microstores" for farmers, manufacturers, artists and small businesses, in an effort to enable individuals to be merchants, entrepreneurs and developers, no matter where they are living. The registration process for a microstore is designed to be easy and convenient. Development of a customized microstore requires minimal technical capability. Owners and developers can further improve their technical and management skills from online forums and training centres operated by WeChat's parent company, Tencent. Providing services and products to developers,



merchants and consumers, WeChat builds digital marketplaces that expand economic opportunities for multiple groups. However, limited data are available to determine the degree to which these efforts are succeeding; in addition, a gender divide exists in the use of these tools, highlighting concerns that vulnerable populations, such as female entrepreneurs, are being left behind by these efficiency increases. Responding to these and other challenges in the

Pacific, a shared digital platform to support more transparent and efficient land transactions has benefited city councils in greater Suva.

For those with access to connectivity, solid and accessible digital infrastructure and applications reduce information asymmetry between resource-rich and resource-poor locations, creating new social and economic growth opportunities. Services, such as education and

"Residents can contribute to larger resilience efforts without having to learn a new skill or technology."

. BOX 9

Technology comes to traditional land transactions in urban Fiji

In Fiji, 91 per cent of the land belongs to traditional indigenous landowners. The iTaukei Land Trust Board (TLTB), a statutory body established in 1940 to protect traditional landowners' rights, administers all land dealings on their behalf. As part of the Future Cities Programme's Supporting Smart Systems initiative, the Asian Development Bank developed a land price index, starting in Tailevu Province, to enable TLTB to become more effective and consistent in the leasing of land. A blockchain technology prototype is also being developed for integration into the new land price index. This prototype will provide an online service platform and a dashboard to retrieve and compare rent prices within surrounding localities. Innovative features of the blockchain prototype include: instant search function, quotes and application; detailed land, lease and price information; ability of land owners to vote directly and have full transparency on lease application status; and final confirmation and lease title issuance.

The project also developed a policy document for a shared digital platform across the four municipal councils in the Greater Suva Area. Councils are now able to share knowledge, information and services with each other. The application of data to address fragmentation across geographies is what truly enabled smart governance in this case.

Source: Case study submitted by ADB.

training, medical care, hazard monitoring and alerts, are made available and accessible to resource-poor locations with affordable mobile devices and data network access. In countries with stronger technology capability and competency, business has grown around data infrastructure, forming economic ecosystems built around digital platforms. The rise of numerous digital platforms continues to generate socioeconomic values in these countries.

Meanwhile, countries which do not have these resources fall further behind.

Traditionally, city leaders have convened platforms, such as public dialogues, polls and town hall meetings, to bring stakeholders together to discuss dedicated issues. With smart technologies, governance in smart cities can take on new forms and innovative channels to meaningfully engage stakeholders. For



example, Seoul's mVoting and "Oasis of 10 Million Imagination" allows its residents to vote on issues of concerns and give ideas to improve the city.¹⁸ These apps have been positively received as a form of meaningful consultation that builds trust between the Government and the people.

Smart technologies also enable residents to be involved as content producers to assist city management. Indonesian cities are making bold steps in engaging citizens in various aspects of urban management through social media. Jakarta is estimated to be the world's most active Twitter city (Semiocast, 2012). At the same time, Jakarta also needs "quick wins" to better manage its flood risk, reduce damage and provide an alert system. In 2014, the University of Wollongong, Australia, worked with the Jakarta Emergency Management Agency and Twitter to create PetaJakarta.org, an online platform which gathers real time flood reports from posts on Twitter by Jakarta residents, and visualize such data into an online map (Holderness and Turpin, 2016). During floods, Twitter users in Jakarta are programmatically prompted to tweet and post photographs using the keyword banjir or "flood" (Holderness and Turpin, 2015). Such flood reports would then be collected in a centralized geospatial database and rendered into a webmap showing geo-located flood information in real time across the city.

In February 2015, PetaJakarta mapped more than 1,000 flooding sites across the city, and the resulting map was viewed more than 160,000 times (Holderness and Turpin, 2015). Besides enabling residents to navigate dangerous flood

situations, the crowdsourced data also enabled the Government to perform flood assessment and response actions in real time (Holderness and Turpin, 2015). More importantly, the project demonstrated the value of crowdsourcing and social media to generate situational knowledge during extreme weather events; it shows that it has the potential to support larger-scale disaster risk management systems and achieve urban resilience in a cost-effective manner. Residents can contribute to larger resilience efforts without having to learn a new skill or technology. The example of PetaJakarta provides an exemplary model of how city leaders can leverage social media and crowdsourcing methods, made possible by the penetration of smartphones, to meaningfully engage and empower residents in urban resilience issues.

Integrated urban planning

Singapore has been making significant progress in incorporating GIS for integrated planning. One example is planning for an age-friendly city. Singapore is expected to have one senior (aged 65 and older) for every four other Singaporeans by 2030.¹⁹ Planning for ageing is thus a national imperative involving multi-agency efforts, such as the Ministry of Health, the Urban Redevelopment Authority, the Housing and Development Board and the Land Transport Authority (Singapore, Ministry of Health, n.d.). To ensure that the city provides older persons with sufficient medical and social services, planners across agencies have built in-house digital geospatial planning tools, such as ePlanner and GEMMA (GIS-

¹⁸ For details, see www.seoulsolution.kr/en/content/oasis-10-million-imagination.

¹⁹ For details, see https://sustainabledevelopment.un.org/content/documents/1525Action_Plan_for_Successful_Aging.pdf, p. 7.



Enabled Mapping, Modelling and Analysis) (Woon and Zainal, 2018). These tools enable planners across agencies to view digitized planning and demographic data, such as distribution of senior residents across estates, as well as locations of recreational facilities and aged-care facilities. By sharing such platforms, planners acquire a consistent understanding of planning issues and can better coordinate planning decisions across departments effectively. For example, planners can view all existing and upcoming facilities, then prioritize the development and social programmes in areas of high concentration of seniors and older persons who live alone. They can also make more informed decisions, such as co-location of the aged-care facilities with ageing social support centres, to better serve seniors' medical and social needs. Collectively, these GIS platforms have enhanced the planning agencies' capacity to make more coordinated and informed decisions across stakeholders for integrated planning.

Innovative key performance indicators for smart, sustainable urban development

Adopting an integrated and holistic urban planning approach supports cities in prioritizing their smart and sustainable development actions. Goris is a city of 23,000 people and the second-largest city of Syunik Province in Armenia. It served as a pilot for the United Nations Economic Commission for Europe's United Smart Cities Project, through which the regional commission and the municipality developed a smart city profile in September 2017 followed by concrete action plans (UNECE, 2017).

The city's performance was evaluated using 72 smart sustainable city indicators, which were grouped into pillars of economic, environmental and social sustainability (UNECE, 2017). These key performance indicators were unique in that they addressed both the smartness and



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"Adopting an integrated and holistic urban planning approach supports cities in prioritizing their smart and sustainable development actions."

sustainability aspects of urbanization, with a focus on localizing the Sustainable Development Goals.

The profile concluded that Goris should start to implement activities with lower costs while the city sought funding for more expensive priority action areas. This approach involved the planning of project proposals and discussions with private and banking investors. Analysts realized that a high level of cooperation among national Government, banking and the private sector is necessary for all the measures to receive stakeholder support.

The local government prepared a list of necessary measures to improve Goris' economic, environmental and sociocultural situation. Each measure was analysed according to its benefits, the resources required and whether the measure could be realized on a short-term basis. Based on this analysis, the measures were given a priority,

with scores ranging from 1 (highest priority) to 3 (lowest priority), and a benefits and resources/efforts score either in the high, medium, or low range.

Following the creation of the smart sustainable city profile, the list of key measures was translated into an action plan. This plan contains a clear list of funding sources and a timeline for the implementation of recommendations. Such a measure provides a transparent framework for sustainable and smart solutions to be implemented and regularly assessed against the key performance indicators. The recommendations in the city profile of Goris have been reflected in the city development plan and the Armenian Urban Development Committee, a national body overseeing urban policy (UNECE, 2017).



3.3 Future policy pathways for smart and inclusive cities

The future of smart and sustainable cities will require positive affirmative action being taken today and into the future. Key potential future policy pathways that could be adopted include:

Improve smart city governance across urban systems, institutions and actors to overcome inequalities and make more informed and integrated planning decisions

Encourage technology firms to become more civic minded and create sustainable smart city solutions with social enterprises

Adopt cybersecurity safeguards in both digital and physical urban infrastructure development planning

Develop smart mobility investment plans that prioritize sustainable urban mobility options for citizens

Expand viable smart city funding mechanisms by enabling cross-sector sustainable partnerships and business matching platforms

. 1***Improve smart city governance across urban systems, institutions and actors to overcome inequalities and make more informed and integrated planning decisions***

To fully harness the opportunities offered by smart cities and to manage, balance and coordinate the various domains and priorities for a city's sustainable development, a systems approach towards creating a smart city is recommended. There are two systems in this approach: integrated master planning and development; and dynamic urban governance. Both enable new forms in the age of smart technologies.

Effective and integrated urban planning and development enables cities to manage the trade-offs and balance the different priorities in the development process, empowering cities to achieve balanced outcomes of economic development, high quality of life and a sustainable environment. This process requires drawing long-term plans that set out local development goals in various domains to align priorities across stakeholders. Up-to-date and comprehensive data enable the authorities to effectively resolve disputes and fraud cases involving land and property ownership issues and protect key infrastructure and resources in times of natural disasters. However, traditional paper-based land surveys and records can be time- and human resources-consuming, and quickly become outdated. In recent years, cities have adopted GIS to store, manage and visualize geographical information. In addition to visualization, digitized

data also support deepened analytics for more informed and integrated planning decisions.

A long-term and integrated development approach also fosters the discipline to build in flexibility to provide space for new opportunities that may arise. In planning for smart systems, it is important to consider the issue of interoperability as new technologies are being rolled out faster than ever.

Governance is about engaging diverse and capable stakeholders, such as citizens, government and businesses, including local enterprises and start ups, in decision-making and oversight of how the city plans, utilizes and manages its resources. It can take many forms, such as public-private partnerships and joint ventures.

Despite the innovative potential of smart cities to advance social, environmental and economic outcomes in cities, smart city governance raises significant issues for consideration. First, there is capacity for smart cities to create or widen existing inequalities. There is a risk that cities could invest in wealthier neighbourhoods when driven by market logic, based on economic potential rather than social needs. This attitude creates a perception of smart cities prioritizing business interests and reinforcing existing sociospatial disparities (Harvey, 2017). Smart cities may therefore marginalize farmers, informal workers, micro-entrepreneurs and small poor communities. A socially inclusive urban development plan is a necessity for smart city agendas. Inequalities can also develop when



smart technology applications do not bridge the gendered digital divide. Particularly in developing countries, minimal education, unequal access to resources and underrepresentation among decision-making authorities result in women being less able to access or use digital technologies (Intergovernmental Economic Organization, 2018). City planning must put emphasis on leaving no one behind, in accordance with the 2030 Agenda. This includes policies to ensure empowerment and participation of women in technology applications.

Vitaly, smart cities could infringe on individual rights to privacy, or human rights more broadly, such as freedom of speech or freedom of

association. Smart cities produce an abundance of data through the various monitoring of transport systems, air quality and CCTV, among many other applications (Powell, 2014). This risk is a governance issue which must be dealt with seriously given the potential for the misappropriation of open-access data. In this manner, smart city policies should bring a theoretical understanding of people's privacy concerns to the forefront in order to protect citizen's rights and curtail use by any party (van Zoonen, 2016). Anonymization of data alone does not fully address privacy issues, meaning initiatives must carefully consider data privacy laws and how to aggregate data to protect and guarantee user privacy.



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Encourage technology firms to become more civic minded and create sustainable smart city solutions with social enterprises

Universities attract high concentrations of young adult or student populations, making cities a hub for creativity, innovation and entrepreneurial environments. This presents an opportunity for city administrators to tap into unexpected ingenuity by co-creating solutions to problems in partnership with the technology sector. When provided with government data sources, talented software engineers can generate ideas rapidly at intensive coding sessions known as “hackathons”. Such programmes combine dynamic ideas from the academic sector with governmental support

and resources to foster innovative solutions to urban challenges. A longer-term engagement than a hackathon is an accelerator, which provides physical spaces and opportunities for technology start ups to advance their ideas to markets. The growth of social enterprise start up models is common across Asia and the Pacific, with the start up ecosystem having doubled in 2017; there are now 565 active tech hubs compared with 287 in 2016 (GSM Association, 2019). The start up landscape offers significant potential for Governments to harness creative thinking in order to drive solutions to citywide problems and for the technology sector to become more civically engaged.

"The start up landscape offers significant potential for Governments to harness creative thinking in order to drive solutions to citywide problems and for the technology sector to become more civically engaged."

. 3

Adopt cybersecurity safeguards in both digital and physical urban infrastructure development planning

Security and safety are vital challenges to cities, without which citizens will not embrace public space or feel comfortable using public transport. Besides safeguarding residents' safety, a secure environment is also crucial to cultivating investor confidence to fuel the region's economic development. Threats to safety and security are multifold. Traditional threats continue to loom, such as homegrown terrorism from the spread of radical ideas online and natural disasters catching a city unprepared. Moreover, as more business and social activities are conducted online, protection against cybercrimes and cyberattacks has added a new dimension to municipal security concerns. The growing pervasiveness of Internet usage in the region and rapid digitalization will increase the region's vulnerability to such cyberthreats.

With increasing transnational network connectivity and the reality of borderless cyberthreats, it is also important to enhance the cyber resilience and security of digital infrastructure, as well as physical infrastructure that is dependent on digital systems. In response to such threats, Singapore launched its cybersecurity strategy in 2016, outlining a comprehensive strategy to strengthen the resilience of critical information infrastructure to create a safer cyberspace, develop a vibrant cybersecurity ecosystem and forge strong international partnerships to enhance national

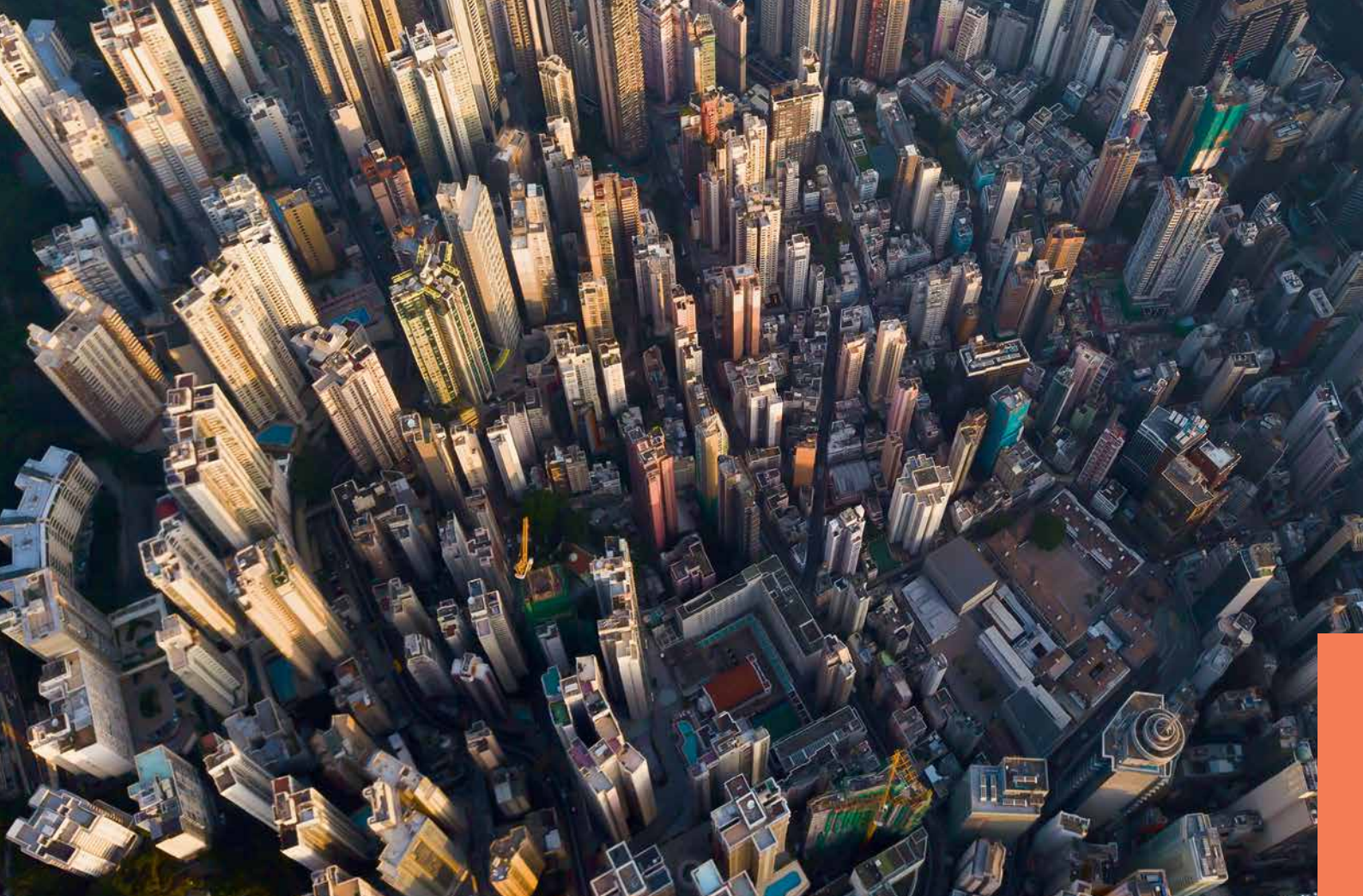
cybersecurity (Cyber Security Agency of Singapore, 2016). Cities in the region could consider formulating their respective strategies to prepare themselves against potential cyberthreats.

. 4

Develop smart mobility investment plans that prioritize sustainable urban mobility options for citizens

Increasingly, cities are exploring the integration of electric vehicles (EVs) and Internet-connected public transport into their mobility configurations. Both present benefits over current single-occupancy vehicle patterns. EVs reduce dependency on greenhouse gas-emitting combustible engines. However, while EVs could potentially change urban lifestyles with safer and more automated services that eliminate accident-prone human drivers, both technologies also require substantial rethinking of a city's infrastructure design to support wider adoption. EVs require charging points integrated with existing roads and power supply networks in order to spur wider adoption, but such investments are costly and time-consuming while demand remains relatively low compared with petrol-powered engines. For example, the Chinese city Shenzhen achieved 100 per cent electrification of its public bus fleet in 2017, yet the full emissions reduction potential of EVs has not yet been realized due to a lack of charging facilities (Dong and others, 2018).

Autonomous vehicles, on the other hand, could reduce traffic congestion as car-to-car



communication technology can theoretically permit vehicles to travel at high speeds with a shorter distance between vehicles as opposed to the more cautious distances required for safe human operation. However, autonomous vehicles may also require different road configurations and storage than existing parking facilities, especially if they circulate between journeys rather than remaining parked. For cities that consider shared autonomous vehicles as their viable future mode of mobility, they could start planning for and implementing regulations now that prioritize shared autonomous vehicles over individual ownership, as recommended by the Shared Mobility Principles for Livable Cities.²⁰ Not planning proactively for autonomous vehicles could have an adverse impact on urban congestion and draw needed revenue away from public transport. Finally, cities should be careful to continue prioritizing pedestrians, cyclists and public transport riders in urban design rather than creating more automobile-centric infrastructure.

²⁰ For details, see www.sharedmobilityprinciples.org/

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Expand viable smart city funding mechanisms by enabling cross-sector partnerships and business matching platforms

Building physical and digital infrastructure often involves considerable investment and cross-sectoral partnerships. Cities frequently face significant barriers in technical know-how in order to meaningfully apply technologies. In this regard, it is worth looking beyond the public sector for additional support and resources in a mutually beneficial manner. By partnering with the private sector, research institutions and peer governments, cities can tap on these external resources for technical capability, financial support and valuable experience.

Private companies have been making tremendous progress in developing mature and market-ready solutions. These range from



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upstream planning and strategy consultancy to downstream engineering work and applications. Industrial partnerships can provide a level of expertise and efficiency to successfully deliver any smart city project. These partners can bring capability and competency that Governments lack, such as professional services, research experiences and opportunities for training and capacity development to the Government and citizens, and as a whole, enhance the authority's capacity to meet the diverse needs of residents.

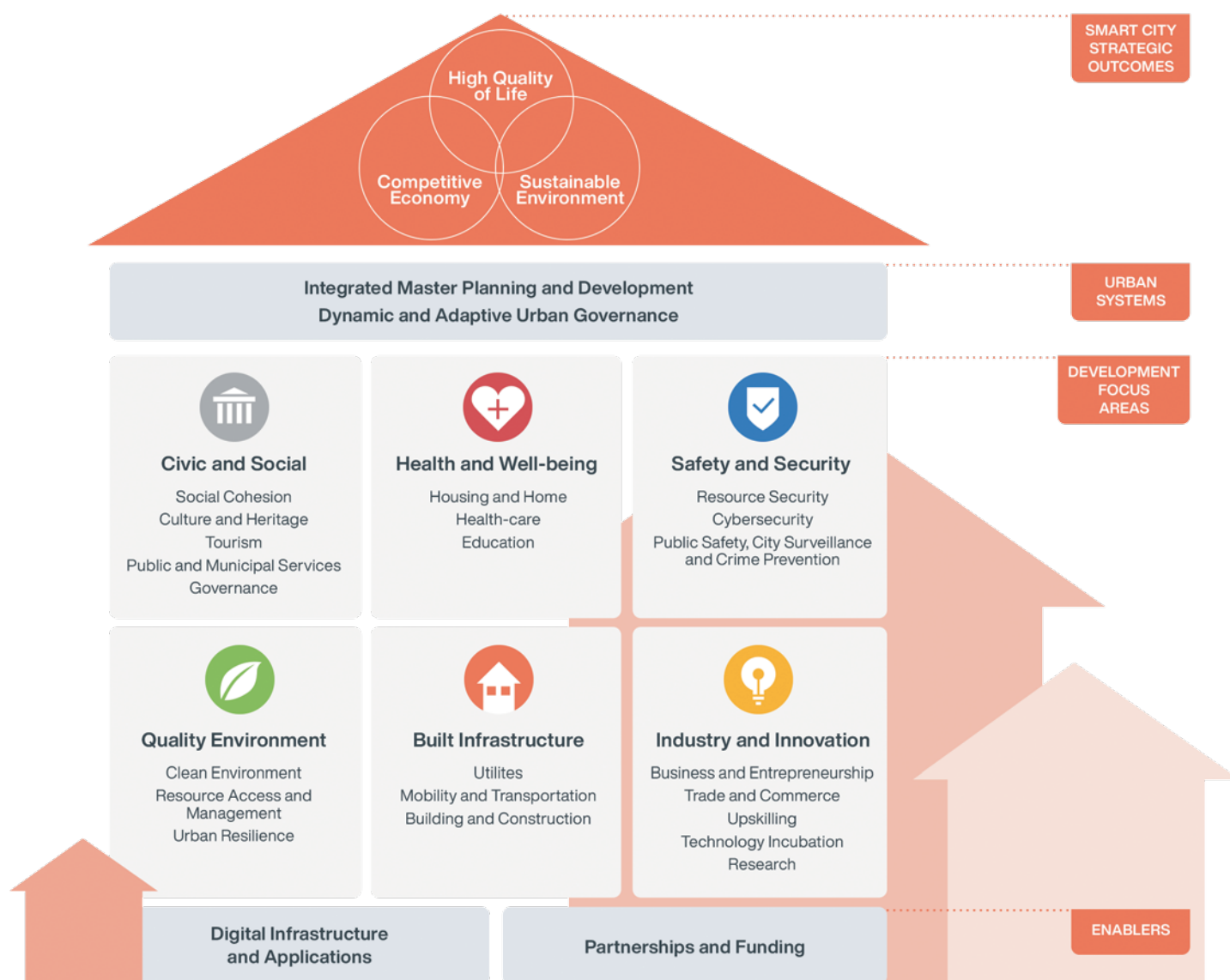
To best match resources with municipal needs, convening platforms that bring stakeholders together are important. Various partnerships have been established through ASCN,

connecting ASEAN cities with private sector solution providers and dialogue partners who are ready to invest and support. ASCN was set up in 2018 to synergize regional smart city development and facilitate smart city projects, with the first batch of 26 cities nominated by national Governments.²¹ Through networking sessions, a governance workshop and other programmes, ASCN provides a model that could be adapted elsewhere in the Asia-Pacific region. By November 2018, the platform had fostered 33 memorandums of understanding or letters of intent among ASCN cities, private firms and external partners. ASCN has proven to be an effective platform to foster effective business matching.

²¹ The first batch of ASCN cities are: Bandar Seri Begawan (Brunei Darussalam); Battambang, Phnom Penh and Siem Reap (Cambodia); Banguwangi, DKI Jakarta and Makassar (Indonesia); Luang Prabang and Vientiane (Lao People's Democratic Republic); Johor Bahru, Kota Kinabalu, Kuala Lumpur and Kuching (Malaysia); Mandalay, Nay Pyi Taw and Yangon (Myanmar); Cebu City, Davao City and Manila (Philippines); Singapore (Singapore); Bangkok, Chonburi and Phuket (Thailand); and Da Nang City, Hanoi and Ho Chi Minh City (Viet Nam).

Figure 7

The ASEAN Smart Cities Framework serves as a guide for planning and implementing smart city projects



Source: Centre for Liveable Cities. Available at www.clc.gov.sg/docs/default-source/books/book-asean-smart-cities-network.pdf, p. 10.

Still, the journey will not be easy. Technology alone cannot deliver sustainable development and improve people's lives. However, with good planning, governance and partnerships, it offers more opportunities than ever to deliver solutions to individuals, businesses and the public sector.

Such promises can be kept, however, only with a sustainable funding approach, which is the subject of the next chapter on urban finance.

Conclusion

The examples above serve to paint an optimistic outlook of how Asian and Pacific cities have been and will continue to address urban challenges with smart systems. The drastic cost decrease of Internet and mobile technologies and applications will promote the ever more pervasive use and integration of these systems in all aspects of urban life. Extensive usage of networked devices generates abundant data for analytics and will stimulate many applications for machine learning. For city leaders, these recent advancements provide unprecedented opportunities to understand their cities in fine granularity and to deliver urban solutions that could potentially have impacts on every single urban dweller in the most efficient way ever. In other words, what has been observed from most of these examples is how smart systems have enabled and empowered cities to make more informed decisions, break down barriers in service delivery and information and transform old methods into systems that are more efficient and effective.

Conversely, smart cities that are poorly planned and governed tend to cause more problems than they solve. In cases involving new and emerging technologies, there are also concerns over safety before the technologies become widely adopted. One example is autonomous vehicles, especially after a fatal self-driving incident in March 2018 in which a pedestrian was killed (Levin and Wong, 2018). Smart systems also significantly change the way workflows and divisions of labour are structured. Such process changes and the resultant new stakeholder relationship formation render irrelevant the legal and institutional systems that were built and designed around traditional workflows. As a result, smart solutions, such as ride-hailing, have raised safety concerns and share responsibility in many incidents. Most cities lack an adaptive legal and institutional governing framework for such new systems in general. At the same time, operating and managing smart systems and new workflows requires different skills and knowledge than traditional urban governance. The need for skills typical of the technology sector rather than municipal management explains why the social discourse around smart cities often brings up the “digital divide”. While smart systems have the potential to benefit cities, it is also important to recognize that smart systems are, at best, a means to an end. Without the relevant supportive systems and frameworks, they also have the power to distort the existing social fabric.

Besides the lack of proper legal institutions to govern these new service models, digitization of information and services also transforms the notion of “accessibility”. The prevalence of digital technologies in urban lifestyles changes the traditional means by which services are delivered and opportunities are accessed. As more services become digitized, accessibility to these services is determined by accessibility to, and the ability to use, digital technologies. Despite wide penetration of smart phones and the Internet, Asian and Pacific cities are still witnessing a significant digital divide (World Bank, 2016). Huawei’s Global Connectivity Index 2018 ranked Singapore 2nd and Bangladesh 78th for their respective performance over a broad spectrum of indicators for ICT infrastructure and digital transformation, among the 79 countries it measured (Huawei, n.d.). In India, Internet penetration was 66 per cent in cities, but only 25 per cent in rural areas, according to Kantar IMRB (n.d.). Even among urban dwellers, most of the unconnected population are from low-income households, socially vulnerable and publicly unengaged groups, such as the elderly, young children, the illiterate, the disabled and the unemployed. In addition to physical accessibility to the Internet and mobile devices through which digital information and services are channelled, the design of such smart systems could also hinder certain groups from taking advantage of these opportunities. There must be measures to humanize municipal technology, whereby feedback channels, citizen participatory processes and timely responses to requests contribute to shaping inclusive smart solutions. However, no universal guidelines currently exist.

