Building Smart Cities and Villages in Azerbaijan: Challenges and Opportunities

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In recent years, many developed and developing countries have turned their attention to the catchy and attractive new concepts of the *Smart City* and the *Smart Village* (Albino, et al. 2015). In the academic and popular literature, these concepts have been presented as universal solutions to urban and rural problems. From Finland and Denmark to India and Singapore, policymakers have rushed to implement these concepts with various degrees of success. Nevertheless, different understandings and incorrect conceptualization and implementation have led to dubious results. Thus, the literature talks a lot about the success of the Danish cities Aarhus and Copenhagen, Finland's Smart Helsinki, Singapore's Smart Nation, and others. However, the examples of Lavasa (India), Ordos (China), and Santander (Spain) are cases where the cities had a great plan but [failed](#) to grow organically as needed by the citizens.

In the following article, I will try to go over the issues on how Smart Cities can be implemented in Azerbaijan, the challenges Azerbaijan may face in implementation, and, finally, opportunities for the country to bring this concept to life.

What is a Smart City and why do we need it?

Before getting into this discussion, it is necessary to understand what the concept is about. The literature cites numerous definitions of Smart Cities/Villages. A simplistic understanding of the Smart City concept defines it as applications and technologies which choose cities and communities as target groups, improve the way of living and

working in the region, spread information and communication technologies (ICT), and more importantly achieve sustainability. For the following article, however, I will use the definition given by Infocomm Media Development Authority (IMDA), an agency for supporting the *Smart City* concept in Singapore. IMDA defines a Smart City as "a village, district, city, region or small country which takes a holistic approach to employ information technologies with real-time analysis that encourages sustainable economic development" (IMDA, 2012).

The first question that arises is: why do we need Smart Cities today? According to the United Nations Population Fund statistics, more than half of the world's population lives in cities. However, this number is increasing continuously and is expected to reach 70% by the year 2050 (UNFPA, 2007). Massive urbanization leads to huge consumption of resources, which results in negative consequences for the environment (Veselitskaya, 2019). This rapid growth in urban populations leads to a variety of technical and infrastructure-oriented problems, such as difficulty in waste management, scarcity of resources, air pollution, human health concerns, traffic congestion, and deteriorating infrastructure. Additionally, social problems such as health care, distribution of pensions, management of social services, education, and others became significantly more complex issues. To prevent the drawbacks of urbanization, cities need solutions that require the collaboration of government, community, city agencies, nonprofit organizations, etc. Cities urgently need innovative organizational and institutional arrangements to solve emerging technical, physical, and social problems. In this case, *Smart City* serves to help make cities better places.

The Smart City concept and the problems of Azerbaijani cities

Azerbaijan is among the list of countries striving to utilize the Smart City/Village approach. Victory in Karabakh and the liberation of those territories pose a new challenge for

Azerbaijan. Massive reconstruction and resettlement of the population are seen through the Smart City/Village concept. Azerbaijani President Ilham Aliyev announced in January 2021 that "settlements recently liberated from Armenian occupation will be re-established based on the concept of smart city/village" (Caspian News, 2021). Moreover, the president signed an order to prepare the Smart City and Smart Village Concept, and a working group was established representing various ministries (ibid). But while in Karabakh the Smart concept will be used to attract the population back, provide sustainable development for the territories, and revive the region, in established cities in Azerbaijan the situation is different. The cities of Azerbaijan, especially Baku, have several growing problems that need to be addressed.

Rapid urbanization. Azerbaijan has a population of over 10 million people, and urbanization continues to increase. 56% of the total population lives in urban areas or cities (World Bank, 2020) while unofficially this number could be higher. For example, Baku has around 2.4 million people, while the Baku Metropolitan Area (the territory where people come from the regions every day for work, study and leisure, encompassing Baku, Khirdalan, and Absheron) may have a population of more than 4 m. Currently, 35% of the labor force, or around 1.5 m people, live in rural areas. Meanwhile, for sustainable agriculture the country may need a much smaller number of people. It is expected that due to increased technological innovation in agriculture, the rural population's migration to urban areas will accelerate. With the high cost of the pandemic, it is expected that within a few years more than a million people will migrate to urban areas and to Baku specifically. This will occur due to further technological advancement in agriculture, robotization, and the decreasing cost of labor in rural areas. The pandemic has accelerated the introduction of advanced technologies in society and especially in agriculture.

**Azerbaijan: Urbanization from 2009 to 2019**
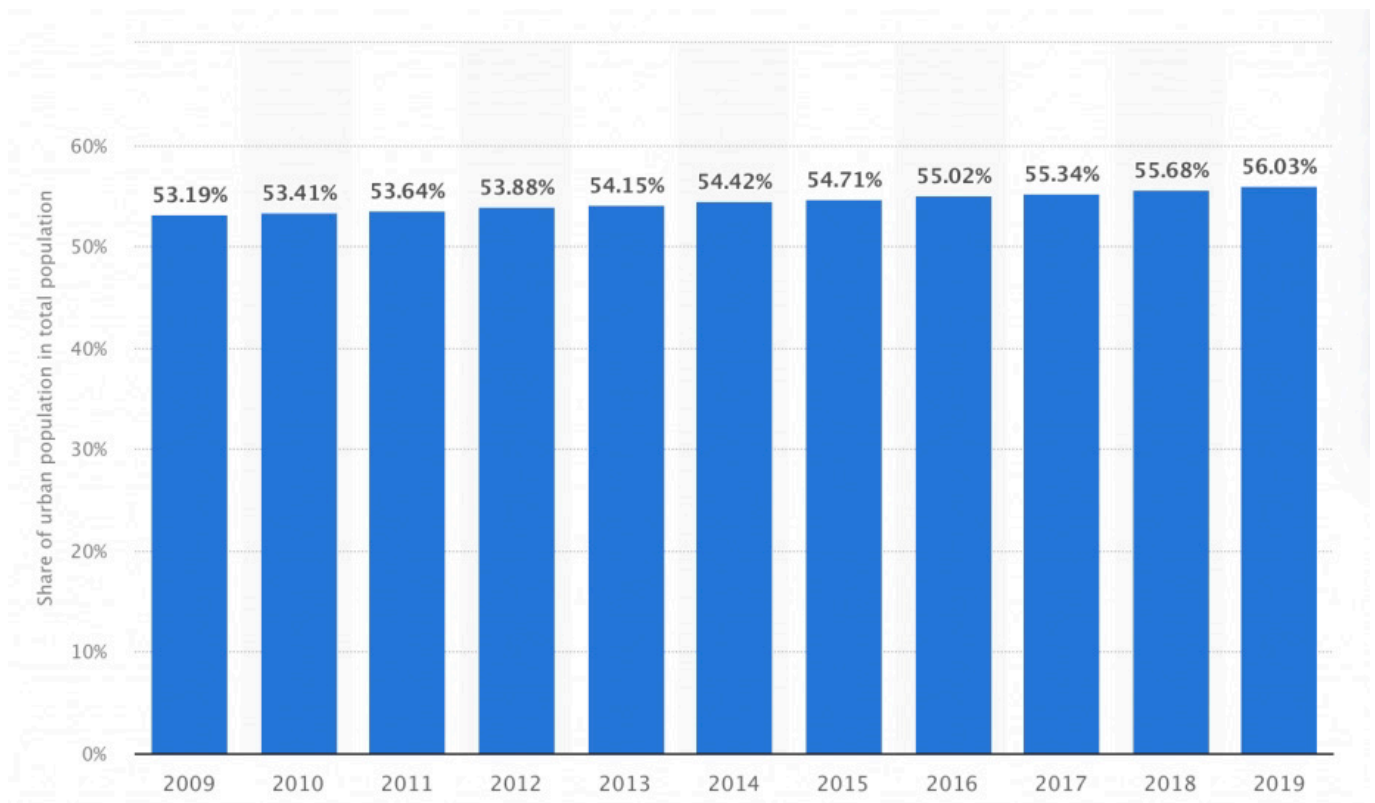
Source: Statista. (2021, June 22). *Urbanization in Azerbaijan 2019*.
https://www.statista.com/statistics/455781/urbanization-in-azerbaijan/

Economic disparity. Economic and social disparities among the cities of Azerbaijan are another problem. The capital city, Baku, accounts for 70% of GDP due to the oil and other business sectors. Meanwhile, the lion's share of tax collection and investments are also generated by Baku. A lag in economic diversification and the absence of structural changes in the economy, combined with persistent human capital gaps between urban and rural populations (World Bank, 2021), have led to this difficult situation. The disparity in income generating abilities between Baku and the rest of Azerbaijan is another problem that needs to be tackled.

Level of Urbanization by Economic Region, 2015

(%)
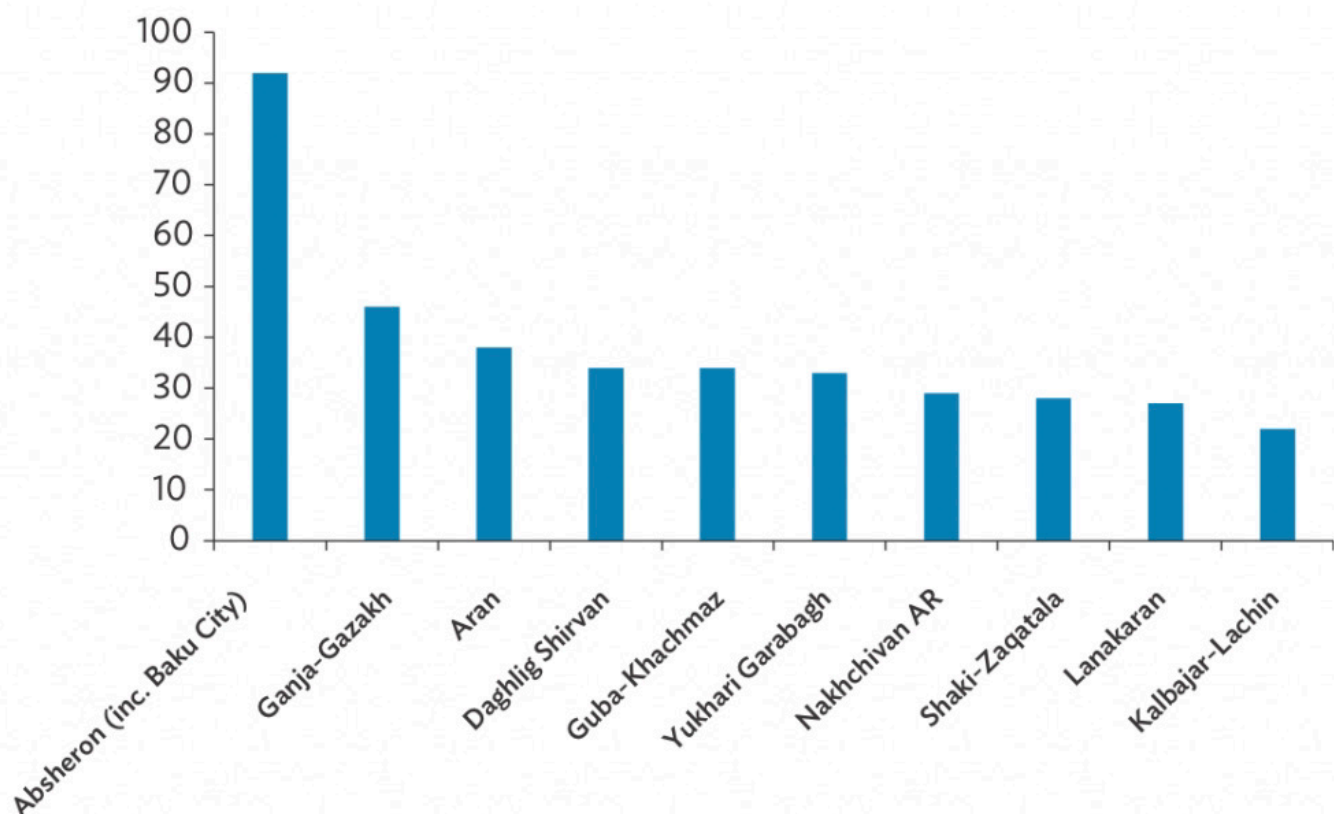
AR = Autonomous Republic.

Note: Data are from government statistics. By making any designation of or reference to a particular territory or geographic area, the Asian Development Bank does not intend tomake any judgments as to the legal or other status of any territory or area.

Source: State Statistical Committee of the Republic of Azerbaijan. 2015. *Statistical Yearbook*. Baku.

Fast Motorization. Massive car ownership in the Baku area is one of the crucial problems of urban development. Since the beginning of 2000, car ownership has increased from 55 to 143 per 1,000 residents (State Statistical Committee, 2019). Out of the 1.4m cars registered in Azerbaijan in 2019, we can assume that at least 1m enter and operate in Baku, contributing to environmental problems, traffic, and accidents. Meanwhile, the low quality of the transportation sector, particularly in Baku, has become one of the most visible issues in urbanization. Urban sprawl and the new settlements on the outskirts of Baku have triggered car usage in and around the area and led to a "domino effect" (Jafarli, 2018). Since residents in this area prefer to use cars over public transportation to commute to work, schools, and other places which are mostly based in the metropolitan area of

Baku, the number of cars is increasing exponentially. The huge amount of car ownership is a warning to government officials to consider its negative effects on the city's development and climate change as well. As an example, such widespread use of cars influences the city environment, increases CO2 emissions, causes noise and pollution, and damages the air quality. Besides that, massive car usage leads to a number of accidents, creates traffic congestion, and takes people's time and energy.

Infrastructure. Despite government investment in regional development programs throughout the 2000s, rural-urban disparities in access to basic services remain significant. Access to drinking water and heating is almost universal in Baku and other urban areas, while in rural areas, only 76% of households have access to running water, and 82% to gas. Access rates are higher in Absheron and Baku and lower among poorer populations in Aran, Daghlig-Shirvan, Ganja, and Guba (World Bank, 2021). The recent drought in Neftchala, Salyan, and other areas shows that the non-rational usage of water has led to problems with water delivery in many regions. That affects not only agriculture but also the living standards of the people.

How can Smart City help the cities of Azerbaijan?

Based on best-case examples from various countries, we can predict where the Smart City/Village concept and technologies can make serious changes.

Urban Transportation. It is worth mentioning that the Smart City concept does not only involve technological changes, but also making smart decisions in the first place. Thus, banning the use of private cars in city centers may lead for example to USD 1.68 bln in savings for the households of Berlin. The dominance of micro-mobility, i.e. using bicycles, electric scooters etc., may lead to 60% fewer annual traffic-related fatalities in London; using robot-shuttles (i.e. trams,

electric buses, etc.) decreases CO2 emissions in Los Angeles by 2.5 mln tons per year or a 100% increase of public space in New York (BCG, 2020). But for Baku and other urban centers, one of the first steps toward smart urban transportation would be linking passenger transportation agencies under one platform. Thus, the average citizen would get on their phone real-time arrival-departure data for all modes of transportation; a single payment mechanism for all modes of transportation, including suburban railroad, metro, buses, and taxis if needed. A flexible flat payment mechanism (via QR codes, NFC, or other applications); improving the comfort of public transportation; and fast passenger transportation via special lanes (already available in Baku but not enforced) could help the city. An additional smart concept could be improving the parking system, allowing online reservations for parking and flexible parking fees preventing cars from parking in city streets.

A smart light system calculating the traffic in a city in real time and making decisions based on a holistic approach is another great option to manage urban transportation. For example, in Singapore, all traffic signals are controlled by the Green Link Determining (GLIDE) system. Under this system, green lights are allocated based on real-time traffic demands, and traffic signals at neighboring junctions along major corridors are linked, minimizing drivers' stops while they travel from one junction to another (this is known as a green wave). The presence of pedestrians is detected through a push-button that they press at crossings.

The car sharing concept that is used today in Azerbaijan mostly for commercial purposes in the Baku metropolitan area could be further developed and made smarter. As in Barcelona, Baku could increase bike usage. Barcelona is implementing bike sharing in its Smart City Planning. The number of bikes is above 120,000 and sharing makes their use more affordable and helps to reduce the number of cars in the city (Zigurat Global Institute of Technology, 2019).

Urban Infrastructure. With increasing usage of utilities, smart usage of water, electricity, gas and waste management is becoming another necessity. The example of other cities shows that such solutions can be implemented in Baku. Thus, in 2015 smart waste bins were introduced in Singapore as part of a smart waste management program called *Smartbin*. The sensing monitors attached to bin lids collect information on contents and location and garbage teams are notified through a central server. This helps the waste collection team to optimize their route planning and, at the same time, keep public spaces constantly clean.

NEWater is high-grade reclaimed water produced from treated used water that is further purified to become safe drinking water. In 2010, the largest NEWater plant was built and now this meets up to 30% of the nation's current water demands. It is expected that NEWater can meet up to 55% of the demand by 2060. The smart monitoring system that uses multi-functional water sensors allows water loss, or non-revenue water, to be kept at 4.6% in Singapore, one of the lowest levels in the world.

Urban Planning. Pedestrian-friendly areas facilitate cities becoming smart and sustainable. The Paris Model may be a good example to apply to the cities of Azerbaijan. The objective was to create a sustainable neighborhood where people can reach everywhere within 15 minutes. The model also focuses on minimizing the number of cars to decrease CO2 emissions and to prevent car accidents.

Threats and weaknesses in Smart City implementation in Azerbaijan

Digital Weakness. Azerbaijan has a big digital divide between the capital and other urban/rural areas. There is a 20-percentage point gap between rural and urban households in fixed internet penetration. This digital divide is mainly due to shortages of fixed infrastructure and lower levels of

digital literacy in rural areas (ADB, 2019). The country will also need to make broadband internet faster, cheaper, and more accessible. Although overall mobile broadband coverage and adoption is high, there is a significant digital divide between urban and rural areas in the quality/speed, use, and affordability of the internet (World Bank, 2019). According to household survey data on ICT use reported by AzStat, in 2018 only 15% of individuals used the internet to interact with authorities and avail themselves of public services, and 7% used it for education or learning activities. Beyond that, internet speed in Azerbaijan is the lowest in Europe, making it difficult to implement the Smart City concept. (AzStat, 2018). Finally, Speed Test Global Index for June of 2021 ranked Azerbaijan [122nd](#) out of 181 countries on speed of broadband internet with its 25.5 mbps of download speed. Azerbaijani internet speed is the worst in Europe, and in the former Soviet republics only Turkmenistan is worse.

Nevertheless, mobile internet speed is ranked decently at 66th place.

Financial Weakness. The technology and user knowledge of e-commerce and e-payment systems is limited, and trust in such systems is low. Only one in 20 people in Azerbaijan (5%) purchased something online in 2017, compared to a worldwide average of almost one in four people (24%). Azerbaijan ranks 68 out of 144 countries on the B2C e-Commerce Index, due to low penetration of e-payments, including credit and debit cards, a shortage of domestic online shops, underdeveloped logistics, lack of trust by both buyers and sellers, and low digital literacy in general. Less than one-third of the population has a bank account, and only one quarter has a debit card, many of which are social insurance and salary cards. Mobile and internet-based digital payment tools are rarely used due to limits on the amount of a transaction and other restrictions. Another barrier is the high transaction fees associated with international credit card payment networks. In addition, there are many barriers in financial

transactions that prevent the development of the financial markets.

Ineffective, Inefficient Governance and Poor Innovation Potential. While all previous problems can be fixed with technological advances and technical solutions, the main hurdle is the issue of governance. In all successful cities where the Smart City concept has been implemented, public participation and involvement in decision-making has been essential. Without the involvement of people and without counting their voices in decisions, no Smart City can work. One of the main problems in Azerbaijan is that it follows a monocentric model in its administration and urbanization. The current situation in Baku in particular shows that it is difficult to manage such a megapolis with traditional methods and there is a great need for new innovative governance, management to cope with traffic and environmental challenges, waste and utility management, e-governance, education, health/pandemic management, etc.. Involving municipalities and local communities could be a solution in laying the foundation of a smart city. A recent Global Innovation Index put Azerbaijan in 82nd place among 131 countries in innovation potential. The weakest sub-area where Azerbaijan is behind many countries is knowledge and technology output. Thus, high-tech export accounts for less than 0.1% of Azerbaijan's GDP, while knowledge impact and knowledge creation is negligible.

Opportunities for Smart Cities in Azerbaijan

The emergence of the COVID-19 pandemic last year made both the public and private sectors move to digitalization, such as public health, education, commerce, and other public services. The recent situation forces the government and citizens to adapt to the changes with the help of technologies. The pandemic helped Azerbaijan to make a breakthrough in the digitization of society, and now more technologies should follow so as not to waste this opportunity.

Additionally, the 44-day war between Azerbaijan and Armenia accelerated the need to restore the cities and villages which have been liberated from occupation. Hence, to develop the Karabakh region in a sustainable way, the Smart City/ Smart Village concept is a primary item on the agenda. There is an urgent need to change the status quo and design a model which will improve all cities in an efficient and effective way and accelerate the economic situation at the same time. The positive side is that the government understands the need for Smart Cities and the president of Azerbaijan even announced the establishment of Smart Cities/Villages in Karabakh. In the aftermath of the war, the region requires concentration in terms of its economic, social, and environmental development. The whole territory is devastated, and there is no infrastructure now, therefore, it should be built from scratch, and certain types of innovations should be implemented. While doing this, the needs and demands of the population should be the primary consideration. In this sense, it might be more applicable and less expensive to the whole Karabakh region to implement the Smart Concept across the territory rather than focusing on one Smart Village. Examples for the area can be smart agriculture, such as agricultural hubs in the region, as well as smart water management, smart electricity, smart education, and more public services.

Conclusion

Despite all the challenges, the establishment of Smart Cities or Smart Villages in Azerbaijan is doable and possible. The government and the private sector can provide all the necessary financial and technical capital for a very short period. What cannot be done within a short period of time is to train and give birth to new clusters of smart, creative people working in various creative industries. The government should put every effort into bringing and training these people since only human capital can make the Smart City concept real.

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