



Smart sustainable cities and smart digital solutions for urban resilience in the Arab region

Lessons from the pandemic



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Economic and Social Commission for Western Asia

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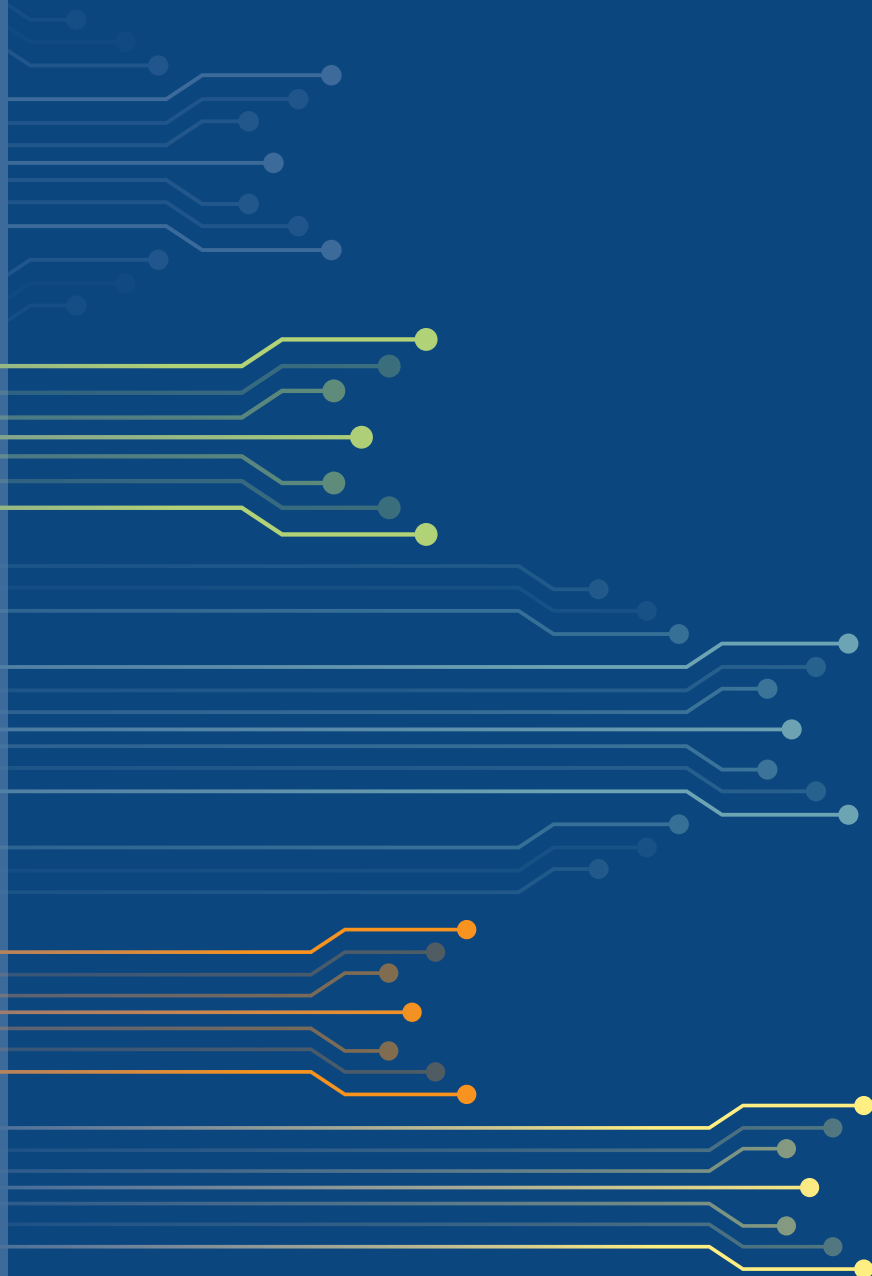
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Introduction



Home to more than half of the world population, cities are major centres of economic activity. In 2019, around 55.72 per cent of the world population dwelt in cities¹ and this proportion is expected to increase to 68 per cent by 2050.² In the Arab region, in 2019, the ratio of city dwellers to total population was at 59.2 per cent,³ higher than the global average. Rapid urbanisation is rendering cities more vulnerable to challenges related to growth, competitiveness, performance and livelihoods, including possible pressures on services and infrastructure. Moreover, unplanned or mismanaged development, along with unexpected shocks and stresses, could put urban systems under severe pressure, generating long-term stresses on basic infrastructure.

Resilience has emerged as a paradigm for responding to shocks and stresses brought about by rapid social, economic, environmental, technological and demographic changes that could affect multiple urban systems, including, inter alia, transportation, food networks, healthcare services, air quality, energy grids, and government services (ICLEI, 2019, p. 5). Cities need a resilient and sustainable operating model capable of providing the solutions required by urban residents, and these solutions need to be economically viable, socially inclusive, environmentally robust, and sustainable. Put differently, solutions should be financially self-sustaining, preserve current resources for future generations, and ensure equitable access to benefits/services across population segments without discrimination.

While there are several definitions of urban resilience, this paper adopts the one used by the United Nations, which identifies the concept as *“the measurable ability of any urban system, with its inhabitants, to maintain continuity through all shocks and stresses, while positively adapting and transforming toward sustainability”*.⁴ In practice, urban resilience is built in two interlinked directions: before a disaster strikes and after.

Before, urban resilience occurs through three main activities: preparedness, prevention, and mitigation; after, it ensues through recovery activities that allow for adaptation and positive transformation (GAUC, 2019, p. 5). Indeed, a resilient city is one that *“evaluates, plans and acts to prepare and respond to threats – natural and human-made, sudden and slow-onset, expected and unexpected – in order to protect and improve the lives of people, secure development gains, foster an investible environment, and drive positive change”* (UN-Habitat, 2021, p. 9). Hence, a resilient city would engage citizens in making plans and conducting assessments and would act in ways that safeguard development gains and provide a positive environment for investments, thus protecting economic assets and enhancing life during crises and subsequently, especially for the marginalised and vulnerable, such as women, low-income children, the elderly, and people with disabilities.

Given the importance of resilience, Goal 11 of the 2030 Agenda for Sustainable Development's Sustainable Development Goals (SDGs) is devoted to “Sustainable Cities and Communities”. SDG 11 envisages cities and human settlements that are inclusive, safe, resilient and sustainable, with access to basic services, transportation, housing, green public spaces, energy, and clean water, while reducing environmental impact and use of resources.⁵ Around the globe, numerous cities have developed national resilience strategies and implemented actions designed to improve resilience to both chronic stresses and acute shocks. Notably, SDG 11 is directly interlinked with all other SDGs except for SDG 2.⁶ Hence, enhancing resilience is of vital importance in achieving the SDGs generally.

In 2015, all United Nations Member States adopted the 2030 Agenda for Sustainable Development (United Nations, 2020b, p. 2).

Most Arab countries have since started aligning their national plans and strategies with the 17 SDGs of the agenda (United Nations, 2020b, p. 1). However, the Arab region is one of the most urbanised regions in the world, which leaves Arab cities at risk of natural, social, economic, technological, environmental and climate hazards, in addition to other challenges that beset the region as a whole with varying degrees, including shrinking civic spaces, conflicts, rentier economies, poverty, water scarcity, gender inequality, unsustainable patterns of resources extraction, and high youth unemployment (ESCWA, 2020a, p. 11). To address these challenges, several countries in the region have already made notable efforts towards urban resilience and sustainable development, albeit at a slow pace compared with other regions. Moreover, several countries, including Algeria, Egypt, Jordan, Morocco, the State of Palestine, Qatar, Saudi Arabia, and the United Arab Emirates, have launched local initiatives to develop Smart Sustainable Cities (SSCs), either by transforming existing cities or by building new ones.

In late December 2019, in Wuhan city, China, there was an outbreak of a disease caused by a previously unidentified coronavirus. The following January, the World Health Organization (WHO) declared this outbreak a Public Health Emergency of International Concern. In February 2020, WHO officially named the disease COVID-19, and in March declared it a global pandemic. Since then, cities have been the main hotspots, globally, causing governments, including in the Arab region, to impose lockdowns. The pandemic has had dire consequences across all levels of development, threatening resilience and sustainability of cities, and has at times brought the world economy to a near halt, influencing strongly urban economic resilience globally. It has also resulted in higher unemployment rates, loss of household incomes, loss of jobs, aggravation of gender inequality, and closure of businesses and schools, and its impact has been particularly severe on vulnerable individuals and groups (UNCDF, 2020a, pp. 3-4). Indeed, the impact of

the pandemic has made it abundantly clear that most cities around the world, including Arab cities, have alarmingly low levels of resilience and high levels of vulnerability, particularly evident in the highly interlinked labour market conditions, business and financial arrangements, and economic governance (UNCDF, 2020b, p. 8).

Globally, most cities are dealing with the pandemic through mitigation measures that have had the effects of increasing deployment of various types of technologies, especially those related to SSCs and the Fourth Industrial Revolution (4IR), enhancing trust in Information and Communication Technology (ICT) as a tool for supporting public health, and providing quick smart digital solutions to governments, organisations, and people during times of crisis. Use of smart digital technology is not limited to cities that have already started their transformation to be SSCs; any city could benefit, but implementation would vary from city to city depending on the economic and financial capabilities of the country and its technological readiness.

In several countries around the world, including Arab countries, the pandemic has also raised issues of digital rights. Vulnerable groups and people living in areas that have no access to digital services or Internet connections have not been able to benefit from the smart digital solutions that have been deployed, which highlights the necessity of ensuring digital rights for all, leaving no one behind.

Economy is one of the critical areas that have been severely impacted by the pandemic (UNCDF, 2020a, p. 3), with a significant drop in the Gross Domestic Product (GDP) of countries globally (UNCDF, 2020b, p. 21). This paper focuses, therefore, on urban economic resilience of cities as one of the four main dimensions of urban resilience, which are the economic, social, environmental, and institutional (OECD, 2018, p. 18), with the aim of capturing the best practices in the Arab region in tackling the socioeconomic challenges of the pandemic, as well as its impacts on Arab cities

and possible opportunities for building back better. In addition, the paper explores the smart digital solutions that could help achieve both resilience and inclusion during pandemics and highlights how such solutions would assist Arab cities in reducing existing vulnerabilities while maintaining and improving local resilience.

Moreover, the paper provides guidelines on how smart digital solutions and future technologies could be harnessed in the urban context of the Arab region to develop urban recovery and resilience strategic plans in times of pandemics. Through providing most up-to-date statistical data and status analyses of Arab countries, the paper draws lessons for ensuring the effectiveness of future local urban resilience planning initiatives, sheds light on best-practice policy actions for cities to take in dealing with the implication of the current crisis, and concludes with several recommendations for

improving resilience and sustainability of Arab cities during and after the current pandemic.

The paper is organised as follows: Chapter 1 presents definitions of the concepts of urban economic resilience and SSCs, along with introducing the interlinks among the concepts of urban economic resilience, SSCs and SDG 11. The status of the Arab region in relation to urban resilience, SSCs and SDG 11 is highlighted in chapter 2. Chapter 3 presents pandemic resilience and the socioeconomic impact of COVID-19 in the Arab region and casts light on the smart digital solutions that can help achieve safety and inclusion through resilient services. Selected global and regional smart digital solutions adopted in response to the pandemic are presented in chapter 4. A number of recommendations for Arab policy makers and planners are given in chapter 5. The paper concludes in chapter 6.

Key messages

The Arab region has the highest rate of population growth after sub-Saharan Africa.

Today, half of the region is urban, but there are significant variations among countries, with some having urbanisation levels as high as 85%.

Moreover, urban population is projected to more than

double in 2050,
compared with 2010

with almost **3/4** of the Arab region being urban by that time.



Measurement of progress in the Arab region towards implementation of SDG 11

on sustainable cities and communities is challenging due to low availability of data,



which are available for only

4 out of 15 indicators

covering only

3 out of 10 targets

The impact of COVID-19 has shed light on systemic vulnerabilities and community weaknesses in the Arab region,

as well as on inequalities compounding both, magnifying decades-long challenges that threaten resilience and sustainability of cities and communities. It has also highlighted yet again the importance of heeding the call for integrated, people-centred urban planning.



City-level mitigation measures have increased trust

in Information and Communication Technologies (ICTs) at both national and local levels

as a means for

- supporting public health
- providing quick, smart digital solutions in times of crisis for governments, organizations, and people.

Service infrastructure and connectivity, including use of smart digital solutions,

are central to achieving urban economic resilience.

Moreover, the dimensions of Smart Sustainable Cities (SSCs) are **closely interconnected**

with components of urban economic resilience, as well as with targets of SDG11 and other related goals and targets.



The pandemic has refocused attention on SSCs and smart digital solutions.

Several governments have started considering adoption of the SSC paradigm to achieve digital transformation of cities.

Currently,

14 out of 22
Arab countries

have either built new SSCs or are in the process of transforming selected existing cities.

By leveraging high technologies, especially those of the Fourth Industrial Revolution (4IR), cities could fight pandemics like COVID-19

employing unprecedented tools, enabling them to build a steady, strong infrastructure for pandemic resilience. For example, Artificial Intelligence (AI), the Internet of Things (IoT), big data, advanced robotics, biotechnologies, 3D printing, drones, and wearable technologies provide a wide range of potential solutions for combatting a pandemic and dealing with its socioeconomic impacts.





Smart digital solutions can enhance urban safety

through, inter alia, increasing traffic safety, unlocking the potential of real-time data in prediction and prevention of crime and terrorism, reducing GHG emissions and addressing violence against women and girls in public spaces.

During COVID-19, selected

smart digital solutions,

such as Automatic disinfection systems, AI-based thermal imaging cameras, Smart Helmets, Mobile Applications, and Interactive maps,

were used to enhance safety and well-being of citizens, rendering cities both more resilient and more sustainable.

Smart digital solutions constitute a critical channel for urban inclusion.

They facilitate good governance, enhance engagement of citizens, and increase efficiency of public services, thereby improving resilience and sustainability of cities.

Remote/Online learning, e-health services, social protection, and digital finance are examples of smart digital solutions used to enhance inclusion and ensure that

"no one is left behind".



Various types of smart digital solutions, including

- AI
- robots
- drones
- self-driving cars
- digital payments
- online platforms
- smart wristbands

have been deployed as part of pandemic-response strategies at the global level for **disease tracking, screening for infection, quarantine and self-isolation, contact tracing, health and clinical management, and business and learning continuity.**

In the Arab region, depending on the development status of the country,

smart technologies are used to combat the COVID-19 pandemic. **Drones, digital and HD cameras, and robots** were used to ensure social distancing and limit movements during lockdowns.

Some Arab governments used

location-based contact tracing applications and devices

to monitor individuals who have tested positive and limit their contact with others. Online platforms have also been used to guarantee continuity of work and learning, while mobile phone applications have been deployed to send citizens awareness raising messages.



Capabilities of Arab countries to provide adequate levels of digital services and/or adapt and adopt smart digital solutions vary.

Challenges include economic issues, conflicts and instability, digital divides, digital skills divides, adequacy of digital infrastructure, protection of vulnerable groups, and reduction of inequalities.

Recommendations

Recommendations for building urban economic resilience include:



Develop **inclusive policies**, encourage community engagement and promote a meaningful transition to a more sustainable approach for emergence of cities from the pandemic stronger and more resilient.



Complexity of the socioeconomic impacts of the pandemic require a **whole-of-society approach**, with use of smart and digital solutions helping mitigate these impacts on urban economic resilience.



Use **smart and digital solutions** to transform and/or build smart sustainable cities.



Pursue resilient, inclusive, gender-equal **economic recovery**.



With the SDGs as a framework, address inequalities in income, health, education, and affordable housing for recovery to lead to resilient, sustainable cities.



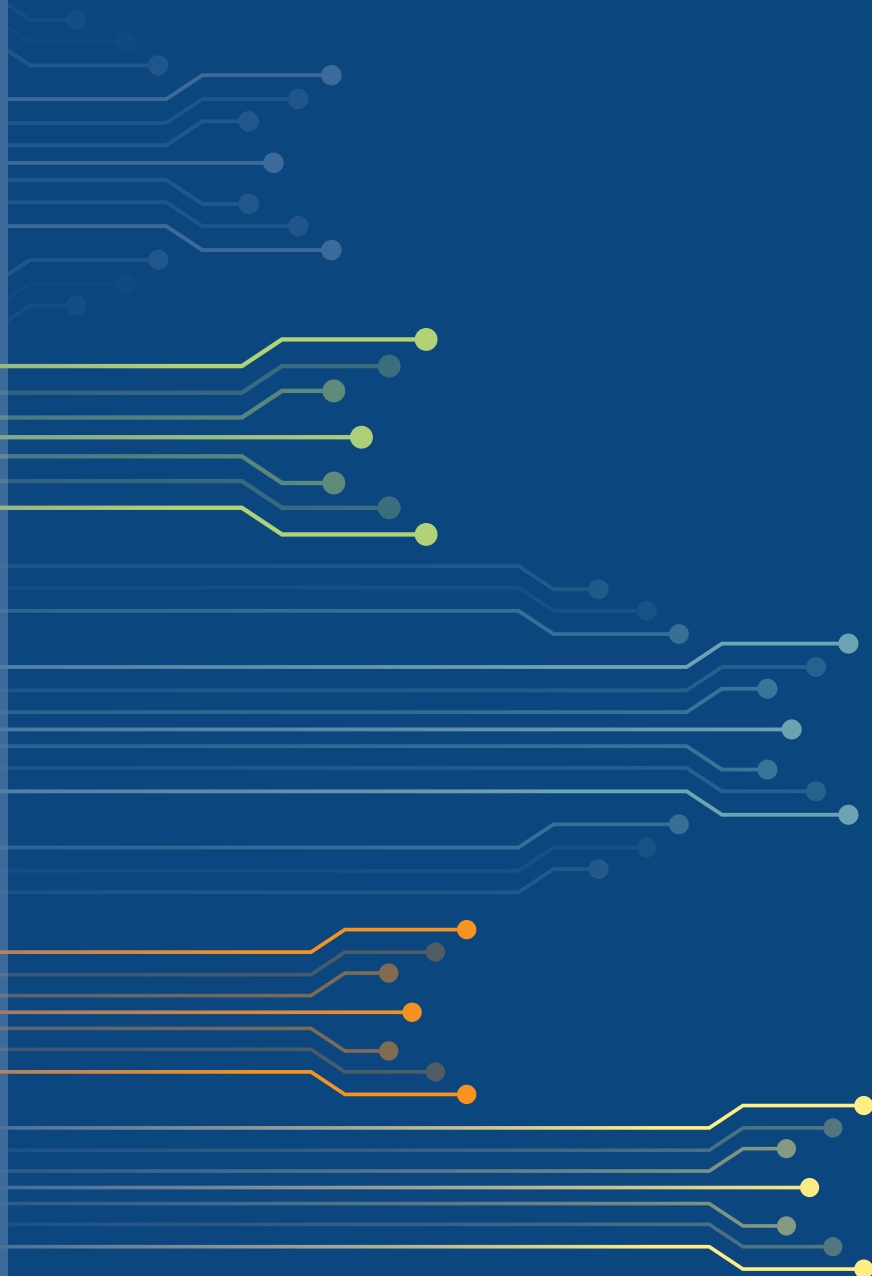
Build **urban economic resilience** through focusing on components of city economy; namely, labour market conditions, business environment, economic governance, financial environment, and infrastructure and connectivity.



Intensify efforts to close the digital divide and ensure **digital rights for all**.

1.

Definitions and intersection between concepts

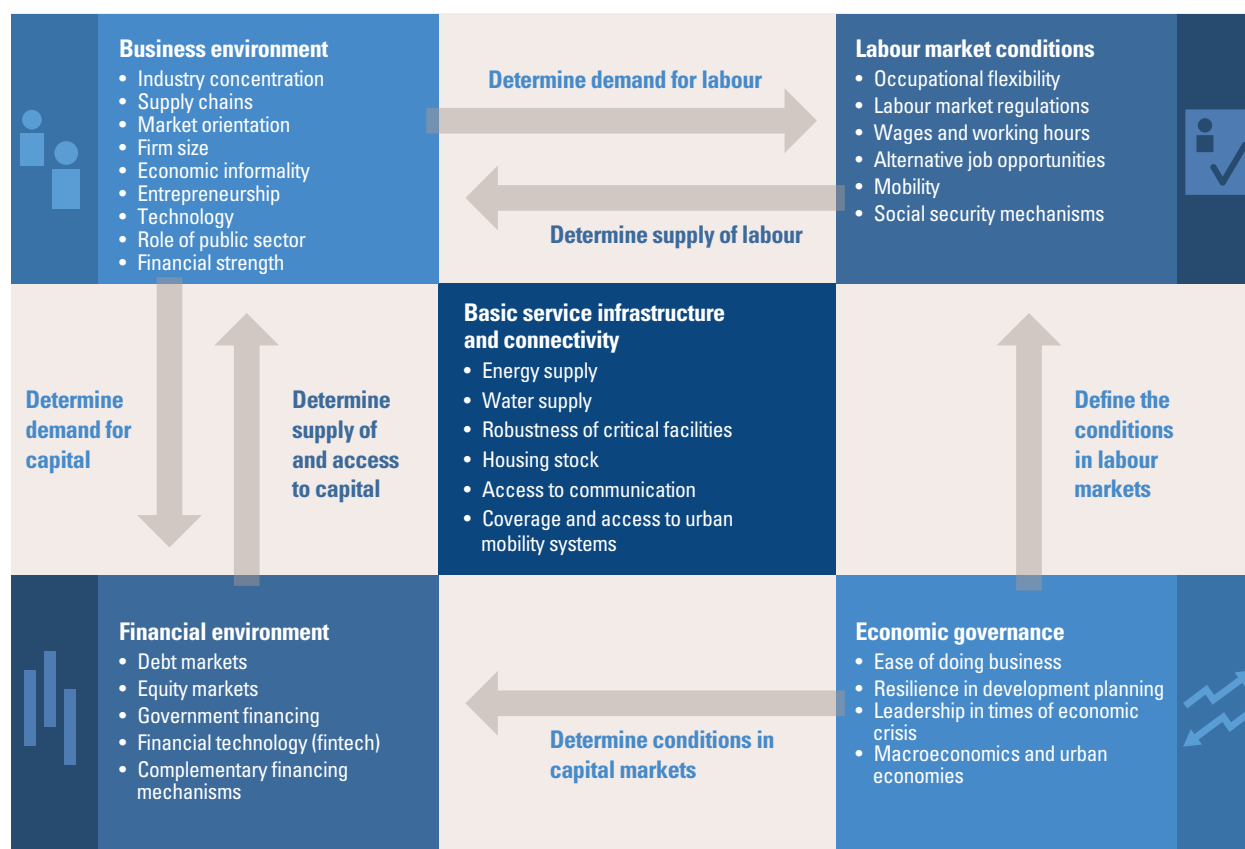


A. Urban economic resilience

Urban economic resilience is defined as “the capacity and related capabilities of urban communities to plan for, anticipate negative shocks, including long-term stresses, to their economies, reallocate and mobilize resources to withstand those shocks, recover from the shocks, and rebuild at least to pre-crisis levels, while placing their economies on the path to sustainable economic growth and simultaneously strengthening their capacity to deal with any future shocks” (UNCDF, 2020b, p. 8). The “Conceptual Framework for Urban Economic Resilience” defines urban economic resilience through four main components, namely: (1) business environment, (2) economic governance, (3) labour market conditions, and (4) financial arrangements (UNCDF, 2020a, p. 4). In January 2021, another component was added to this framework: (5) Basic Services Infrastructure and Connectivity. Figure 1 illustrates this framework (UNCDF, 2021, p. 8-9).

The “business environment” and “economic governance” components refer to urban systems and describe, respectively, the conditions for both public and private business operations, and the structure of local economies and the rules and regulations that are followed to govern the activities of businesses. The third and fourth components refer to factor markets, namely, labour and capital. The fifth, the basic services infrastructure and connectivity, addresses enabling and facilitating continuity under stressful conditions of operations of the other four components (UNCDF, 2021, p. 9). City performance over the five components is measured using 16 resilience performance indicators, with the findings serving to suggest areas for improvements and plans for actions.

Figure 1. Components of city economy and resilience



B. Smart sustainable cities

Smart Sustainable Cities (SSCs) have emerged as a possible solution to resilience and sustainability challenges ensuing from unprecedented rapid urbanisation (Ibrahim, 2020a, p. 13). Designed to provide a series of smart solutions, both ICT-based and non-ICT-based, aimed at minimising impacts of economic, social and environmental urban challenges; such as those of poverty, gender inequality, healthcare, climate change, water, energy, and governmental services; SSCs are built following a citizen-centric approach, in which all solutions are provided to all citizens, including vulnerable groups, such as women, persons with disabilities, the elderly, and the poor.⁷

There are numerous definitions of the SSC and its dimensions. This paper adopts the definition of

an SSC as “an innovative city that uses Information and Communication Technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental as well as cultural aspects” (ITU-T, 2016, p. 11). The paper also adopts six main dimensions of the SSC, namely, smart economy (competitiveness), smart environment (natural resources), smart governance (participation), smart living (quality of life), smart mobility (transport and ICT), and smart people (social and human capital) (Giffenger and others, 2007, p. 13; EESC/EU, 2017, p. 12; Luque-Vega and others, 2020, p. 1). As illustrated in table 1, these dimensions are divided into 33 factors reflecting the most important aspects of each dimension.

Table 1. SSC dimensions and factors

Dimension of SSC ^a	Related factors	
Smart economy (Competitiveness)	Innovative spirit Economic image and trademarks Flexibility of labour market Ability to transform	Entrepreneurship Productivity International embeddings
Smart environment (Natural resources)	Attractive natural conditions Environmental protection	Pollution Sustainable resource management
Smart governance (Participation)	Participation in decision making Transport governance	Public and social services Political strategies and perspective
Smart living (Quality of life)	Cultural facilities Individual safety Education facilities Social cohesion	Health conditions Housing quality Touristic attractivity
Smart mobility (Transport and ICTs)	Local accessibility Availability of ICT infrastructure	(Inter)-national accessibility Sustainable, innovative, safe transport systems
Smart people (Social and human capital)	Level of qualification Social and ethnic plurality Flexibility Participation in public life	Affinity for life-long learning Creativity Cosmopolitanism/open-mindedness

^a Giffenger and others, 2007.

C. Urban economic resilience, SSCs and SDG 11

The contribution of SSCs to the attainment of urban economic resilience and SDGs, particularly SDG 11, has rarely been explored. Analysis of the dimensions and targets of the three reveals strong interlinks. Some dimensions and targets are interconnected, such as the 'smart mobility' dimension of SSCs (table 1), 'mobility systems' of the urban economic resilience (figure 1) and target 11.2 of SDG 11 (see Annex). Table 2 presents the interlinks resulting from comparing the dimensions of urban economic resilience and SSCs with the targets of SDG 11, taking into consideration that SDG 11 is closely related with all other SDGs bar

SDG 2. When there is no direct interlink between the targets of SDG 11 and dimensions/factors of the SSC and urban economic resilience, the mapping will then consider other SDGs that are interlinked with SDG 11. For example, 'entrepreneurship' is one of the main factors under the 'smart economy' dimension of SSC and under the 'business environment' dimension of the 'urban economic resilience', but is not directly addressed by the targets of the SDG 11. However, it is one of the main targets of SDG 8, which has a nexus with SDG 11 and this indirect connection needs to be taken into account.

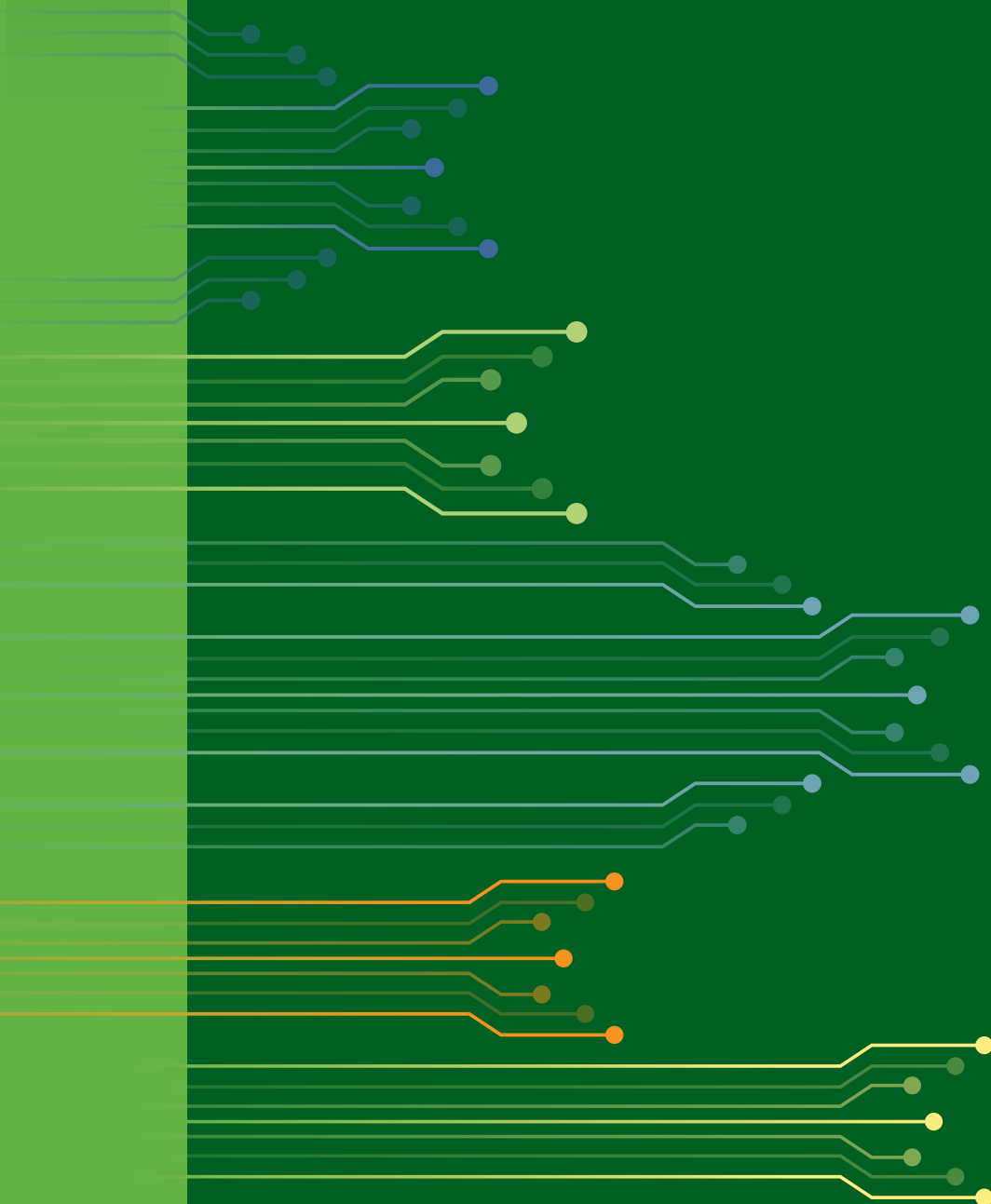
Table 2. Interconnected dimensions and targets of urban economic resilience, SSCs and SDG 11

Interconnected dimensions and targets	Urban economic resilience	SSCs	SDG 11	
			SDG 11 targets	Interlinked SDGs
	Urban services (Housing stock, robustness of critical facilities, access to communication)	Smart living (Housing quality, educational facilities, cultural facilities, individual safety)	<u>Target 11.1</u> (By 2030, ensure access for all to adequate, safe, and affordable housing and basic services and upgrade slums)	–
	Urban services (Coverage and access to urban mobility systems)	Smart mobility (Local accessibility, (Inter)-national accessibility, sustainable, innovative, safe transport systems)	<u>Target 11.2</u> (By 2030, provide access to safe, affordable, accessible, and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons)	SDGs 1, 3, 8, 9, 10, 13 ^a
	Urban services (Energy supply, water supply)	Smart environment (Environmental protection, pollution, Sustainable resource management, attractive natural conditions)	<u>Target 11.6</u> (By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management)	SDGs 12, 13, 14, 15, 17 ^a
	Economic governance (Resilience in development planning, ease of doing business, leadership in times of economic crisis)	Smart governance (Political strategies and perspective, public and social services, participation in decision making) Smart living (Social cohesion)	<u>Target 11.b</u> (By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels)	SDG 16
	Economic governance and Business environment and Labour market conditions	Smart economy (Innovative spirit, economic image, and trademarks, Flexibility of labour market, Ability to transform, Entrepreneurship, Productivity, International embeddings)	Through connected SDGs	SDG 8 Good jobs and economic growth SDG 9 Innovation and infrastructure

^a [https://sustainabledevelopment.un.org/content/unosd/documents/4057Module percent204 percent20SDG percent 2011_Chicago percent20Takase.pdf](https://sustainabledevelopment.un.org/content/unosd/documents/4057Module%20percent204%20percent20SDG%20percent2011_Chicago%20Takase.pdf).

2.

Status of the Arab region



A. Urban resilience in the Arab region

Cities worldwide seek to improve their resilience to stresses and shocks. Afflicted with chronic challenges, such as economic stresses, water supply problems, pollution, conflict, and refugee influxes, the Arab region is taking serious steps towards achieving urban resilience, albeit at a slow pace, with several initiatives aiming to build resilience in the urban context. Depending on the development level of country, these initiatives vary in size, implementation modality, thematic focus, level of relevant engagement of stakeholders, and duration. There is a notable commitment among local actors in several Arab states to resilience building and the support they are receiving from national governments and international development partners (UNDP, 2018, p. 123). For example, more than 20 cities across the region have benefited from technical and financial support from various international development partners in improving urban resilience to climate risks and natural hazards. The partners include ESCWA, UN-Habitat, UNDP, UNISDR, the World Bank, and the beneficiaries include cities in Algeria, Comoros, Djibouti, Jordan, Lebanon, Morocco, the State of Palestine, Saudi Arabia, the Sudan, Tunisia, and the United Arab Emirates (UNDP, 2018, p. XIII).

All countries of the Gulf Cooperation Council (GCC) have reflected climate change risks in their urban planning and urban-resilience building processes (UNDP, 2018, p. 76). For example, in 2007, the ruler of Dubai set a policy on green building standards in the Emirate, directed towards improving water conservation and energy efficiency in new buildings.⁸ In January 2021, the Housing Minister of Bahrain indicated that construction of new towns will henceforward be green and smart, in accordance with the relevant United Nations 2030 Agenda goals, particularly SDG 11, through, for example, using environment-friendly materials, providing open green areas, and planting trees along streets.⁹ A third example

is Masdar city near Abu Dhabi in the United Arab Emirates, which is the world's first full eco-city. Built from scratch, it is one of the newly constructed smart and sustainable cities in the region, with zero carbon emission, zero waste, availability of modern smart services, and use of green energy.¹⁰

All six countries in the Mashreq subregion have launched regional and national initiatives to improve urban-resilience building through strategy development, urban disaster resilience, instructional reform, disaster risk education, risk assessment, disaster preparedness and emergency response. For example, as part of the 100 Resilient Cities programme of the Rockefeller Foundation, the capital city of Jordan, Amman, launched, in 2017, Amman Resilient Strategy, intended to assess the resilience status of the city and initiate a series of prioritised activities and actions to overcome existing resilience-related challenges (RA, 2017, p. 14). Moreover, in 2017, the Jordanian Government endorsed the Jordan Response Platform for the Syria crisis, which is a resilience-based approach to addressing the needs of Syrian refugees and the Jordanian host community by bridging the divide between short-term humanitarian response and long-term development (ESCWA, 2019a, p. 86). Prior to the crisis that erupted in October 2019, Lebanon was taking steady steps towards promoting urban resilience by investing significant efforts in improving emergency preparedness through emergency centres and drills (UNDP, 2018, p. 97). The State of Palestine has initiated strategies and policies for urban resilience in its National Policy Agenda of 2017-2022. One of the main national priorities under the sustainable development plank of this Agenda is the achievement of resilient communities through ensuring security and public safety, meeting local needs, adapting to climate change and revitalising agriculture (PMO, 2016, p. 36). In 2014, Egypt launched

the Strategic Urban Planning and Design Programme, a joint programme between the Ministry of Housing and Urban Communities, the Ministry of Transport, the UN-Habitat, and the United Nations Development Programme. The programme has the objective of improving and inspiring national planning practices related to urban resilience and vulnerability to climate change, as well as enhancing community engagement in planning practices at all levels.¹¹

The Maghreb subregion features extremely diverse characteristics, some of which may have a significant impact on building urban resilience. In 2020, the government of Morocco launched a national project to support Moroccan cities in preparing and designing urban resilience strategies. The project seeks to address the priorities of the Sendai Framework and aims at creating a vision for building urban resilience for each city, implementing the diagnostics of

resilience, and developing adequate action plans (World Bank, 2020, p. 2). In 2018, Algeria established a healthcare security protocol with France to secure treatment of Algerians in French hospitals, aiming to enhance the resilience of its national healthcare systems. Additionally, in 2018, Algeria and Mali ratified a memorandum of understanding on employment, labour, and social security, including provisions for protection of migrant workers and their rights (ESCWA, 2019a, p. 95). Finally, the Cities Alliance Tunisia Country Programme was launched in 2016 to promote productive, inclusive, and resilient urban development in Tunisian cities through technical assistance in various key areas, including developing urban policies and strategies; promoting gender equality and participation of women in decision making; capacity building for local authorities; and developing, financing, and implementing infrastructure projects.¹²

B. Smart sustainable cities in the Arab region

Numerous cities around the globe have started their transformation process towards being smart and sustainable. The transformation process is often based on two different development paradigms, namely, (1) the brownfield model, in which the transformation process takes place in existing cities and (2) the greenfield model, in which cities are established as new from scratch (Ibrahim, 2020a, p. 72).

In general, Arab countries adopted both transformation models. For example, Algeria, Djibouti, Egypt, Kuwait, Lebanon, Morocco, the State of Palestine, Qatar, Saudi Arabia, Tunisia, and the United Arab Emirates started building new cities following the greenfield model, including South Saad Al Abdullah City¹³

in Kuwait, Masdar City¹⁴ and Dubai Silicon Oasis¹⁵ in the United Arab Emirates, Tangier Tech City¹⁶ and City of BenGuerir¹⁷ in Morocco, King Abdullah Economic City¹⁸ and Neom Smart City¹⁹ in Saudi Arabia, Rawabi City²⁰ in the State of Palestine and Lusail City²¹ in Qatar. Each of these cities has its own identity and is being developed according to particular economic, social, and environmental needs. In contrast, several countries announced medium- and large-scale brownfield SSC projects to solve existing urbanisation and sustainability problems and provide various services to citizens, such as the cases of Amman, Algiers, Dubai, Jeddah, Muscat and Rabat. Table 3 summarises the status of SSC initiatives in the Arab countries (Ibrahim, 2020a, p. 73).

Table 3. SSC status in the Arab countries

Country	SSC initiatives (Y = yes, N = no)	SSC project	Used Approach (B = brownfield, G = greenfield)
Algeria	Y	Algiers Smart City	B
		Cyberpark City of Sidi Abdellah	G
Bahrain	Y	Manama	B
Comoros	N	–	–
Djibouti	Y	Iroley Smart City (in planning stage)	G
Egypt	Y	New Capital (unnamed yet)	G
		Smart Village	G
Iraq	N	–	–
Jordan	Y	Amman Smart City	B
		Eco-city Feta	B
Kuwait	Y	Kuwait City	B
		South Saad Al Abdullah City	G
Lebanon	Y	BeitMisk Village	G
Libya	N	–	–
Mauritania	N	–	–
Morocco	Y	Rabat City	B
		Casablanca	B
		Tangier Tech City	G
		BenGuerir	G
Oman	Y	Muscat	B
State of Palestine	Y	Ramallah City	B
		Rawabi City	G
Qatar	Y	Doha City	B
		Lusail City	G
Saudi Arabia	Y	Riyadh City	B
		Jeddah City	B
		Al-Ahsa City	B
		King Abdullah Economic City	G
		Knowledge Economic City	G
		Prince Abdul Aziz Bin Mousaed Economic City	G
		Jazan Economic City	G
		Neom Smart City	G
Somalia	N	–	–
Sudan	N	–	–
Syrian Arab Republic	N	Marota City (near Damascus city)	G
Tunisia	Y	Tunisia Economic City (in planning stage)	G
United Arab Emirates	Y	Dubai City	B
		Abu Dhabi City	B
		Masdar City	G
		Dubai Silicon Oasis	G
		Desert Rose City	G
Yemen	N	–	–

“–” means unavailable.

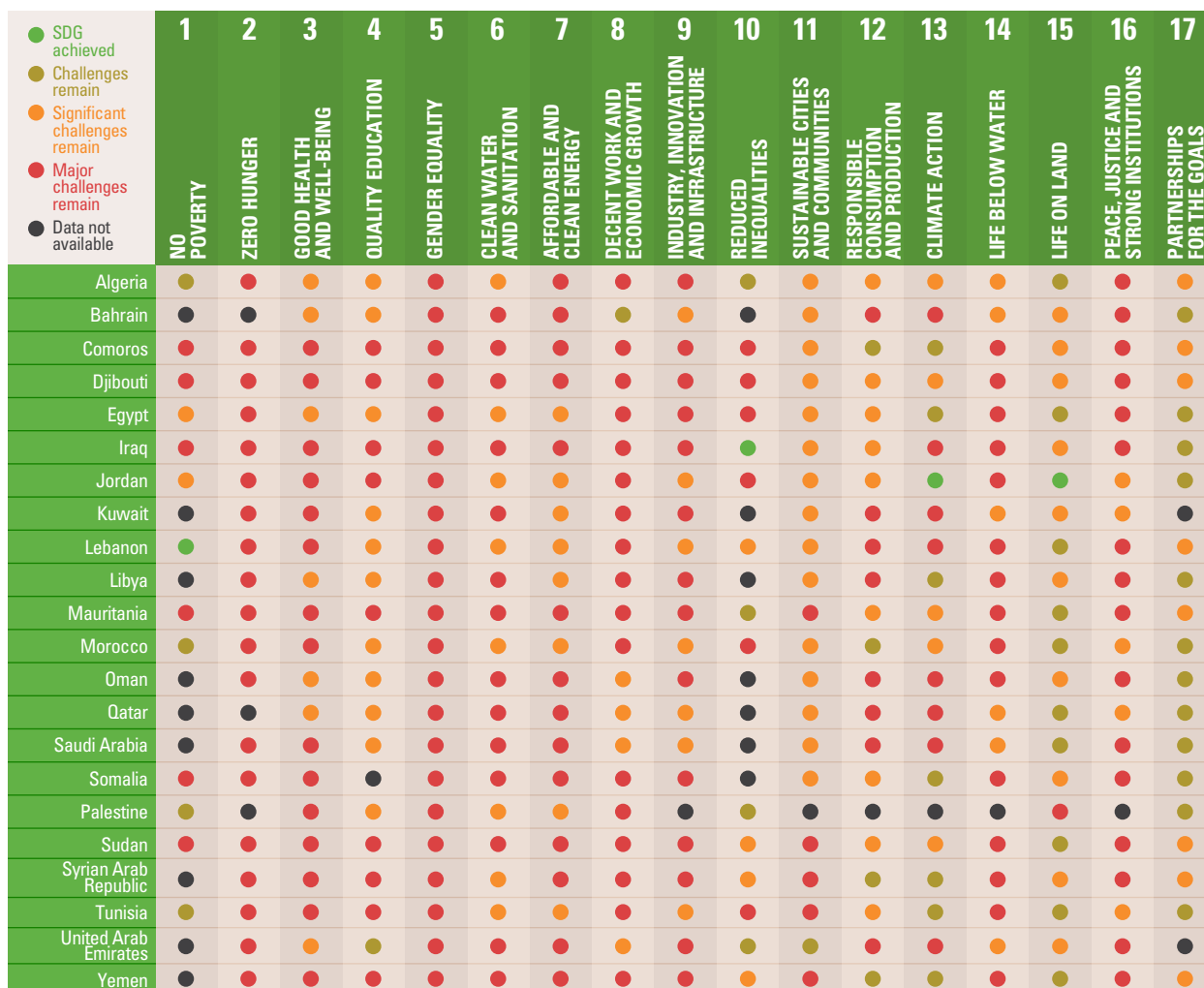
C. Implementation of SDG 11 in the Arab region

In 2015, all United Nations Member States adopted the 2030 Agenda for Sustainable Development and its related SDGs (United Nations, 2020b, p. 2). Each country in the Arab region aligned its national plans with the SDGs according to national priorities and needs. However, the degree of implementation varies depending on the stability of the country, its development level, and availability of resources and means of implementation. According to the Arab Region SDG Index and Dashboards Report 2019 (SDSN, 2019, p. 10) and the Arab Sustainable Development Report 2020 (ESCWA, 2020a, p. 147), measurement of

progress of implementation of SDG 11 in the region is difficult due to low data availability, with data available for only 4 out of 15 indicators, covering only 3 out of 10 targets (ESCWA, 2020a, p. 147).

Collected available data in the 2019 regional SDG report (SDSN, 2019, p. 12) show that Arab states perform well on SDG 11, except Mauritania, the Sudan, the Syrian Arab Republic, Tunisia, and Yemen, that show downward trends. The SDG dashboard and SDG trend dashboard, including SDG 11, for the Arab region are available in figures 2 and 3, respectively.

Figure 2. 2019 SDG dashboard for the Arab region



Source: SDSN, 2019, p. 12.

Figure 3. 2019 SDG trend dashboard for the Arab region

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	NO POVERTY	ZERO HUNGER	GOOD HEALTH AND WELL-BEING	QUALITY EDUCATION	GENDER EQUALITY	CLEAN WATER AND SANITATION	AFFORDABLE AND CLEAN ENERGY	DECENT WORK AND ECONOMIC GROWTH	INDUSTRY, INNOVATION AND INFRASTRUCTURE	REDUCED INEQUALITIES	SUSTAINABLE CITIES AND COMMUNITIES	RESPONSIBLE CONSUMPTION AND PRODUCTION	CLIMATE ACTION	LIFE BELOW WATER	LIFE ON LAND	PEACE, JUSTICE AND STRONG INSTITUTIONS	PARTNERSHIPS FOR THE GOALS
Algeria	↗	→	↗	↗	↗	↗	↗	→	↗	••	↗	••	→	→	↗	↗	↗
Bahrain	••	••	↗	↗	→	↑	↗	↗	→	••	→	••	↑	↗	↓	→	••
Comoros	→	→	→	↓	→	↓	↗	↗	→	••	→	••	↑	↓	↓	↗	↓
Djibouti	↑	→	→	→	↗	→	→	→	↑	••	↓	••	↑	↓	↓	→	↑
Egypt	↗	↗	↗	↗	→	↗	↗	↗	↗	••	→	••	↑	→	↗	→	↑
Iraq	↗	→	→	••	→	↗	↗	→	→	••	→	••	→	→	↓	→	↓
Jordan	→	→	↗	↓	→	↑	↗	→	↗	••	↗	••	↑	→	↑	↗	→
Kuwait	••	↗	↗	→	→	↑	→	↗	↗	••	↓	••	↗	↓	→	→	••
Lebanon	↑	→	↗	↗	→	↑	↗	→	↗	••	↓	••	↑	→	↗	→	↓
Libya	••	↓	→	••	→	↗	↗	→	→	••	↓	••	↗	→	↗	↓	↗
Mauritania	↑	↓	→	→	→	↗	↗	→	→	••	↓	••	↑	→	↗	→	↓
Morocco	↗	→	↗	→	↗	↑	↗	→	↗	••	→	••	↑	→	↓	↗	↓
Oman	••	→	↑	↗	→	↑	↗	↗	↗	••	↓	••	↗	→	↓	↗	••
Qatar	••	••	↗	↗	↗	↑	↗	↗	↗	••	↓	••	↓	→	↓	↗	••
Saudi Arabia	••	→	↗	↗	↓	↑	↗	↗	↑	••	→	••	↓	→	↗	↓	••
Somalia	→	→	→	••	↗	↓	→	↗	→	••	↓	••	↑	→	↓	→	↗
Palestine	→	••	↗	↗	→	→	↗	→	••	••	••	••	••	••	••	••	↓
Sudan	↓	↗	↗	→	→	→	↗	↗	↗	••	↓	••	↑	↗	↑	↗	↑
Syrian Arab Republic	••	↓	↗	↓	↓	→	→	↗	→	••	↓	••	↓	→	↗	→	↓
Tunisia	↗	↗	↗	→	→	↑	↗	→	→	••	↓	••	↑	→	↗	↗	↓
United Arab Emirates	••	↗	↗	↗	→	↑	↗	↑	↑	••	→	••	↓	↗	→	↗	••
Yemen	••	↓	→	→	→	↑	→	→	↗	••	↗	••	↑	→	↓	↓	↓

Source: SDSN, 2019, p. 13.

As illustrated in figure 3, 15 Arab countries still face significant challenges in the implementation of SDG 11, with collected data showing that performance of most is either stagnating or deteriorating. In addition, missed data are related to targets that fall into three main categories (ESCWA, 2020a, p. 147): (1) targets to ensure

inclusive cities and participation of civil society in human settlement planning and management (i.e., targets 11.2, 11.3, 11.7 and 11.a), (2) targets to ensure sustainability in land management (i.e., targets 11.6, 11.3, 11.7, 11.a, 11.b and 11.c), and (3) targets to ensure resilience to human-caused disasters (i.e., targets 11.5, 11.6 and 11.b).



3.

Pandemic resilience and role of smart digital solutions

Shocks and pandemics have deep and long-lasting impacts on cities all over the world, and those of COVID-19 have been multidimensional. Isolation measures have caused incomes to collapse, aggravated the already deep economic and social inequalities, engendered a wave of domestic violence, and heightened racism. Vulnerable populations, such as women, the elderly, persons with disability and people who live in densely populated or informal areas, have been the most strongly impacted, compounding the difficulties they had in accessing essential urban services, such as healthcare, and educational and financial services (Moraci and others, 2020, p. 2). In response, cities have started to deploy various

types of digital technologies to provide smart digital solutions aimed at minimising the consequences.

This chapter highlights the concept of pandemic resilience and discusses the socioeconomic impacts of the COVID-19 pandemic on the Arab region. It also highlights how the use of smart digital solutions has helped in combating the pandemic, with a focus on maintenance of safety and inclusion within cities, which, along with urban resilience, are critical factors in developing sustainability of cities. Indeed, all three, i.e., safety, inclusion and resilience, are interlinked and constitute hallmarks of the sustainable city of SDG 11.

A. Pandemic resilience

Impacts of pandemics vary from one city to another depending on the disease and the conditions of the society it afflicts. Various types of infectious diseases still pose a considerable threat to numerous societies globally; some, the endemics, are found within specific geographical areas, while others, the epidemics or pandemics, can spread across regions. An example of the latter is the current COVID-19 pandemic (European Parliament, 2020, ps. 1-2). The unexpected outbreak of an epidemic or pandemic could have immediate as well as long-term socioeconomic impacts of varying degrees on countries, leaving resilience and sustainable development of afflicted cities at stake.

The Edmond J. Safra Centre for Ethics at Harvard University (ESCE, 2020, p. 11) defines pandemic resilience as “*the tools that permit a society to control a highly infectious disease while preserving*

essential public institutions, mobilizing the economy to provide surge capacity to fight the disease, and keeping the rest of the economy maximally open”. Thus, the infrastructure of pandemic resilience entails an adequate toolset for controlling the various impacts of the pandemic, while reducing economic consequences of the measures taken.

By leveraging high technologies, especially those of the 4IR, cities could fight pandemics like COVID-19 employing unprecedented tools to build a steady, strong infrastructure for pandemic resilience. For example, Artificial Intelligence (AI), the Internet of Things (IoT), big data, advanced robotics, biotechnologies, 3D printing, and wearable technologies could provide the tools needed for providing a wide range of potential solutions to combat a pandemic and deal with its associated socioeconomic impacts (Ibrahim, 2020b, p. 3).

B. Socioeconomic impact of COVID-19 in the Arab region

The COVID-19 pandemic is far from being a mere health crisis, for it is impacting the core

of societies and economies, exposing serious vulnerabilities and fault lines across institutions,

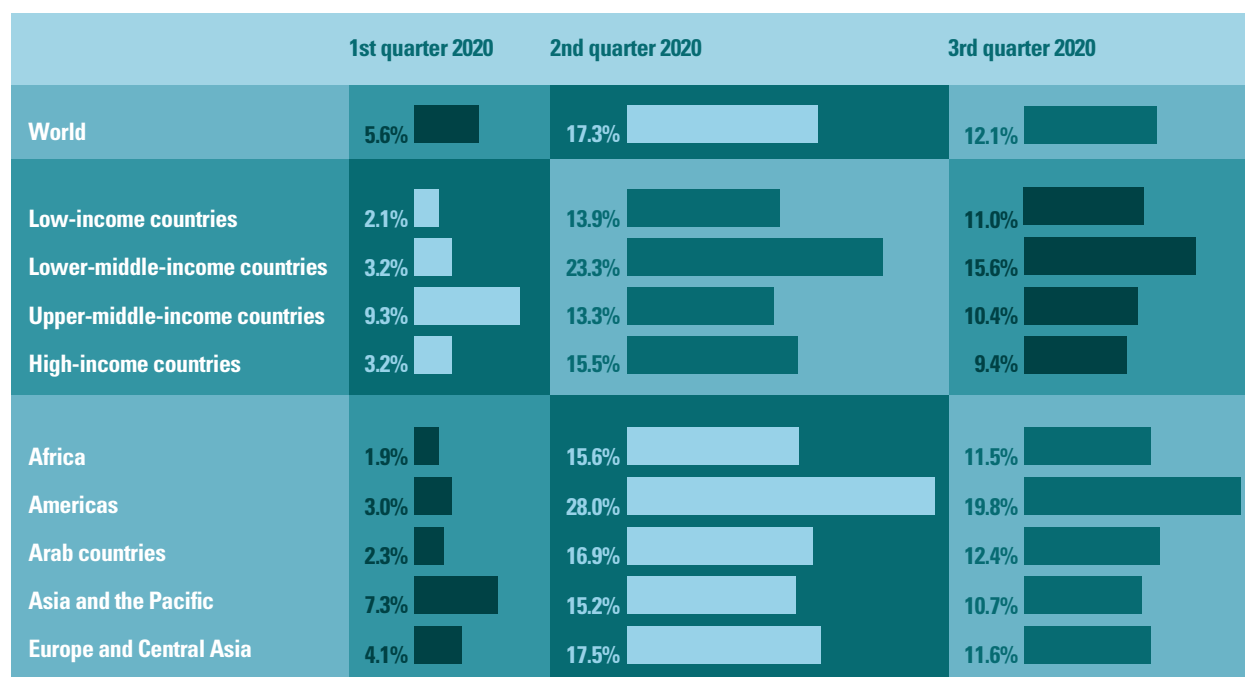
societies and economies all around the globe. Impacts on the Arab region have been significant and are likely to be deep and long-lasting. These include huge negative effects on public health, and shocks to food systems, educational systems, economies and labour markets.

Arab cities contribute most of the GDP of their countries. Hence, their closure to control the pandemic resulted in massive drops in the real GDPs in Arab countries. Between January and mid-March 2020, businesses in the region lost \$420 billion in market capital and countries lost nearly \$11 billion in net oil revenues (ESCWA, 2020, p. 2). The International Monetary Fund (IMF) Databank indicates that due to the impacts of the ongoing pandemic, all Arab countries suffered in 2020 excessive drops in real GDP growth, compared with 2019. Indeed, the rate of growth in all Arab states, except for Egypt, was negative, indicating decline. The most affected countries were Libya, Iraq, the State of Palestine and Oman, with GDP growth rates of -66.7 per cent, -12.1 per cent, -12 per cent

and -10 per cent in 2020 respectively, compared with 9.9 per cent, 4.4 per cent, 0.9 per cent and 0.8 per cent, in 2019, respectively. However, IMF estimates show that GDP growth in all Arab countries is expected to recover in 2021.²²

According to the International Labour Organization (ILO, 2020, p. 5), there was a severe drop in working hours across the entire Arab region during the second and third quarters of 2020, with regional statistical data showing that working hours losses amounted to 16.9 per cent and 12.4 per cent, respectively, compared with 2.3 per cent in the first quarter, which averages to 10.5 per cent over the three quarters. The resulting loss in the share of labour income in the economy affected economic growth in all Arab countries negatively. Notably, the use of digital platforms has mitigated, to some extent, the negative impact of lockdown and the loss of working hours. Figure 4 shows working-hour losses for the first three quarters of 2020 for the world, and by region, including the Arab region, and income group.

Figure 4. Working-hour losses, world and by region and income group, first, second and third quarters of 2020 (Percentage)



Source: ILO, 2020, p. 5.

ILO data also show that the unemployment rate in the Arab region for people aged 15 or over increased from 8.1 per cent in 2019 to 9.9 per cent in 2020.²³ More importantly, although all available data are provisional estimates, there are alarming trends in the expected loss in 2020 of 1.7 million jobs (ESCWA, 2020b, p. 2) and the anticipated rise of the total poor by 14.3 million, which would raise the total to 115 million people (United Nations, 2020a,







p. 14). Evidently, urgent action by policy makers is called for, as the anticipated total number of the poor is almost equal to one quarter of total Arab population. Moreover, all the above-mentioned facts and statistics are directly related to urban economic resilience, which highlights importance and urgency of Arab cities taking resilience enhancement measures, including deployment of all possible, appropriate smart digital solutions.

C. Smart digital solutions for combating COVID-19

Smart digital solutions, based on emerging technologies that form the key building blocks of SSCs and the 4IR, have been deployed to combat the ongoing pandemic and mitigate its socioeconomic impacts of on nations at various levels and in several

ways, from tracking and tracing positive cases to managing lockdowns and delivering food. A small selected list of potential smart solutions for fighting the pandemic and its social, economic and environmental impacts is given in table 4 (UNIDO, 2020, p. 8).

Table 4. Selected potential smart digital solutions for combating COVID-19 and its impacts

	Responses to the HEALTH CRISIS	Responses to the ECONOMIC CRISIS
Drones 	<ul style="list-style-type: none"> • Delivery of critical supplies • Disinfection of public spaces • Measurement of body temperatures • Enforcement of quarantine controls 	<ul style="list-style-type: none"> • Increased efficiency on delivery of services • Scan extensive and highly populated areas and broadcast information
Robotics 	<ul style="list-style-type: none"> • Monitoring and assisting patients • Optimisation of medical stock • Delivery of medicine and food 	<ul style="list-style-type: none"> • Remote inspection, repair and maintenance • Semi-autonomous operations
3D printing 	<ul style="list-style-type: none"> • Production of medical equipment and essential components 	<ul style="list-style-type: none"> • Counteract component shortages • Design and test prototypes for new products
Blockchain 	<ul style="list-style-type: none"> • Digital identity, including health status • Medicine safety tracking • Management of healthcare claims 	<ul style="list-style-type: none"> • Resilience of supply chains • Traceability and transparency about the origin and transformation process
AI and big data 	<ul style="list-style-type: none"> • Analyse data and model viral outbreaks • Assist the development of vaccines • Analyse patterns to improve control 	<ul style="list-style-type: none"> • Data and trend analysis to predict demand changes and assess impacts
IoT 	<ul style="list-style-type: none"> • Public health data collection • Analyse air quality inside buildings • Assist transport of critical goods • Surveillance applications 	<ul style="list-style-type: none"> • Improve accuracy and response time • Enhance understanding of consumers preferences and needs • Digital twinning of industrial facilities to enable quick switch of production lines

The fallout from the pandemic has redirected attention towards SSCs and smart digital solutions. Several governments started considering adoption of the SSC paradigm to achieve digital transformation of cities, since it offers considerable scope for innovative solutions to provision of essential social services, development of new businesses, and enhancement of economic and social resilience against unforeseen shocks. Examples of current use of smart digital solutions in response to the pandemic include AI being

used in developing vaccines and tracking infected personnel using people-tracking wristbands; robots to deliver medical supplies and meals within hospitals and to patient rooms; and drones to spray disinfectant on public areas, deliver groceries, restrict movements during lockdowns, and measure body temperature; while 3D printing technology is being used in regenerative medicine and tissue engineering to create living human cells and tissues, as well as in producing medical equipment.

1. Smart digital solutions to enhance urban safety

One of the main issues in developing a resilient city is protection and improvement of life. Urban safety is also a main target for SDG 11. The New Urban Agenda, issued by UN-Habitat, defines urban safety as *“enabling city’s inhabitants to live, work and participate in urban life without fear of violence and intimidation, taking into consideration that women and girls, children and youth, and persons in vulnerable situations are often particularly affected”* (United Nations, 2017, p. 9). Thus, for a city to be safe, it needs to create conditions conducive to promotion of the mental and physical health residents, including through guarding against health risks stemming from pandemics. The city also needs to be prepared for and respond to unexpected emergencies, such as floods, fires, and natural disasters, in addition to crime prevention and promotion of social cohesion and peaceful coexistence. Examples of common urban safety issues include unsafe streets (e.g., potholed and/or unilluminated streets), unsafe transportation (e.g., unenforced road rules and regulations, loose electrical wires), crime (e.g., thefts, muggings), and gender safety (e.g., violence against women and harassment of women and girls) (Roberts, 2018, p. 7).

Among other things, the use of new technologies, such as sensors, AI-based thermal imaging cameras, and IoT devices, help manage traffic, reduce fatalities, slash greenhouse gas (GHG) emissions, accelerate emergency response

times, and lighten the burden of disease. Cities would then be both more resilient and more sustainable. Such technologies were already in use before the pandemic, but some were upgraded to mitigate its dire consequences on people and cities, as illustrated in table 4.

Smart digital solutions:

- Can significantly enhance **traffic safety**. Smart algorithms, applications and devices that collect real-time traffic data can be used to manage and reduce traffic congestion, by providing drivers with real-time alerts and advice regarding the slowest and fastest routes, as well as by applying variable speed limits. Moreover, car accidents can be predicted using big data from connected cars, helping cities respond quickly to emergencies, thus reducing fatalities and curbing traffic jams by quickly clearing hazards.²⁴
- Are unlocking the potential of real-time data in **prediction and prevention of crime and terrorism**. Gunshot detection systems, intelligent video security cameras, home security systems, crime-mapping platforms, crowdsourced crime alerts, and smart tools for detection of threats used in large crowds are examples of technologies being used to gather real-time data to combat crime and terrorism. Used well, these technologies can help city authorities run facial recognition systems, read license plates, map crime and terrorist

networks, and detect suspicious anomalies; all of which help cities predict and deter crimes and acts of terrorism before they occur.²⁵

- Can contribute greatly to **reduction of GHG emissions** through use of tools such as smart grids and smart meters, and institution of smart buildings and smart transport. Replacing traditional fossil-fuel vehicles, which are a main cause of environmental pollution, by electric vehicles in smart transport solutions can make a significant contribution. According to Ericsson, smart digital solutions can potentially reduce the global GHG emissions by 12 per cent by 2030, and by 15 per cent if used also in agriculture. Smart grid solutions have the largest reduction potential, ranging from a medium estimate of 1.6 per cent to a high estimate of 3.9 per cent, while the corresponding range is 0.9-1.4 per cent for smart buildings, and 0.6-1.1 per cent for smart transport. (Ericsson, 2015, ps. 1, 3 and 4).
 - Can play a key role in **empowerment of women and girls and promotion of gender equality** by enhancing and facilitating access of women and girls to various resources, including information, and capacity building initiatives and services. In addition, smart digital solutions can assist in combating violence against women and girls by enhancing their security and by allowing them to organise campaigns to raise their voice. For example, social media have been used by Egyptian women and girls to create online campaigns, such as the “Shoft Taharosh (I Saw Harassment)” initiative, to raise awareness of sexual harassment in public spaces (UN-ESCWA, 2019b, p. 50).
- Have been used during the COVID-19 pandemic around the globe to enhance the **safety and comfort**. Examples are numerous:
- Automatic disinfection systems have been used to disinfect surfaces of luggage in airports and bus stations to minimise the spread of the coronavirus.
 - Smart automatic temperature measuring and hand sanitiser machines, equipped with audio modules and large, contactless screens to provide instructions on how to proceed and to show body temperature, have been installed at entrances of public and private establishments, public spaces, and shopping malls, to eliminate contact between people and ensure public safety.
 - Smart helmets, each with an infrared camera, have been deployed to automatically detect body temperature and recognise faces, guaranteeing safety and security of police officers. Such a helmet with the ability to scan the temperature of hundreds of people every minute has already been used by police in the United Arab Emirates in combatting the coronavirus.
 - Mobile applications have been used to provide information on the disease and techniques of protection from it, and, by using real-time data from national health organisations and interactive maps, to make citizens aware of affected areas and exact location of infected people.
 - AI-based thermal imaging cameras have been widely used to scan public spaces to identify any potentially sick people.

2. Smart digital solutions to enhance urban inclusion

Urban inclusion implies that “no one is left behind”, with the United Nations defining it as *“the process of improving the terms of participation in society, particularly for people who are disadvantage on the basis of age, sex, disability, race ethnicity, origin, religion, or economic or other*

status, through enhanced opportunities, access to resources, voice and respect for rights” (United Nations, 2016, p. 20). Thus, ensuring inclusion in a city entails providing the conditions for all citizens participating in the economic, social, political, and cultural institutions and activities of society.

Smart digital solutions can serve as a critical channel for urban inclusion. For example, through mobile applications and online services, they allow all citizens to access, including in real-time, permissible city data collected from diverse sources with due consideration of issues of data privacy and sensitivity. New technologies are also connecting people with information sources and opportunities, such as those pertaining to public services, skills training, markets, jobs, and legal rights. Moreover, these technologies, particularly the ICTs, can facilitate good governance, enhance interaction with citizens, and increase efficiency of public services, thereby improving resilience and sustainability of cities.

To curb the spread of the coronavirus during the pandemic, governments imposed successive lockdowns and confinement measures. Various types of technologies have been used to sustain the daily life of people under lockdown and support continuity of business and educational systems. For example, more than 90 per cent of governments have already implemented remote learning to address the needs of around 1.6 billion students impacted by this crisis.²⁶ Online platforms, such as Zoom, MS Teams, CISCO WebEx and Google Meet, are being widely used to guarantee continuity of school and university

work during closures. These platforms are also used to support the working from home modality adopted by many businesses around the globe, as well as to organise virtual meetings, fora, and conferences. Governments and healthcare institutions have also used online applications to publish information to citizens and communicate with them, either to provide support or to get feedback on urban services and needs;²⁷ all of which has helped facilitate transparency in governance and urban inclusion.

The pandemic is also driving many countries to adopt such e-health services as teleconsultations, in addition to using mobile contact tracing and warning applications to inform citizens if and when they come in proximity of or in contact with persons infected by the virus and encourage them to contact their health authorities if they need health support.²⁸ Moreover, several governments have used digital means to extend social protection coverage and disburse financial support more efficiently, especially in support of the most vulnerable. For example, the JoMoPay e-Wallet initiative of Jordan is a mobile application that offers Syrian refugees and local communities, who have no access to banking services due to the pandemic, the opportunity to pay bills, receive salaries and repay loans.²⁹

3. Smart digital solutions in urban services

In addition to enhancing urban safety and inclusion, smart digital solutions can also reduce the impact of existing, context-specific urban challenges at all city levels, through providing digital services and tackling problems at various urban systems, such as those for energy generation, transport, waste disposal, and pollution control. In the following, some examples are cited.

- IoT enabled sensors are used to collect real-time data to detect leaks in water pipes

and send alerts to responsible engineers to take on-time actions to mitigate the consequences. The sensors are also used to monitor the distribution of water across the network, measure water level and provide real-time flood warnings.

- In energy systems, smart grids use smart appliances to alert operators to imminent acute problems. For example, in some cities power consumption of traffic lights is monitored in real time. Moreover, demand response

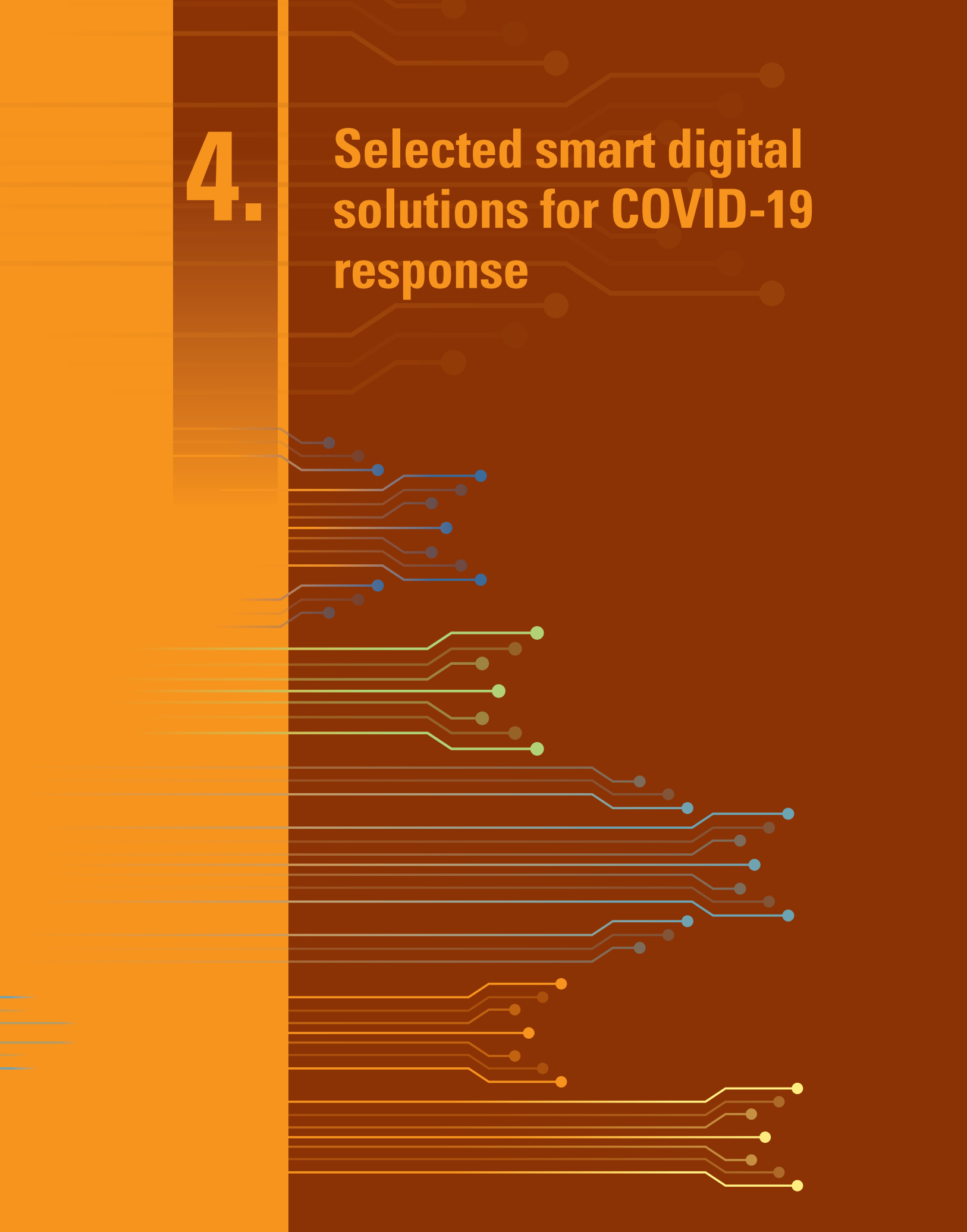
models reschedule demand for energy to a different appropriate time if it is found to exceed capacity; conversely, when demand is detected to be low, the quantity of the energy distributed is reduced. Hence, energy is distributed more effectively, energy demands are controlled more efficiently, and continuity of provision of energy services is ensured, while reducing both energy loads and prices.

- AI provides smart digital solutions to make life easier. For example, AI-based robots are used in some factories to detect and deal with chemical spills. These robots are intelligent enough to recognise the type of the chemical substance involved, realise the risk, and decide according to the nature of the hazard whether to clean the spill or contact authorised officials.

During the ongoing pandemic, governments globally have been restricting face-to-face contacts, forcing companies, organisations and factories, including water and electric utilities, to implement working from home protocols, when possible. Use of the technologies involved in the foregoing examples must have been invaluable in reducing risks of impending acute problems. Water and energy engineers could work from home and respond to problems upon getting alerts from already deployed smart digital systems; installed robots could ensure continuity of work in large factories without the need for having all employees in place; and governments could provide online smart services over the Internet or through Mobile applications to ensure the continuity of the needed government services as well as to share and exchange data and information with citizens.

4.

Selected smart digital solutions for COVID-19 response



Digital technologies have become integral to daily life during the pandemic. Countries, organisations and companies have switched to online work and education to ensure continuity of critically important processes, and many governments and institutions around the globe have also urgently accelerated development of digital strategies and policies to mitigate the disruptive impact of the pandemic on individuals, companies, institutions, societies,

and economies. As a result, various types of smart digital solutions have been deployed as part of pandemic-response strategies, including AI, robots, drones, self-driving cars, digital payments, online platforms, and smart wristbands.







This chapter highlights selected examples used around the globe generally and in the Arab region in specific, and addresses challenges facing Arab countries in this regard.

A. Smart digital solutions from selected global cities

- AI and big data have helped in tracking people in several countries, reducing the spread of infection. For example, to help disrupt virus transmission, Chinese authorities used AI and big data tools, such as migration maps, to collect real-time data on location of people who had visited the Wuhan market, the epicentre of the pandemic. The maps collected data from transportation records, mobile phone numbers and online payment records.³⁰
- Singapore has launched a mobile phone application called “TraceTogether” to reduce transmission. The application exchanges short-distance Bluetooth signals between mobile phones to detect other users of the “TraceTogether” when individuals are in proximity to each other. Collected data are stored in mobile phones for 21 days. The Ministry of Health uses these data to identify contacts of any person diagnosed positive and sends warning messages to enable them to take appropriate precautions.³¹
- In April 2020, Germany launched a smart application to gather temperature, pulse and sleep pattern data from people wearing smartwatches to screen for flu-like symptoms. Collected data are presented on an online interactive map available to health authorities and the public, allowing them to assess prevalence of infection across the nation.³²
- AI-based thermal and HD cameras, designed to raise an alarm when the temperature of a person reaches a dangerous level, were used in China and the United Kingdom to scan public spaces for potentially infected individuals.
- Robots were used in China to deliver food to patient rooms and medical supplies within hospitals to guarantee contactless delivery.
- Drones were widely deployed to spray disinfectants on public spaces in China, Honduras and Spain and to deliver groceries to quarantined areas in Australia, China and the United States, and to restrict movements of citizens in Belgium, China, France, Italy, Spain and the United Kingdom.
- Global Positioning System (GPS) technology, using interactive maps, has been used in China, Germany, India, Poland, Singapore, the United Kingdom and the United States to provide awareness data on the disease and exact locations of infected individuals and areas.
- To monitor movements of people diagnosed with Covid-19, smart wristbands, each of which alerts the authorities when the wearer leaves her/his home or tries to remove it, have been used in Belgium, India, Hong Kong and South Korea (Ibrahim, 2020b, p. 3).

Table 5 cites selected examples from around the world, excluding the Arab region.

Table 5. Examples of smart digital solutions used globally, excluding the Arab region, during the COVID-19 pandemic

	Function	Technology used	Countries/examples
Disease tracking 	Real-time tracking of spread of disease	Migration maps, data dashboards, real-time data from mobile phones, AI, machine learning, wearable technology	China, Germany, Italy, Singapore, Sweden, Taiwan, United Kingdom, United States
Screening for infection 	Screening populations and individuals for disease	AI, thermal and HD cameras, digital thermometers, mobile phone applications	China, Iceland, Germany, Singapore
Quarantine and self-isolation 	Enforcing quarantine and self-isolation	AI, drones, GPS systems, cameras, smart wristbands, mobile phone applications	Australia, Belgium, China, France, Germany, Iceland, Italy, South Korea, United Kingdom
Contact tracing 	Identifying, warning and tracking individuals who come in contact with an infected person	Web-based toolkits, GPS systems, wearable technology, mobile phone applications, real-time monitoring applications and devices	China, Germany, Singapore, South Korea
Health and clinical management 	Diagnosing infected individuals, predicting clinical outcomes, monitoring clinical status, providing capacity for telemedicine services and virtual care	AI for diagnostics, robots, online platforms for virtual care and/or telemedicine, machine learning	Australia, Canada, China, Ireland, United States
Business and learning continuity 	Ensuring continuity of work and learning	Online platforms (e.g., Zoom, Google Meet, MS. teams), web-based toolkits and applications	Australia, Belgium, China, France, India, Netherlands, Spain, Singapore, United Kingdom, United States

B. Smart digital solutions from selected Arab cities

To reduce and/or control the number of new cases of Covid-19, most Arab governments have taken some of the world's strictest measures, including suspension of passenger flights, closure of land borders, and imposition of lockdowns. In addition, to varying degrees

depending on the level of development of the country, they have been deploying sophisticated technologies to ensure social distancing and limit movement during lockdowns, through the use of drones, digital and HD cameras, and robots. Some Arab governments have used

location-based contact tracing applications and devices to monitor individuals who have tested positive and limit their contact with others. Online platforms have also been used to guarantee continuity of work and learning, while mobile phone applications have been deployed to send citizens awareness raising messages about the pandemic. In the following, some examples are given.

- ‘ALHOSON UAE’ and ‘TraceCovid’ in the United Arab Emirates,³³ ‘BeAware’ in Bahrain,³⁴ ‘Tabaud’ (i.e., distancing) and ‘Tawakkalna’ in Saudi Arabia³⁵ and ‘Wiqaytna’ in Morocco³⁶ are all proximity tracking applications that use location data to send an alert to the individual when closeness to or contact with someone infected is detected.
- In support of online learning, the Emirati Telecommunication Regulatory Authority announced availability on all networks in the country of five free-to-use educational applications: Google Meet, Avaya Spaces, Slack, Cisco WebEx, and BlueJeans.
- With the aim of increasing public safety during the pandemic, the Jordanian government launched the ‘Mouneh’ platform, which is essentially an electronic directory of licensed companies and applications that provide goods delivery services to households across the country using electronic ordering.³⁷
- Drones have been used in the United Arab Emirates to spray disinfectant on public spaces; in Jordan, Kuwait, Saudi Arabia, and the United Arab Emirates to restrict population movements; in Saudi Arabia to measure body temperature of people (Ibrahim, 2020, p. 3); and in Qatar to spread awareness messages in several languages using loudspeakers asking residents to adhere to safety measures and urging them to stay home.³⁸
- Electronic wristbands or bracelets have been deployed in Algeria, Bahrain, Jordan, Kuwait, Oman, Saudi Arabia, and the United Arab Emirates to ensure that individuals diagnosed with COVID-19 stay at home for the duration of their quarantine or isolation.
- The United Arab Emirates police has started using smart helmets to monitor those who may be infected with the virus.
- During the pandemic lockdown period, use of non-contact digital payments has been widely adopted in GCC countries.
- To ensure continuity of public services, the Moroccan Ministry of Economic, Finance and Administration Reform released a telework guide aimed at offering government employees and civil servants the opportunity to carry out their professional duties, either completely or partially, from various locations without needing to be in the workplace in person.³⁹
- The Greater Amman Municipality has adopted Accela Cloud Technology (Accela’s Software as a Service) as a smart digital solution to reintroduce approved business operations and keep critical citizen services running while maintaining public health and safety guidelines in the Jordanian capital.⁴⁰
- The Government of the United Arab Emirates launched the DOH RemoteCare application, which is a free, virtual doctor for COVID-19 that enables people to receive healthcare services at home without the need for visiting a clinic or hospital physically. The application has a smart tool to examine symptoms, book appointments, diagnose non-emergency cases, provide teleconsultation with doctors, either using voice calls, video calls, or text messages. It also enables users to get medicines delivered to their homes.
- The Egyptian General Healthcare Authority has started applying telemedicine to provide more than one million citizens in Port Said governorate, through an online application named Al-Balto (i.e., Coat in Arabic), with various medical care services in both Arabic and English in eight specialisms: paediatrics, dermatology, obstetrics and gynaecology, nutrition and venereology.⁴¹
- Uniquely in the Arab region, Tunisia has built and deployed a police robot to patrol public areas of the capital, Tunis, to monitor

application of quarantine procedures. The robot, which was developed locally by a Tunisian company called Enova Robotics, is a small armoured vehicle equipped with sensors, a microphone, a thermal camera, and surveillance cameras that are controlled remotely; along with laser and GPS systems and a long-range Wi-Fi connection.⁴²

- Although most Arab governments do not accredit remote distance learning, most, such as Egypt, Jordan, Lebanon, Kuwait, the State of Palestine, Tunisia, Saudi Arabia, and the

United Arab Emirates, have adopted online learning techniques to ensure continuity of the learning process and limit spread of the coronavirus among students at schools and universities. Educational systems in these countries had to accept this learning modality as a temporary solution.

- Likewise, many companies in the region that have implemented the working from home modality including conducting conferences, workshops, fora, and meetings via online platforms, consider this to be temporary.

C. Challenges facing the Arab region during the COVID-19 pandemic

The COVID-19 pandemic has significantly impacted various aspects of life, including employment, education, health services, travel, economy, and daily activities. It has also increased internet consumption during lockdowns and quarantine for working, learning, information-seeking and sharing, communicating, and entertaining. As in the rest of the world, the Arab region has endured a great deal of suffering and Arab governments have tried to mitigate the impact by the use of appropriate, smart digital solutions. However, not all Arab countries are capable of providing an adequate level of digital services and/or apply smart digital solutions. Pertinent challenges are summarised below.

1. Economic challenges: The pandemic has aggravated the economic challenges facing the Arab region at a time when it has not yet recovered fully from the 2008 global financial crisis and the drop in oil prices in 2014. In addition to the drop in working hours, and the rising unemployment levels resulting from the lockdown measures taken by countries across the region, many countries are highly dependent on oil and gas resources, tourism, and remittances, all of which have been negatively impacted by the pandemic. These factors combined significantly diminished real GDP growth in Arab countries, which in turn reduced

their financial capacities. Deployment of smart digital solutions during the pandemic requires financial investments of volumes that are highly dependent on the type of technology to be used, from online services to robots and AI systems. However, the amount of investment that could be provided relies heavily on the economic strength and development level of a country. In term of economic development, Arab countries can be divided into four categories: oil countries, non-oil countries, Least Developed Countries (LDCs) and Conflict Afflicted Countries (CACs). Most of the oil countries (i.e., GCC countries) have been able to use various types of technologies to mitigate impacts of the pandemic, while non-oil countries have been able to provide smart digital solutions at a comparatively lower level. LDCs and CACs, on the other hand, were already limited in their ability to respond effectively to the pandemic in general, let alone apply smart digital solutions.

2. Conflicts and instability: Arab countries caught up in armed conflict and those under instability conditions face deep, long-lasting specific challenges that undermine their ability to deploy smart digital solutions. Armed conflicts tend to be concentrated in urban areas, affecting civilians severely in terms of casualties, as well as destruction of basic urban services.

Most infrastructure, including digital, in Arab countries caught up in armed conflicts, such as Iraq, Libya, the Syrian Arab Republic, and Yemen, has suffered from massive destruction, generally reducing the ability to deliver digital services in mitigation of the pandemic, and these conflicts have impeded the necessary health response to the pandemic. In Lebanon, which faces domestic instability, the severe political, economic, and financial crises have pushed the country to the edge of total collapse.

3. **The digital divide:** Responses to the COVID-19 pandemic in the region have exacerbated the digital inequalities, both within and across countries, that are often referred to as the digital divide; itself a critical barrier to access to smart digital solutions. The elderly, who have a high level of illiteracy; marginalised groups, such as women and persons with disabilities; and residents of small and poor cities, rural areas, refugee camps and remote areas, underserved or unserved by broadband have not benefited from solutions such as telecommuting, e-learning, e-commerce, digital cash transfers, and e-conferencing. The pandemic, through the effects of the digital divide, has exacerbated socioeconomic inequalities in the region.
4. **Digital skills divide:** The pandemic has highlighted and widened the digital skills divide across the world, including in the Arab region. It has also cast a spotlight on the vital role of digital skills in all aspects of life and the need for enhancing digital education, since digital skills are required for telecommuting, distance learning, data analysis, communication and use of online platforms, and e-commerce and e-delivery services. In the region, vulnerable

people, including women, the elderly, persons with disabilities and refugee workers, are some of those with poor digital skills. Smart digital solutions in response to the pandemic were deployed at various levels in some countries, and not at all in others. Those on the wrong side of the digital divide could not benefit from them where offered. Hence, the pandemic has not only revealed the digital skills divide between countries, between women and men and between rich and poor, but also widened it.

5. **Digital infrastructure:** The poor or outdated digital infrastructure in some countries of the region rendered them unable to provide essential digital services to their citizens during the pandemic.
6. **Vulnerable groups and inequality:** The COVID-19 crisis has exacerbated existing vulnerabilities of all social groups. Vulnerable groups in Arab countries, including women, persons with disabilities, the unemployed, the elderly, refugees, workers in the informal sector and those living in slums, are at risk of becoming even poorer and more vulnerable. In particular, at 25 per cent only, economic participation of Arab women is the lowest in the world and they have limited access to land and financial resources (United Nations, 2020a, p. 15), and the pandemic has put additional economic impacts on them due to the loss of income and isolation resulting from lockdowns and pressures on the Arab economies. In addition, at 37 per cent, the ratio of Arab girls and women who suffer gender-based violence had been already high (United Nations, 2020a, p. 15) and the risk has been heightened due to the psychosocial pressures of lockdowns.

5.

Recommendations: smart digital solutions for urban economic resilience during and after COVID-19



The dire consequences of the pandemic are likely to prove deep and long-lasting, requiring multidimensional actions to reduce impact on urban areas. Achieving urban recovery and resilience in the Arab region during and after the pandemic entails well-organised efforts and actions. Following are relevant recommendations, divided into two main categories, covering (1) the early recovery phase, focussing on actions needed during the spread of successive waves of the pandemic; and (2) the new normal phase, focussing on actions to consider after the end of the pandemic or subsequent to vaccination of the population against the virus.

1. Early recovery phase:

- a. **Apply precautionary measures to help prevent the spread of the COVID-19 virus:** To ensure resilience and sustainability of societies, Arab countries need to continue taking all needed precautionary measures to protect cities and citizens from potential further waves of the pandemic, including enhancing their adaptabilities for any possible external shocks. Cities can return to normal life only gradually, following careful, well thought out plans. Remote working and learning could be maintained when needed, until the threat of the pandemic ceases or most of the population is vaccinated.
- b. **Extend application of adequate smart digital solutions:** Adoption and adaptation of adequate smart digital solutions is highly recommended. In each Arab country, use of advanced technologies would depend on economic level, available financial resources, and readiness level of digital infrastructure. Smart digital solutions could help maintain social distancing (e.g., in public areas, workplaces and banks), isolate and track infected people, monitor streets during lockdowns, share awareness messages (e.g., text, voice

and video messages), facilitate use of digital payments, and develop relevant mobile phone applications (e.g., for virtual healthcare). Governments need to work closely with local Internet providers to manage and maintain bandwidth for consumers and businesses, which requires new, urgent policies to tackle the challenge of high consumption during lockdowns while reducing cost to facilitate access to Internet-based services.

- c. **Apply well-planned actions to jump restart economies:** The economy is one of the critical areas that have been significantly impacted by the pandemic. Arab countries need to focus on jump restarting their economies, and mitigating the impact on affected and vulnerable groups, including providing all possible resources to aid local businesses that have been negatively affected in driving their revenues and maintaining business continuity. Moreover, governments need to plan carefully under the fiscally stressed and strained conditions they now face, which requires coordination with numerous stakeholders, including the private sector, sectoral agencies and community groups, to prioritize investments and develop integrated measures, thereby facilitating delivery of services and maintaining city resilience and sustainability. By delivering smart digital services, cities would also be moving toward being smart, inclusive, and green.
- d. **Provide appropriate, timely healthcare services:** Governments need to continue supporting healthcare services, targeting, in particular, slums and informal settlements that house poor people whose livelihoods have been badly disrupted. Establishing cooperation programmes with the private sector and civil society could help provide healthcare services and reduce the load on

the over stretched public healthcare system. The private sector could also contribute smart digital healthcare devices and solutions (e.g., e-health solutions and services) if it has the requisite experience and capabilities.

e. Pay special attention to vulnerable groups:

Special attention needs to be accorded to vulnerable groups to prevent further deterioration of their living conditions, including by providing accessible smart digital services and solutions. Cities could also introduce temporary measures to avert eviction of those unable to pay rents or mortgage; provide financial support and humanitarian assistance; and ward off disconnection of utility services, such as electricity, water and the Internet, to those unable to pay their bills.

2. New normal phase:

a. Enhance urban planning through promotion of resilience and sustainability of cities:

Impacts of the pandemic have highlighted the potential of cities in leading build-back-better efforts, as well as their crucial role as front-line responders in crises. Post pandemic, urban planning at all levels would need to be enhanced by mainstreaming public health considerations in all planning processes, and addressing inequalities in access to basic services, through setting targets for resilience, safety, inclusion, smartness, quality of life and sustainability. Moreover, planning would need to be radically changed from being reactive to emergencies to following proactive preparedness and decision-making approaches designed to expand capabilities for coping with unpredictable future crises. Furthermore, resilience and sustainability evaluations would have to be critically improved by advancing from single-hazard analyses to multi-hazards assessments.

b. Accelerate the process of transforming Arab cities into smart and sustainable ones: Arab cities that have not yet adopted strategies

and policies of transformation into SSCs need to initiate well thought out plans for doing so. A more digitally connected city can provide equitable opportunities to all; and collect, analyse and disseminate real-time data to provide citizens with context-based smart digital economic, social, environmental, and cultural services, including access to healthcare, while protecting socioeconomic and personal data. Smart applications facilitated by big data collection and ICT infrastructure would also contribute radically to enhancing resilience and sustainability. Finally, a smart city would foster innovation and entrepreneurship, provide an environment conducive to empowerment of citizens, build capacities, develop infrastructure, and use appropriate indicators and indices of progress.

c. Strengthen use of new and future technologies: The Arab region needs

to develop the capacity not just to use technology but also to produce it; for example, for testing for viruses and developing vaccines. Although the use of many 4IR technologies, such as virtual reality and AI, in most domains, except in the medical sector, does not need particular laws and legislations (UN-ESCWA, 2019c), law makers in each Arab country need to enact laws to facilitate use of technologies such as drones, autonomous vehicles, robotics, blockchain, nanotechnology for medical applications, and biotechnology, while ensuring that innovation is incentivised, rather than stifled.

d. Devote efforts to coping with the unforeseen future crises: Arab countries can be part

of the global scientific efforts aimed at addressing unexpected future crises through participation in collaborative regional and international Research and Development (R&D) programmes and projects that help bring together the best minds and available data from different countries around the globe for the benefit of all. Such efforts would additionally strengthen the R&D ecosystem in the Arab region.

- e. **Make vigorous efforts to close the digital divide and ensure digital rights:** Arab countries need to develop strategies and frameworks to close the digital divide by digitally empowering marginalised groups, such as women, the elderly, persons with disability, and people in poor areas. Governments need to promote universal access to the ICT infrastructure, enhance literacy and digital skills, and ensure affordability and connectivity. Moreover, adequate national plans, strategies, policies, and laws need to be developed to ensure digital rights for all, including the right to access and use all types of smart digital solutions and services, including the Internet, ensuring that no one is left behind.
- f. **Intensify efforts towards achieving urban resilience and sustainability:** Arab countries need to accelerate efforts to improve urban, including economic, resilience and sustainable development, through establishing context-based resilience strategies and policies that explore connections among multiple and cascading hazards, in addition to finding means for integrating the global SDGs into all national strategic and development plans.
- g. **Boost gender equality and support the most vulnerable groups:** Additional efforts are needed for empowering women and girls, reducing gender-based violence, and supporting vulnerable groups, through enhancement of digital and other skills needed at the workplace, ensuring access to education and vocational trainings, either by traditional means or online, and finding means for transferring cash to the most vulnerable households, especially those headed by women. The role of girls and women as agents of change after the pandemic should be recognised and prioritised through involving them in planning, consultation and decision-making. Raising awareness of importance of using smart digital solutions to support reporting of gender-based violence at home and in public, as well as violence against boys, refugees, persons with disabilities and any other vulnerable group is also called for.
- h. **Improve educational systems:** Governments need to develop new visions for education to facilitate lifelong learning, innovation, and critical thinking. National and regional investment in scientific R&D should be boosted, given the technological evolution that will affect all future development sectors within cities and countries. In addition, new educational policies to accept distance learning modalities and accredit online certificates need to be developed, in cooperation with relevant national and international educational institutions.
- i. **Adopt remote work and virtual meeting modalities:** Enterprises with jobs that are amenable to teleworking need to consider continuing telework and virtual meetings to cut operational costs and reduce carbon emissions from urban mobility.
- j. **Reduce impacts of urban mobility on environment:** Policies and plans for promotion of eco-friendly models of urban mobility using green technologies and smart digital services, such as traffic sensors and smart parks, are needed. In addition to reducing the impact of urban mobility on the environment and climate change, the result would more inclusive, smart, resilient, and sustainable cities.

6. Conclusion



Urban structures can be eroded and/or compromised by shocks and stresses, threatening city resilience and sustainability. In addition to advancing resilience, sustainability and social cohesion in communities, smart digital technologies can provide innovative context-based solutions and address a vast range of challenges.

The COVID-19 pandemic has had wide-ranging socioeconomic consequences, including loss of lives and disruption to livelihoods. It has exposed low levels of urban resilience and high levels of vulnerability in times of crisis. Hence, urban planning and design need to put much effort into making cities more resilient, green, inclusive, smart, and sustainable, and thus able to accommodate variables and cope with unexpected conditions with minimal catastrophic failures. Indeed, adoption of best possible technologies to mitigate the impact of the pandemic on societies has already accelerated globally.

Like many others around the globe, Arab countries have acted quickly and decisively to mitigate the impacts of the pandemic, but the region has nonetheless sustained severe socioeconomic damage. Regional policymakers in cities have had to mitigate the threat to public health while taking urgent steps to rebuild local economies and guarantee adequate social safety nets. Immediate measures taken by most Arab countries include increasing healthcare spending to strengthen existing systems and

provide care to infected persons, and supporting local economies and ensuring liquidity. However, the average size of fiscal packages was smaller than in other regions around the globe.

Around the world, digital technologies have become increasingly integral to the daily life of people. Many Arab countries have already deployed in mitigation various smart digital solutions, ranging from use of interactive maps in tracking virus spread to use of drones and robots to spray disinfectants and deliver food and medical supplies. However, the pandemic has magnified many decades-long challenges that threaten resilience and sustainability of many cities and communities in the region. Urgent urban planning is needed to build back better, with the aim of meeting international standards and achieving SDGs, especially SDG 11 of “Sustainable Cities and Societies”, which requires tackling the digital divide, poverty, inequality, and unemployment. In addition, Arab countries that have not yet launched initiatives to make their cities smart and sustainable need to develop adequate national plans for that. Post-pandemic national development plans would need to consider all citizens, including the most vulnerable and marginalised groups, such as women, persons with disability and people living in small and poor cities, rural areas, refugee camps and remote area. Deciding on whether to target or ignore one or the other of these groups can ultimately make the difference between whether resilience and sustainability of society as a whole are achieved or not.

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Annex

SDG 11: (Make cities and human settlements inclusive, safe, resilient and sustainable)	
Target	Proposed indicators
11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums	11.1.1 Proportion of urban population living in slums, informal settlements or inadequate housing
11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons	11.2.1 Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities
11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries	11.3.1 Ratio of land consumption rate to population growth rate
	11.3.2 Proportion of cities with a direct participation structure of civil society in urban planning and management that operate regularly and democratically
11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage	11.4.1 Total expenditure (public and private) per capita spent on the preservation, protection and conservation of all cultural and natural heritage, by type of heritage (cultural, natural, mixed and World Heritage Centre designation), level of government (national, regional and local/municipal), type of expenditure (operating expenditure/investment) and type of private funding (donations in kind, private non-profit sector and sponsorship)
11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations	11.5.1 Number of deaths, missing persons and persons directly affected by disaster per 100,000 people
	11.5.2 Direct economic loss in relation to global GDP, damage to critical infrastructure and number of disruptions of basic services, attributed to disasters
11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	11.6.1 Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities
	11.6.2 Annual mean levels of fine particulate matter (e.g., PM2.5 and PM10) in cities (population weighted)
11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	11.7.1 Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities
	11.7.2 Proportion of persons victim of physical or sexual harassment, by sex, age, disability status and place of occurrence, in the previous 12 months
11.a Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning	11.a.1 Proportion of population living in cities that implement urban and regional development plans integrating population projections and resource needs, by size of city
11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels	11.b.1 Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-2030
	11.b.2 Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies
11.c Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials	11.c.1 Proportion of financial support to the least developed countries that is allocated to the construction and retrofitting of sustainable, resilient and resource-efficient buildings utilizing local materials
1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance	1.4.1 Proportion of population living in households with access to basic services
	1.4.2 Proportion of total adult population with secure tenure rights to land, with legally recognized documentation and who perceive their rights to land as secure, by sex and by type of tenure
6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	6.3.1 Proportion of wastewater safely treated

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Endnotes

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