Smart Cities and Quality of life
A report from the GCC
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According to the 2021 Smart city index (SCI) of the IMD World Competitiveness Center and Singapore University of Technology and Design (STUD), Riyadh ranks 30 on the index among 118 cities worldwide. Riyadh jumped 23 spots, from the 53rd spot to the 30th spot from 2020 to 2021. The survey measures residents' satisfaction about five main aspects: health and safety, mobility, activities, opportunities and jobs, and governance. It is interesting to notice that, with the exception of Singapore, Auckland, New York, all the high scoring cities are relatively small European cities, certainly not exceeding the 3+ millions of inhabitants as the case of the GCC capitals (Smart City Index, 2021). The same GGC countries, score also good in the Quality of Life index 2021, seeing Oman as the best, ranking, 14th worldwide and 1st among the Asian countries. In general, all the GCC countries are well positioned, scoring among 14th to 55th, and are among the first 10th in Asia, together with Japan and Singapore (Quality of life index, 2021).

Looking at it from a citizen's perspective, within the parameters in terms of safety, health care, cost of living, commuting time, pollution and climate. Each country is offering excellent services to the citizens in making the lifestyle very easy and manageable. Sometimes it is challenging for elderly; however they constitute a minority in the GCC, and can count on younger generation's support, thanks to the traditional extended family system. The Quality-of-Life Program was launched in 2018 to improve the quality of life of residents and visitors to the Kingdom of Saudi Arabia by developing the necessary environment to create more vibrant options that enhance the participation and experience of citizens and residents.

The program counts representatives from each ministry to create a shared platform, able to address the quality across all the areas of life. It targets to directly impact citizens in each sector: sports, culture and entertainment, human capital, and launching several academies and programs. The program aims to bolster the participation of citizens, residents and visitors in cultural, entertainment, sports, tourism, and urban activities, and other related activities that nurture their quality of life. Such diverse options will definitely have their own economic and social impact through creating jobs, diversifying economic activity, targeting the worldwide ranking amongst the top livable cities (Saudi Arabia, 2018). The Quality of Life Program involves investing in promoting a more livable and vibrant urban form with some smart technologies and approaches that can positively enhance people's lives.

Saudi Arabia opened to developing the tourism sector as well as contributing to strengthening the Kingdom's position as a global tourist destination, achieving tangible accomplishments. This includes launching the tourist visa scheme and increasing the number of registered sites in the UNESCO World Heritage List in addition to localizing leadership professions in the hospitality sector, enabling mechanisms for the private sector and automating the licensing process to facilitate investors' "ease-of-doing-business" and establishing development funds (VisitSaudi, 2019). The municipal services sector is also one that has recently received great initiatives in the areas of urban landscape beautification, city humanization, and city services enhancement. Such initiatives will help focus the efforts on all aspects of quality of life and secure high living standards for the Kingdom's residents and visitors. The United Arab Emirates (UAE) had established a participatory platform in occasion of the 50th national anniversary, to co-design the next 50 years together with their citizens (Fifty-Years-Charter, 2018).

It can be easily claimed that the GCC-countries have a strong innovation culture, highly technologically literate citizens, and a public sector that rigorously promotes creative thinking and innovation. The smart approaches adopted in Riyadh and the latest technologies and digital solutions are aiming to achieve the well-being of its citizens, residents, and visitors. Many applications are used to elevate the quality of life and to encourage more cooperation between residents and the city authorities, and governmental entities to report any infrastructure problems so that it can be fixed in a timely manner. For example,

Amana 940 has been provided to residents of Riyadh to provide the latest methods of notifying the municipality with any challenges or problems. It ensures a speedy reaction and response to any city or infrastructure related problems. Hather is another application that provides Riyadh's residents of the locations and routes of rain gathering and floods, as well as enabling the application users to send reports on the location of floods. With the e-government all personal information is on one platform and connected to the governmental system and database, including properties, employment contracts, renting contracts,... etc.

In addition, many of the governmental services can be done online without the need to waiting time or commuting trips, including passports, identification documents, marriage license. This is in addition to speed and flexibility in processing digital government transactions and digital identity services, ease of starting new businesses and reducing waiting times, as well as the contribution of government applications and platforms to ease of access to information, completion of transactions and the great role they played in raising health and safety indicators, especially during the recent pandemic.

There is no doubt that it further accelerated the digital transformation, increasing how people use technology and how they perceive the technological advancement in their city in addition to how it is helping to alleviate the urban and health challenges. As an example, online education has efficiently worked and proved success in Riyadh and the whole Kingdom of Saudi Arabia, and that is because of the technological smart foundation that has been effective and in use for many years. Same for online purchase and home delivery services, extended to all the possible sectors.

There are many smart initiatives that are consistent through the three GCC cities ranking high on Smart Cities Index, Abu Dhabi, Dubai, and Riyadh. These are applied with some distinction, and include:

Municipalities are organized through a service center to manage smart public services and utilities through a central, cloud-based control center that contains an integrated and interconnected system for control and management, which integrates with systems in various municipalities and departments.

Among those, *Environmental Monitoring* becomes better as there is an increasing number of environmental monitoring stations; also e.g. cars that contain environmental monitoring devices to take measurements, and send them to the environmental monitoring station (such as temperature, humidity, pollution rate...etc) are used or a Smart Parking service with the aim of guiding people to vacant parking lots, if any, in order to save time and effort and reduce parking congestion (Smart Abu Dhabi).

Moreover, on streets control, it can be counted a Billboards Control and an Optical Distortion Treatment to remove violating advertising panels, writings, and posters that distort the public appearance through automated monitoring cars. On a larger urban scale, municipalities are equipped with a Smart Cities Platform for Municipal Asset Management to use base maps and geospatial data in order to manage municipal assets through the Internet of Things (IoT), for example, checking the capacity of parks and slaughterhouses and other municipal facilities and their congestion. It includes Road Initiatives as:

› IoT-based guard barriers
› Digital signals
› Digital city map locator integrated with city map application
› Smart poles (CCTV cameras, street lighting, control sensors …)
› Built-in GPS sensors to report congestion in traffic flow
› Comprehensive mobility plan (e-CPM). Electricity generation gangway
› Private digital pedestrian crossings (for people with special needs)
› SOS in Emergency cases

Gardens and Green Spaces Initiatives are offering:

› Digital billboards
› Integration of social media channels
› Outdoor gym to facilitate sports practices for young and old people
› Umbrellas and solar flowers for energy production of lighting
› Laser lighting shows for public events in green areas
› Digital lighting and sounds for dancing musical fountains
› 3D digital designs on walls
› Entertainment based on (7D) animation in large gardens
› Geographic Information System (GIS)
› Supervisory control and data acquisition (SCADA)

› Automatic operation / suspension of distilled deep irrigation, Integration of city entrances and traffic center with LED and laser lighting
› Integrated advertising boards with Public Information System (PIS)

The programs are completed by a Waste Management Initiatives, with

› Sensors of building waste containers, and Smart Waste Containers,
› Waste tracking solutions
› Geographical layer of smart waste information
› Waste reports integration with unified city applications (Smart Dubai)

Resilience to extreme weather is implemented in Saudi Arabia through

› a Flood Initiatives based on Hydrological information system (HIS)
› an Automated flow control sensor for automatic cleaning reports
› a SWIM awareness management
› 3D mapping for flood preparedness and building safety control
› Building Information Model (BIM)
› HVAC system
› Electronic Natural disaster management platform
› Wireless frequencies RFID QR
› Supervisory control and data acquisition (SCADA)
› Public solar energy based W.C.
› integrated with sensor monitoring of hygiene time. (Saudi Smart City Initiative).

Besides the traditional urban management tools and implementation, this is showing a massive commitment in the last years to improve a comprehensive system of e-governance and services to the citizens in terms of quality of life.

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