

# The world's first "Smart Nation" vision: the case of Singapore

Esra Banu SIPAHI,

*Necmettin Erbakan University, Faculty of Political Sciences, Konya, Turkey*  
[dr.esrasipahi@hotmail.com](mailto:dr.esrasipahi@hotmail.com)

Zabihullah SAAZI,

*Faculty of Public Policy and Administration of Kabul University, Konya, Turkey*  
[zabihullahsaazi@gmail.com](mailto:zabihullahsaazi@gmail.com)

## Abstract

"Smartization" is the policy that Singapore as a city-state with a small geographical territory, limited natural resources, increasing urban density and aging population but determined to become an exceptional city-state has adopted to overcome various national challenges, improve the quality, efficiency and performance of urban services, sustainable development and overall improvement of citizens' lives. In this regard, the Smart Nation initiative, which has been undertaken in late 2014 is considered a turning point that aims to make Singapore the first smart nation or the first smart country (mega-smart city) in the world. This paper is dedicated to the study of Singapore's digitization process, especially the initiative of Smart Nation, which is an upgraded version of the smart city. In the framework of this article, the factors of Singapore's transition to the digitization process, especially the Smart Nation initiative, are discussed, the plans and programs related to this process and the country's achievements in this direction are explained. Meanwhile, along with all the achievements, the challenges, limitations and problems of the initiative of forming the Smart Nation have been pointed out.

**Keywords:** Singapore, Smart City, Smart Nation, Mega Smart City.

## 1. Introduction: The First Steps Toward "Intelligent Island"

"Singapore", which comes its name from native Malay name for the country "Singapura" and derived from the Sanskrit word for "lion city" with official name of the Republic of Singapore, is a small city-state with a total area of 597km<sup>2</sup> on the current political map of the world, located in the south of the Malay Peninsula and it is the smallest country in Southeast Asia. Singapore, which has water border with Malaysia to the north and Indonesia to the south, has a population of more than five and a half million (5,637,000) [1], which makes it one of the most densely populated countries in the world. The country, which consists of a main island (known as Singapore Island) and more than sixty smaller islets, is home to people of diverse ethnicities with different origins and cultures, from Chinese and Malays to Indians, Eurasians and Asians. The Chinese make up the largest ethnic group in the country with 74.3 per cent of the population, followed by the Malays and Indians with 13.5 per cent and 9.0 per cent of the resident population respectively and the remaining 1.6 per cent of the population are constituted from other (Asian and Eurasian) ethnic groups [2].

Although Singapore has a relatively long history of several hundred years and was once the capital of the Kingdom of Singapura (Malay: Kerajaan Singapura) between the 13<sup>th</sup> and 14<sup>th</sup> centuries, which was founded on the island by Sang Nila Utama [3], but the land emerged as an independent city-state in the late 20<sup>th</sup> century. Singapore, along with other neighboring islands of the British colony, gained independence and formed the state of

Malaysia in 1963, but Singapore's alliance with them did not last long because of ideological reasons and, two years later, seceded from Malaysia and formally emerged as an independent state. Thus, the small island which is hot and humid throughout the year and suffers from lack of natural, underground and basic resources (from energy deposits to drinking water resources and from forests even to farms/fields), had to stand on its own feet as an independent state.

Given this, the only resources that Singapore could rely on and count on were its geographical location as a coastal land as well as its population (human resources). The geographical location that could make Singapore an important trading center in the region dates back to the distant past, when Stamford Raffles, the British East India Company's envoy, bought the fishing island in 1819 from a Malay princeling. According to his idea, the Island had the potential to become a valuable trading post in the Malacca Straits between the Indian and Pacific oceans [4]. Within a short period, not only did Raffles' dream come true, it went beyond that, and as a result, Singapore became one of the major trading centers in Southeast Asia and even in the world. Undoubtedly, this was not because Singapore exported manufactured property using its own resources, but because it became able to attract foreign investment and encourage foreign traders to invest in the country. Opening the gates for foreign investments was not enough and the post-colonial government had to provide practical grounds for attracting investment and competing with other commercial centers in the region. Besides that, it should prepare work opportunities for its fast-growing population. All this, on one hand, required the construction or reconstruction of economic-commercial infrastructure according to the new conditions of markets and global trade; on the other hand, there was a need to educate people who could both be absorbed in the labor market and play a role in its growth. In other words, there was a need for some kind of fundamental development in both material and human dimensions, which forced Singapore to move rapidly towards industrialization and the application of new technology in all areas related to the affairs of the city-state [4, 5].

In contrast to many Third World countries, which viewed the multinational corporations (MNCs) with skepticism and saw them as new colonizers, Singapore had a different attitude about these corporations: Singapore was not only positive about them, it also saw them as tools for industrialization and connection to global markets, as well as a source of labor, capital and technology. Thus, the early 1960s can be considered as the beginning of the industrialization process of Singapore due to the influx of foreign investment and the connection of Singapore with transnational and multinational corporations; however, the first and basic step towards Singapore becoming a smart island was taken in the early 1980s.

In 1981, the National Computer Board (NCB) was established under the National Computer Board Act (Act No. 14) as a new public body. The board was formed as a result of a study conducted in 1980 by the Committee on National Computerization; the committee which was looking for ways to develop Singapore as a regional center for computer software development and services. Soon after the establishment of the board, the Civil Service Computerization Program was launched, and in this regard, ten

government ministries were the first institutions in which the computerization program was implemented. The NCB was responsible for three main tasks. First, it had to implement computerization of the Civil Service. Second, it had to coordinate computer education and training. Third, it had to develop and promote the computer services industry [6].

In 1986, the first National Information Technology (IT) Plan was launched. The overall purpose of this national plan was to develop the IT capabilities of the public and private sectors, to increase Singapore's overall economic competitiveness and also to improve the quality of life of ordinary citizens. The Masterplan for IT in Education was launched in 1997 by the Ministry of Education, which according to this masterplan "IT-based teaching and learning" or use of IT had to be prepared in the field of education in all schools. In addition to formal education, non-formal IT instruction, including IT awareness and IT training were designed and implemented among segments of the population that were older or less amenable to new technologies. In parallel, Singapore paid close attention to building and maintaining a world-class information technology infrastructure. Given the importance of infrastructure as a competitive advantage as well as being part of a vital support system, Singapore began its efforts since 1960s and made significant progress in this field [4].

In this way, Singapore took the first steps towards becoming a smart island and was going to put into practice the idealistic vision of Singapore as an Intelligent Island outlined by the IT 2000 Committee in a report released by the NCB in 1992: "In our vision, some 15 years from now, Singapore, the Intelligent Island, will be among the first countries in the world with an advanced nation-wide information infrastructure. It will interconnect computers in virtually every home, office, school, and factory" [7]. As can be seen from these statements, Singapore, with its distinctive characteristics, aspires to make quick progress in creating a nation where technology is integrated into every part of life. In this study, Singapore is considered as a key example of cities that are on route to becoming smart cities. In this context, the initiatives, investments, and services created for Singapore, which is intended to be the world's first mega-smart city, are assessed.

## **2. Vision of Smart Singapore: Initiative of "Smart Nation"**

The small size of the land (geographical area) and other problems such as lack of underground resources, overcrowding (density) of the population, overgrowth of the population, hot and humid weather throughout the year and some other problems/challenges like this, which somehow are related to the small size of the geographical area of the country makes the main/major problems of Singapore as a city-state. The small geographical area has compacted the urban environment, increased traffic congestion and made it difficult to create a livable environment with adequate greenery and to provide housing. In addition, the aging of the population together with declining birth rates is another problem that Singapore suffers from. As the 3<sup>rd</sup> most densely populated country in the world, Singapore has a population density of 7,688 people per square kilometer, according to the official statistics [1] and it's expected that the number of people aged 65 years and above in Singapore will become triple or 900,000 (1 in 5). Thus, Singapore is experiencing an unprecedented age change in which older people should be supported by only a small population of workers [5].

Addressing all of the above challenges and finding solutions to all of those problems in the age of industry and technology required a smart response that Singapore attempted. In other words, to overcome the challenges, the government of Singapore has come up with a smart solution by resorting to the maximum use of new technology. In order to realize this, it has launched the “Smart Nation” initiative in late 2014 and the “Smart Country 2025 Plan”, which is “the first blueprint for a smart country and an upgraded version of the smart city in the world” [8]. In the framework of this initiative, Singapore’s goal, apart from providing an appropriate answer to the mentioned challenges, is to make maximum use of technology to improve the quality of life of citizens, strengthen businesses, help government organizations to provide better services to citizens and, in a word, become the world’s first smart nation; “a nation where people live meaningful and fulfilled lives, enabled seamlessly by technology, offering exciting opportunities for all.” [9]. It aims to turn the vision of “Everything and Everybody Everywhere All the Time” [10] into reality. “Smart Nation”, as the highest step in this direction, is an initiative by the Government of Singapore to effectively use technology in various areas of life and aims to “support better living, stronger communities and create more opportunities, for all” [11]. According to Prime Minister Lee Hsien Loong in a speech at the launch of the Smart Nation Initiative, on the one hand, improving people’s lives by connecting to each other using smart devices and sensors; on the other hand, resolving complex urban policy issues by using information and communications technologies (ICTs), supporting knowledge-based economy, exploring new economic opportunities and enhancing economic productivity through new technology, makes the main aims of Smart Nation initiative [9].

The Smart Nation Initiative was not launched as a big program all at once, but marks the culmination of previous efforts by the Singaporean government to digitize public service delivery or “e-government” [12]. The main programs or initiatives within the framework of e-government began in the late 1980s with the Civil Service Computerization Program as discussed earlier. This process was followed in the form of other programs and plans, like IT 2000 Strategic Plan (1992), e-Government Action Plans (2000), iGov 2010 initiative (2006) and e-Gov Masterplan (2015) [13]. In contrast to previous programs and initiatives that were somewhat limited to specific areas and focused on increasing efficiency and performance in providing public services through the use of digital technologies and platforms, the initiative of Smart Nation was much more comprehensive, more inclusive and proposed a nationwide “digital transformation” aimed at the digitizing all aspects of urban life in city-state often through coordination and collaborations with non-state actors such as businesses, NGOs and citizens [11].

In order to implement the Smart Nation programs, simultaneously with the announcement of the initiative, the Singapore Government launched the Smart Nation Program Office (SNPO) in 2014; an office which operated under the Prime Minister’s Office (PMO) as an institutionalized body of the initiative. In 2016, the Government Technology Agency (GovTech) was established to provide digital government services to the public and to develop infrastructure to support the Smart Nation project. Another important step in this direction was the establishment of the Smart Nation and Digital Government Office

(SNDGO), which started its activities in 2017 under the supervision of PMO. SNDGO plans and priorities key Smart Nation projects like Smart Nation Sensor Platform and National Digital Identity, promotes digital transformation, tries for building of long-term susceptibilities for the public sector and boosts the acceptance and participation of people and industries in the Smart Nation forming process [14]. SNDGO, which also includes the Smart Nation Program Office (SNPO), together with GovTech form a structure called Smart Nation and Digital Government Group (SNDGG) (refer to Figure 1) which has the main responsibilities related to the Smart Nation initiative.

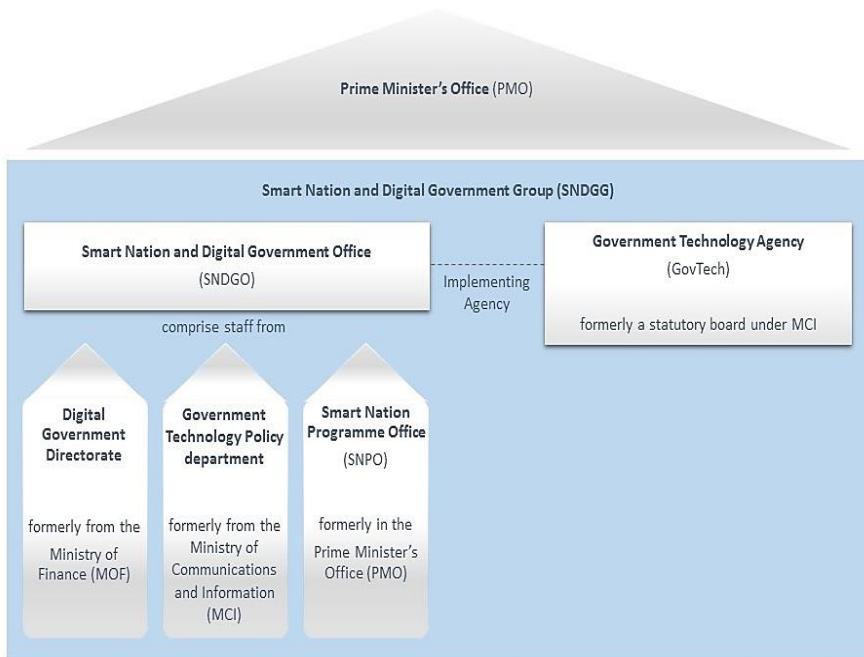


Fig. 1. Organizational chart for SNDGG at the formation of the Prime Minister's Office

Source: Website of Prime Minister's Office, <https://www.pmo.gov.sg/Newsroom/formation-smart-nation-and-digital-government-group-prime-ministers-office>

The Smart Nation Initiative, which focuses on the five main domains of; public sector services, home and environment, transportation, business productivity and active health and enabled aging [15] is generally made up of three major components which are called “the Three Pillars of a Smart Nation”: Digital Government, Digital Economy and Digital Society. The Digital Government carries on investing in infrastructures and creating/obtaining shared open platforms for citizens and businesses to learn and develop; the Digital Economy encourages businesses to invest in technology and talent to growth beyond the country's borders; and the Digital Community allows people and empowers them to nurture their talents and equip themselves with the latest digital technologies to understand their greatest inspirations and live better lives together [16].

The Smart Nation initiative which is called the “next-gen nation-building effort” of Singapore, as Prime Minister Lee has acknowledged, “is about Singapore taking full advantage of IT. Using IT comprehensively to create new jobs, new business opportunities, to make the economy more productive, to make lives more convenient. To make Singapore an outstanding city in which to live, work and play” [17]. Thus, the Smart Nation Initiative is a general framework for maximizing the use of new technology, especially information technology (IT), to make Singapore the first smart nation of the world by 2025. In other words, it aims to make Singapore the world’s first fully smart/intelligent city-state or the first mega-smart city of the world.

### 3. On the Way to Become the World’s First Mega-Smart City: Current Projects and Spectrum of Services

#### 3.1. Current Projects

As mentioned before, one of the important steps of Singapore which stands out with its claim to be the first mega-smart city among the smart cities in the world, is the creation of the Smart Nation concept, and the mechanism created for the implementation of this initiative is the Smart Nation Platform. The Smart Nation Platform, which aims to realize the “Smart Country 2025 Plan” to transform Singapore into a smart country or smart city-state, focuses on three major axes of *Connect*, *Collect* and *Comprehend* [18] which are called “*Three Cs*”. Within the framework of the “three Cs” concept and in order to promote the widely use of digital and smart technologies throughout the country, Singapore has designed and identified key Strategic National Projects that are considered as key factors for the realization of the Smart Nation plan. GoBusiness, CODEX, E-Payments, LifeSG, National Digital Identity, Punggol Smart Town, Smart Nation Sensor Platform and Smart Urban Mobility are the Strategic National Projects which set the foundation for the transformation of Singapore into a Smart Nation and turning the vision of the world’s first Smart country into reality (refer to Figure 2).

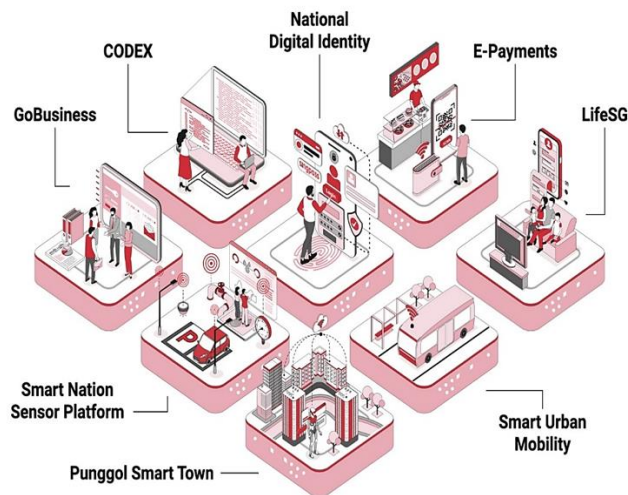


Fig. 2. Strategic National Projects

Source: Smart Nation Singapore<sup>3</sup>, Strategic National Projects, <https://www.smartnation.gov.sg/initiatives/strategic-national-projects>

The strategic national projects proposed to make Singapore a smart country can be summarized as follows:

- *GoBusiness*: This platform is a way to facilitate transactions between businesses with the government or, in other words, it is a platform for businesses to access e-services and resources of the government like grants and licenses. To facilitate these transactions, the government has merged applications for grants and licenses and placed them on two separate websites under the headings of Business Grants Portal and GoBusiness Licensing Portal. The Business Grants Portal (BGP) is a way for businesses to apply for financial assistance, by which businesses no longer need to refer to different government agencies or provide separately the same information for each application. With the GoBusiness Licensing Portal, businesses can easily apply, amend, renew or terminate licenses from multiple agencies as quickly and easily as possible [19].
- *Core Operations Development Environment and eXchange (CODEX)*: This is a digital platform which is shared between government agencies and private sectors to offer digital services better, faster and more cost-effective. It aims to enable a lean, agile and future-ready government. CODEX develops an exchange platform for the public and private sectors to share digital data and components, improve the way of interaction and, based on that, reduce mistakes and improve the quality and security of services [20].
- *E-Payments*: With the increasing importance of electronic payments (e-payments) and its transformation into a simple, fast, seamless and secure digital transaction around the world, the Singapore government has resorted to electronic payments and has placed it among its priorities in order to keep up with the world's technological developments and make payments easier for citizens and businesses. In order to create a simple, efficient and secure platform for electronic payments, the Singapore government has taken steps since 2014, which the most important of them are: *FAST* (Fast and Secure Transfers), which launched in 2014 to facilitate direct transfers between businesses and consumers across different banks; *PayNow*, which launched in 2017 to facilitate peer-to-peer transfers between customers of banks by entering their mobile number, personal identification number and the like; *PayNow Corporate*, which launched in 2018 and makes way for government agencies and businesses to pay and receive funds directly and immediately by using of a Unique Entity Number; *NETS* (Network for Electronic Transfers), which as an electronic payment service provider developed an interoperable and open-access e-payment solution in 2018 to make transactions more convenient; and *SGQR* (Singapore Quick Response Code standard), which was introduced in 2018 and enables merchants to accept mobile payments from different service providers with just one QR code. In the same way, in 2021, non-bank financial institutions received access to FAST to provide financial transactions more conveniently for consumers and businesses [20].
- *LifeSG*: This is an application for accessing government services which was originally launched in June 2018 by the name of Moments of Life and then re-branded to LifeSG in August 2020. By LifeSG, Singaporeans can easily access government services and information (it helps connect citizens easily and by fingertips to more than 40 government services), stay up to date with the latest news

and updates, track their applications and more [21]. To protect the security of users' data and information, LifeSG has complied with the Public Sector Governance Act (PSGA), which formulates and manages data sharing and protection in the public sector. Due to this, all data is encrypted and in order to use LifeSG services, logging into Singpass is mandatory.

- *National Digital Identity (NDI)*: In line with the shift to more government services online and the need for a secure and easily accessible digital ecosystem, National Digital Identity (NDI) underpinned by Singpass has been introduced by the Singapore government to facilitate safe and easy online transactions for citizens with both public and private sectors. The Singpass, which was launched in the framework of the NDI initiative, is a platform that paves the way for users (both businesses and citizens) to transact safely and conveniently with the government and other private service providers. Using the Singpass platform, users can access more than 700 government agencies and private sector services. Singpass is considered as a key factor in the national digital economy and acts as a gateway for international trade to establish and activate cross-border business transactions. Underpinned by Singpass, NDI uses applications such as Singpass app, Myinfo and Myinfo Business to achieve the goals of the National Digital Identity initiative [20].
- *Punggol Smart Town*: with the known name of Punggol Digital District (PDD), Punggol Smart Town is Singapore's highly-anticipated "smart district" which aims to bring digital businesses, industries, academia, community and the high-tech lifestyle together in one district to strengthen the formation of a vibrant, connected, strong and dynamic digital community. PDD, which is designed with an integrated master plan and opens from 2024, aims to transform the business and way of working, living, learning and playing. It is designed to create a "smart" space for work, live and play, make it easy for citizens to access the latest technologies realizing new possibilities and tries to transform the urban landscape of Singapore [22].
- *Smart Nation Sensor Platform (SNSP)*: This is an integrated nationwide platform which collects essential data by using sensors to analyse them and, based on that, create smart solutions for different issues (like urban planning, infrastructure, emergency services for disadvantaged individuals etc.) and responds appropriately to various necessities. In this regard, many important steps have been taken [20] where *Tracking Water Usage and Leaks* is one of them. The Singapore government launched a pilot wireless sensor network at the end of 2018 to collect water data transmitted from smart meters from more than 500 sensors on the Yuhua estate. The results of this experiment showed that these smart meters can help homeowners save water by providing real-time water consumption data and detecting water leaks through a mobile app. Likewise, an earlier trial in Ponggol in 2016 showed similar results; helping households save nearly 5 percent on water consumption through early leaks detection. *Drowning Detection System at Public Pools* is another important stride in this direction. According to this, a pilot program using computer vision to detect possible drowning incidents in public swimming pools has been undertaken. This program is designed in such a way that if there is a danger to the swimmers or they are in distress, it will warn the lifeguards to help them as soon as



possible. *Smart Lamp Posts for Urban Planning* is another step in this regard. The need to collect data on air quality, rainfall, footfall and the extent of the effects of global warming in order to take the necessary measures and fine-tune urban plans, including the design of pedestrian routes and safer roads for pedestrians, has prompted Singapore to take smart measures. Considering this importance, since 2019, the Lamppost-as-a-Platform trial has been carried out, which based on that, the sensors are placed on lamp posts to collect the required data in an intelligent way. *Personal Alert Button for Elderly* makes another important pitch related to SNSP. In order to address the urgent needs of the elderly as soon as possible, since April 2021, Personal Alert Button (PAB) has been installed in the apartments of more than 5,600 elderly people to request emergency assist if needed. With the activation of PAB, an alert is sent to the Senior Activity Centre, so that they can check the situation, make a voice call with the person requesting help and take immediate action.

- *Smart Urban Mobility*: The small size and growing population have prompted Singapore to seriously and accurately remake its transportation road-map and achieve the creation of an effective transportation infrastructure using digital technologies. Considering this importance, Singapore has recognized Smart Urban Mobility as one of its strategic national projects which aims to create a convenient and reliable public transportation system with the maximum use of digital technology and also support to realize the vision of car-lite Singapore. In this regard, some important steps have been taken [20] that *Analyzing Anonymized Data Obtained from Commuters' Fare Cards* is one of these steps. By analyzing such data, the Singapore Land Transport Authority (LTA) can easily identify important and frequently used points for commuters, and based on that, manage the urban transportation system efficiently and meet the needs of passengers (citizens) in a better way. *Hands-Free Ticketing Technology* is another step in this regard. In line with efforts to make the public transport system more inclusive, which is considered one of the priorities of the Singapore government, the use of hands-free fare gates is being investigated, by which the elderly, people with mobility challenges and families with young children can easily enter and exit bus and train stations without tapping their fare cards on the card readers. *Self-driving Shuttles* make another stride in this direction. In order to better connect cities and help commuters, especially the elderly and people with disabilities, experiments have been conducted to provide the basis for the use of autonomous or self-driving vehicles (Self-driving Shuttles) in public transportation. This will help to improve public transportation services, especially in crowded hours and areas, as well as late-night.

### **3.2. Spectrum of Services**

Along with the eight strategic national projects as mentioned earlier in the study, the smart nation focuses on six initiatives or domains mainly, which are: National Artificial Intelligence Strategy (National AI Strategy), Digital Government Services, Business, Urban Living, Health, and Transport [20]. Within the framework of these projects and programs, a wide range of smart services have been undertaken by the Singapore government to provide citizens, some of which are being offered, some of which are being planned, and some of which are in the experimental stages. Some of the most important

smart services that are provided in Singapore within the framework of the Smart Nation Initiative are as follows:

- *Transportation and Urban Transport Services*: The development of the Intelligent Transport System (ITS) was launched in Singapore many years ago and today the most developed intelligent services in this country are related to the transportation and urban mobility sector. ITS, which was launched to improve traffic flow and ensure road traffic safety, is a complex and multi-dimensional system that, along with other initiatives related to transportation such as free public transportation during the morning rush hour and vehicle quota system, has a prominent role in improving the urban transportation system. *ONEMOTORING*, *Expressway Monitoring and Advisory System (EMAS)*, *Your Speed Sign*, *Parking Guidance System* and *Bus Information System* are the Smart transportation services which provides by using ITS components in Singapore [5]. *ONEMOTORING* is a comprehensive portal launched by the Land Transport Authority (LTA) and provides services related to urban mobility and transportation for drivers, vehicle owners and all citizens of Singapore. Through this web portal, which is also accessible on mobile devices, citizens can have accessibility to traffic information which is collected from surveillance cameras installed on the roads and taxi cars and see snapshots of roadways. It also provides information on traffic news, road maps, street directions, parking information, travel time calculator, ERP (Electrical Road Pricing) rates, traffic images of major expressways and sections where road works are in progress. This portal also provides information and guidance for citizens about buying, selling, transferring and maintaining their vehicles [23]. To monitor and detect road incidents, in the framework of the *Expressway Monitoring and Advisory System (EMAS)*, the LTA uses surveillance cameras to detect the accident site and activate the vehicle recovery crew. The vehicle recovery crew arrives at the accident site within 15 minutes and, as part of the Vehicle Recovery Service (VRS), tows the crashed vehicle to the nearest designated off-highway parking lot. “*Your Speed Sign*” are smart electronic devices which are installed on the side of the roads to display the real speed of vehicles and warn drivers if they exceed the speed limit. These devices are helpful in keeping the speed of vehicles under the limit and consequently maintaining safety on the roads. *The Parking Guidance System* has been launched since 2008 by LTA which provides the necessary real-time information about parking availability for drivers. On the one hand, this system can help in reducing the amount of circulating traffic searching for available spaces and, on the other hand, it helps in more efficient use of existing parking facilities. Relevant information for drivers is displayed on the electronic signboard and is accessible either online at the One Motoring Portal or on mobile applications like MyTransport.SG. In order to provide citizens with real-time information about buses, LTA has launched a *Bus Information System* that allows commuters not only to know the actual location of buses on different routes, but also to access information about bus loadings. With the help of this system, commuters can access space availability information and see space availability with a color code; green indicates available seats, yellow indicates available standing spaces and red indicates restricted standing. This helps them decide whether to board the incoming bus or the

next bus. Using applications launched by LTA such as MyTransport.SG and a number of other applications, such as Singabus, SG Buses, How2Go (H2G), Taxi-Taxi@SG, gothereSG, etc., commuters can obtain the necessary information about buses and other alternative land transportation vehicles.

- *Emergency Services:* In order to meet and respond to urgent needs and unexpected events, the Singapore government has created an organization called the Singapore Civil Defense Force (SCDF) since 1980s. The main role of SCDF as a uniformed organization which works under the eyeshot of the Ministry of Home Affairs (MHA) is the provision of firefighting services including the formulation and implementation of regulations related to fire safety, civil defense shelter matters, reduction of accidents caused by hazardous substances, rescue and emergency medical services. With “A World-Leading Life Saving Force Through People, Innovation & Partnership for an Emergency Ready Nation” vision and “To protect and save lives and property for a safe and secure Singapore” mission, SCDF tries to provide urgent services to the citizens in the mentioned fields [24]. The organization has placed four special hotlines of Fire Engine/Ambulance, Non-Emergency Ambulance, Fire Hazard Reporting and General Enquiries on its official website that citizens can contact the relevant authorities through in case of need and in urgent conditions. Along with this, SCDF has also launched a number of applications to facilitate citizens’ access to emergency services, one of which is the *mySCDF* application through which citizens can send their feedback to SCDF and obtain SCDF’s annual reports, learn how to use a fire extinguisher and learn how to perform CPR and AED. Another related application in the field is an application called *myResponders*, which, along with the 995 number that was launched for emergency medical services (EMS), plays a significant role in providing electronic health services. The application warns users specifically about suspected cases of cardiac arrest nearby and guides them to take the necessary measures until the arrival of SCDF staff. Apart from applications, the SCDF website also offers a number of electronic services, including online payment for SCDF services, applications for training courses at SCDF for general education programs and a locator of SCDF facilities.
- *Health Services:* Due to the fact that modern cities, whose infrastructure is based on innovative information and communication technology, should pay special attention to the provision of health and treatment services to maintain the health of their citizens [25], in the framework of Smart Nation health initiatives, the Singapore government has launched the HealthHub which is known as “Singaporeans’ digital healthcare companion”. Through the HealthHub, which acts as “national population enablement platform for digital health”, citizens can view health and wellness information, access personal health records, links to healthcare services and institutions, and perform transactions with the public health department, such as making appointments, paying bills, and refilling medications [26]. To improve health care with technology, the Singapore government is increasingly using assistive technology and robotics in health care. Helping the elderly and people with disabilities lead independent lives so that they can perform their daily tasks and activities independently, improving patient care (for example, helping them with

automatic bathing machines, helping stroke patients' brain so they can exercise, alerting early dementia patients to take their medication) as well as increasing healthcare productivity and reducing the workload of healthcare workers (such as the use of drones that deliver drugs and equipment or automated data analysis that improves daily performance and reduces waiting time) are among the main things that the Singapore government has focused on to increase the use of technology and robotics in the health field. In this regard, it will not be out of place to mention the robot called RoboCoach Xian, which has the role of a trainer and is used by the Singapore government to teach physical exercise routines to elderly people individually or in groups. Another aspect that is focused on in the framework of the smart nation initiative in the health sector is the launch of a telehealth system. Using telehealth, the Singapore government provides integrated and seamless medical care in the form of online medical consultations without the need for citizens to visit a healthcare institution in person. In this regard, the Singapore government has launched the Smart Health Video Consultation website since April 2017, which allows patients to speak with their care team remotely via video conferencing [27]. Promote widespread use of wearable technologies such as fitness trackers, smart watches and even smart clothing that can monitor a patient's health to record vital signs such as blood pressure, heart rate and body temperature, as well as transmit data over the internet to designated healthcare professionals or family members are among the things that are considered in the form of telehealth. The Smart Health-Assist pilot project in Jurong Lake District which launched its plan in late 2015 by IDA aimed to support the aging population of Singapore in the healthcare field using smart technology. In the framework of this project, smart sensors were installed in homes for the elderly and patients suffering from chronic diseases to transmit data related to their health to health care providers online and provide the basis for their care and treatment. To encourage citizens to exercise to maintain their health, the Singapore government has launched the National Steps Challenge™ which is the world's first population level, fitness tracker-based physical activity initiative. With this innovative challenge using the Healthy 365 app, Singaporeans are encouraged to take extra steps and engage in moderate to vigorous physical activity daily as part of their daily lives and even receive rewards when they reach the physical activity milestones [28].

- *Safety and Protection Services:* Along with other mechanisms, including the application of severe punishments against crimes and strict control of the government and security institutions on firearms, it seems that the use of new technologies plays a significant role in providing security, reducing the number of crimes and consequently, raising the sense of personal security in Singapore. Apart from the number “999” which can be used to contact the police in case of emergency, as well as the police hotline (1800-255 0000) and traffic hotline (6 547 0000) that citizens can contact these two institutions, there is a SMS service designed especially for those who are deaf and hard of hearing or have speech impairment called Emergency Short Messaging Service Helpline or “Emergency SMS 71999” in short. In line with security and protection programs, Singapore Police provides web-based electronic police center under the name of the Electronic Police Centre (ePC) for

citizens to gather information, fill police report online, apply for certified copies of police reports, apply for criminal records, etc. [29]. All this has placed Singapore on the list of the top cities and countries in the world from a security point of view; as according to the latest indexes, after Copenhagen and Toronto, Singapore is ranked third among the safest cities in the world [30] and sixth among the safest and most peaceful countries in the world [31]. Today, Singapore is one of the countries whose residents have the highest sense of personal security, and this country is one of the countries with the lowest crime rates in the world. The city-state ranks second in three fields of infrastructure security, digital security and health security and takes place among the 15 countries with the highest level of personal security at the global level [30].

- *Electronic Interactive and Communication Services*: Singapore's connection to the wireless internet with wide broadband and maximum use of smart phones by citizens has paved the way for launching internet sites with citizen-central content to increase the amount of online transactions between citizens and government institutions as well as with businesses. In order to maximize the range of online services and change the form of governance from "Government-to-You" to "Government-with-You", since 2000, the Singapore government has designed and implemented various plans such as e-Government Action Plan (2000-2003), e-Government Action Plan II (2003-2006), iGov Masterplan (2006-2010) and eGov2015 Masterplan (2011-2015). The Singapore e-Government programs are divided into three categories; programs for citizens, programs for businesses and programs for government [5]. In the framework of programs for citizens, the Singapore government launched *data.gov.sg* in June 2011 to provide easy access of citizens to publicly-available government datasets; *OneInbox* in December 2013 to provide an official government platform that citizens can receive government-related correspondences electronically and *SingPass* in July 2015 which is an authentication system to access citizens to all e-services of the government. Citizenconnect, eCitizen, e-Visitor, etc. are the other programs which are launched for citizens. *OBLIS*, which allows businesses to apply, update, renew or terminate any online business licenses issued by government agencies online; *Business Incentive Profiler*, which provides businesses a one-stop access to all government grants available to businesses; *Government Electronic Business (GeBIZ)*, which is one-stop e-procurement portal, etc. are the programs which are launched in the framework of programs for businesses. The *Government Cloud (G-Cloud)*, that provides a secure ICT shared environment for government agencies; *Infocomm Security Masterplan*, which serves to guide Singapore's national-level attempts to secure its country against external or internal cyber-threats; *Cube*, that provides social networking platform among public officers to exchange ideas, etc. are the programs which are launched in the framework of programs for government [5].
- *Energy Sector Services*: Optimum and effective use of energy is an important issue that is considered in the direction of shaping the smart Singapore. In order to provide reliable energy, promote effective competition in the energy market and develop a dynamic energy sector, the Energy Market Authority (EMA) operates as a legitimate body under the Ministry of Trade and Industry. EMA, which operates with the vision

of “Smart Energy, Sustainable Future” and “To Forge a Progressive Energy Landscape for Sustained Growth” mission [32], is trying to maximize the use of smart technology in the energy sector. EMA has launched its special website to explain its visions, plans, projects, achievements and service spectrum related to electricity, gas, renewable energy, electric vehicle charging system, etc. and establish a path to provide communication between citizens and this institution related to the mentioned cases. Together with grid operator Singapore Power (SP), EMA launched the Intelligent Energy System (IES) Pilot to improve network operations, provides real-time information about the electricity consumption of consumers, provides monitoring of consumers on their energy consumption and makes it possible for consumers to choose the energy package that best suits their needs [33].

- *Environmental Services:* The smallness of geographical territory and lack of land to collect and store rainwater have made the lack of water a constant challenge in Singapore as a country with a large and fast-growing population. In addition to this, the hot climate situation and the increasing population cause different environmental problems, which managing and control of them undoubtedly require accurate plans and measures. In order to manage these causes, the Singapore government has created two statutory boards: The National Environment Agency (NEA) and the Public Utilities Board (PUB) in the form of the Ministry of Sustainability and the Environment (MSE). The NEA has responsibilities related to improving and sustaining a clean and green environment [34]; whereas, the PUB is responsible for ensuring a sustainable and efficient water supply in the country [35]. The use of smart solutions by resorting to the use of new technology is the way that the relevant institutions have resorted to; apart from encouraging citizens to save and increase efficiency in water consumption by sending messages from the National Water Company, Singapore Power provides a mobile application that allows citizens to know the economical ways to use water and electricity, get information about their outstanding bills and payment status and submit meter readings. NEA monitors climate issues and related information such as pollution levels, 24-hour PSI values, the integrated air quality reporting index, etc. is available online to citizens through the official website of this institution. In this regard, since 2015, smart waste bins have been introduced as part of the smart waste management program. The sensing monitors that are attached to bin lids collect information about content and location and this is notified to a waste collection team through a central server to help the waste collection team optimize their route planning and constantly keep public spaces clean.

#### **4. Evaluation and Conclusion**

For a long time, the idea of turning Singapore into an “Intelligent Island” has been proposed by the administrators of this country. The small territory, limited resources, dense population, ever-increasing population and, as a result, the problems caused by them required a suitable and quick response of the government. The administrators of Singapore looked at resorting to new technologies as a solution and tried to turn the small island into a smart city-state. A city-state that should be a perfect example of a “smart city”; a city that uses information and communication technology (ICT) to create a high quality of life,

create a more interactive environment and make its services more efficient [36]. The Smart Nation initiative, which was launched in late 2014, is considered a milestone in this direction, which aims to make Singapore the first smart city-state or the first mega-smart city in the world. Although the mentioned initiative is facing some challenges, limitations and obstacles, but in the form of this initiative, many steps have been taken towards the digitization of the country, and many programs are on the edge of planning, testing or implementation.

Thus, despite all the efforts and achievements, the smart nation initiative faces significant obstacles, challenges and limitations. The connecting of “Everything and Everybody Everywhere All the Time” [10], which makes the vision of every smart city as well as Singapore, is not entirely available yet as expected. For example, it has been pointed out that the Smart Nation initiative has been unable to capture the public imagination in practice and lacks a clear success story [37]. The fact that the initiative is in the hands of the government and consequently that the government is at the center of the Smart Nation initiative, -while the smart city model should be citizen-oriented and “citizen needs-centric” [38], has negatively affected the role of the private sector and the opportunities which can be available in this sector [39]. Lack of attention or little attention to the interests and demands of stakeholders, considering that the smart nation initiative is actually like breaking the boundaries from the point of view of data, can be a big challenge on the way to the formation of the smart nation. Citizens’ reluctance to share personal data, as well as lack of trust in the government’s ability to protect this data, is another major challenge for the Smart Nation initiative [40]. The problems of the pioneer generation (65 years old and above) in using new technologies, as well as the possible problem of the financial ability of the poor in using some services, such as owning and installing smart devices or paying for broadband, etc., are among other challenges facing the Smart Nation initiative [18].

Due to these challenges and problems, opinions have been raised by experts that Singapore needs a new and inclusive Smart Nation vision that does not leave any citizen behind; a vision to focus on closing the participation gap and scaling up partnerships while strengthening the digital psyche [41]. However, responding to the needs of the citizens and addressing the country’s problems is something that Singapore has achieved to some extent, but whether or not the ambitious goal of becoming the world’s first smart nation will be realized is something that the passage of time will reveal.

## References

- [1] Department of Statistics, [Online]. Available: <https://www.singstat.gov.sg/find-data/search-by-theme/population/population-and-population-structure/latest-data>. [Accessed 25 03 2023].
- [2] Department of Statistics, Ministry of Trade & Industry, Republic of Singapore, "Census of Population 2020, Statistical Release 1: Demographic Characteristics, Education, Language and Religion," *Census 2020*, p. 7.
- [3] J. Leyden, *Malay Annals*, London: A. & R. Spottiswoode, New-Street-Square, 1821.
- [4] A. Mahizhnan, "Smart cities: The Singapore case," *Cities*, vol. 16, no. 1, pp. 13-18, 1999.

- [5] S. K. Lee, H. R. Kwon, H. Cho, K. Jongbok and D. Lee, "Singapore, Republic of Singapore," in *International Case Studies of Smart Cities*, American Development Bank (IDB), 2016, pp. 1-32.
- [6] "National Library Board eResources," [Online]. Available: <https://eresources.nlb.gov.sg/history/events/f499072d-330f-4763-a105-dd9940f1890b#1>. [Accessed 03 04 2023].
- [7] National Computer Board, "The IT2000 Report," in *A Vision of an Intelligent Island*, Singapore, National Computer Board, 1992, p. 10.
- [8] N. Wang, "Singapore's Experience and Enlightenment of Building a "Smart Nation"," *E3S Web of Conferences 251, 2021 International Conference on Tourism, Economy and Environmental Sustainability (TEES 2021)*, 2021.
- [9] L. H. Loong, "Prime Minister's Office Singapore," 2014. [Online]. Available: <http://www.pmo.gov.sg/newsroom/transcript-prime-minister-lee-hsien-loongs-speech-smart-nation-launch-24-november>. [Accessed 10 04 2023].
- [10] S. Leonard, "Inside Singapore's preparations to become a Smart Nation, Exclusive interview with Steve Leonard," 2015.
- [11] Smart Nation Programme Office, "About Smart Nation," 2016.
- [12] C. W. Tan and S. Pan, "Managing e-transformation in the public sector: an e-government study of the Inland Revenue Authority of Singapore (IRAS).," *European Journal of Information Systems*, no. 12:4, pp. 269-281, 2003.
- [13] J. J. Woo, "Technology and Governance in Singapore's Smart Nation Initiative," sh Center for Democratic Governance and Innovation. Harvard Kennedy School, 2018.
- [14] "Smart Nation Singapore, Milestones of Singapore's Smart Nation story," [Online]. Available: <https://www.smartnation.gov.sg/about-smart-nation/our-journey/milestones>. [Accessed 12 04 2023].
- [15] V. Felice, "Singapore: Smart City to Smart Nation," *Case Study Series No. 63*, p. 2, 2020.
- [16] "Smart Nation Singapore, Transforming Singapore Through Technology," [Online]. Available: <https://www.smartnation.gov.sg/about-smart-nation/transforming-singapore>. [Accessed 12 04 2023].
- [17] L. H. Loong, "Prime Minister's Office Singapore," 2017. [Online]. Available: <https://www.pmo.gov.sg/Newsroom/national-day-rally-2017>. [Accessed 20 08 2023].
- [18] E. S. Chia, "Singapore's Smart Nation Program: Enablers and Challenges," 2016.
- [19] "Gobusiness Singapore," [Online]. Available: <https://www.gobusiness.gov.sg/run-and-grow/>. [Accessed 22 04 2023].
- [20] "Smart Nation Singapore, Strategic National Projects," [Online]. Available: <https://www.smartnation.gov.sg/initiatives/strategic-national-projects>. [Accessed 20 04 2023].
- [21] "LifeSG," [Online]. Available: <https://www.life.gov.sg/about-us>. [Accessed 22 04 2023].
- [22] "jtc," [Online]. Available: <https://estates.jtc.gov.sg/pdd>. [Accessed 22 04 2023].
- [23] "ONEMOTORING," [Online]. Available: <https://onemotoring.lta.gov.sg/content/onemotoring/home.html>. [Accessed 02 05 2023].
- [24] "SCDF," [Online]. Available: <https://www.scdf.gov.sg/home/about-us/corporate-philosophy>. [Accessed 02 05 2023].
- [25] A. Labus , B. Rodić, M. Radenković, S. Mitrović and T. Naumović, "An IoT system for healthcare in the smart city," *Smart Cities and Regional Development (SCRD) Journal*, pp. 77-89, 2022.
- [26] "HealthHub," [Online]. Available: <https://www.healthhub.sg/about-us>. [Accessed 04 05 2023].
- [27] "IHIS," [Online]. Available: <https://www.ihis.com.sg/vc>. [Accessed 04 05 2023].
- [28] "HealthHub," [Online]. Available: <https://www.healthhub.sg/programmes/37/nsc>. [Accessed 04 05 2023].
- [29] "Singapore Police Force," [Online]. Available: <https://eservices.police.gov.sg/homepage>. [Accessed 05 05 2023].



- [30] "The Economist, Safe Cities Index 2021," [Online]. Available: <https://safecities.economist.com/>. [Accessed 05 05 2023].
- [31] "Global Peace Index 2023," [Online]. Available: <https://www.visionofhumanity.org/wp-content/uploads/2023/06/GPI-2023-Web.pdf>. [Accessed 05 05 2023].
- [32] "Energy Market Authority," [Online]. Available: [https://www.ema.gov.sg/Vision\\_Mission\\_Values.aspx](https://www.ema.gov.sg/Vision_Mission_Values.aspx). [Accessed 06 05 2023].
- [33] "Energy Market Authority," [Online]. Available: <https://www.ema.gov.sg/cmsmedia/Newsletter/2012/04/eyeon-emaIES.html#:~:text=The%20IES%20Pilot%20is%20an,share%20information%20seamlessly%20and%20securely>. [Accessed 06 05 2023].
- [34] "Natal Environment Agency," [Online]. Available: <https://www.nea.gov.sg/corporate-functions/who-we-are>. [Accessed 06 02 2023].
- [35] "PUB Singapore's National Water Agency," [Online]. Available: <https://www.pub.gov.sg/about>. [Accessed 06 05 2023].
- [36] S. Carboni, "The new advanced Cities from the Green and Digital to the Smart Cities," *Smart Cities and Regional Development (SCRD) Journal*, pp. 109-122, 2022.
- [37] K. Kwang, "Commentary: Singapore's Smart Nation vision blurry without a success story," Channel NewsAsia, 2017.
- [38] M. Pavlovskaya and O. Kononova, "The Smart City Vision: The Internet-of-Postal-Things (IoPT) Approach," *Smart Cities and Regional Development (SCRD) Journal*, vol. 2(1), pp. 57-69, 2018.
- [39] T. Weizhen, "today, The Big Read: Speed bumps hinder Singapore's Smart Nation drive," 14 04 2017. [Online]. Available: <https://www.todayonline.com/singapore/big-read-speed-bumps-hinder-singapores-smart-nation-drive>. [Accessed 08 05 2023].
- [40] G. Ong-Webb, "Commentary: To benefit Singaporeans, Smart Nation must leverage big data, overcome privacy issues," Channel NewsAsia, 2017.
- [41] C. Soon and S. Goh, "Commentary: Singapore needs a new Smart Nation vision that doesn't leave any citizen behind," Channel NewsAsia, 2021.

