

Azerbaijan's smart cities/villages concepts for Karabagh region. How real and doable to lead to success?

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Abstract

The past few years in Azerbaijan have been marked by growing government interest in using ‘smart’ solutions in urban and rural planning. The results of the Karabakh conflict pushed these aspirations even further, with ‘smart’ technologies being seen as the key instruments in the redevelopment of the de-occupied territories. Since cities are vital mechanisms for economic growth, it is generally believed that applying modern technologies in urban and regional planning can increase the economic performance of a nation while ensuring sustainability. This article will discuss Azerbaijan’s existing experience in ‘smart’ development and examine the extent to which the role of public-private partnership as a tool that can possibly facilitate smart transformation of cities and regions ensuring wider range of prospects for various stakeholders including residents, business actors, authorities, educational institutions, NGOs and so on, as well as create a more sustainable economic and social environment. In the case of Azerbaijan. Special attention is given to the experience of the prominent smart communities in different part of the world, in terms of the applied models of private-public collaboration. The comprehensive SWOT-analysis of the PPP concept in smart cities is conducted based on which the conclusions regarding its collisions and potential are made. Considered on the recent trends in urban development the significance of searching for new approaches to the city governance, in order to cope with the challenges more efficiently and provide advance services for the citizens, is highlighted. The concepts of Smart Cities are viewed as powerful vehicles for fostering urban prosperity. This article also opens a general discussion about the concept of the ‘smart city’ and how it can be understood in the context of public-private partnership as a tool that can possibly facilitate smart transformation of cities and regions ensuring wider range of prospects for various stakeholders including residents, business actors, authorities, educational institutions, NGOs and so on, as well as create a more sustainable economic and social environment. Furthermore, it discusses the problems of conceptualisation and operation-allocation of smart city projects in Azerbaijan and elsewhere, and the ways in which they can lead to project failure or success. The article also addresses the problems of implementation of the smart city concept in the country and discusses how to adapt general visions and global aspirations for smart and sustainable cities to the Azerbaijani context. Furthermore, the article suggests which metrics and policy domains the authorities should consider when translating the smart city visions into policy while applying PPP elements. The article also discusses the preconditions for success, and whether Azerbaijan has the necessary infrastructure and specialists for its implementation.

Keywords: Smart cities, smart villages, smart governance, Karabagh, Azerbaijan.

1. Introduction

Worldwide, the notion of smart city is getting more and more relevant for both academics and policy makers. Regardless of confusion about what a smart city is, as several similar terms are often used interchangeably, and the term is also used in ways that are not always consistent. According to [1], there is neither a single template of framing a smart city, nor a one-size-fits-all definition of it.

The growing urbanisation of the past years has led to increased vehicle traffic in Azerbaijan’s cities, resulting in extra focus on traffic management and its improvement as a part of city planning. In this case, the improvement and efficiency of smart transportation or mobility has become one of the priorities of the Baku’s ‘smart city’ plan. The question is what exactly ‘smart transportation’ is, and how it can make movement through cities more

efficient. The 'Internet of Things (IoT) manages, evaluates, and monitors transportation systems to be effective, efficient, and safe [2]. The idea: smart sensors and controllers handle all the traffic management, only interfering when necessary. Thus, the importance of new technologies and their management is paramount in the implementation of a smart transportation system. Moreover, it is safer than traditional transportation system, as it involves machine learning and IoT.

This article will discuss the issues on how Smart Cities can be implemented in Azerbaijan, is that myth or reality? The potential challenges and obstacles which may come up through the implementation finally, opportunities for the country to bring this concept to life.

2. Literature Review

Defining Smart cities is a big subject. Many fields of research have shown an interest to study the concept of Smart City. They give birth to theories related to spatial planning [3], economic geography [4], knowledge economy [5], urban technology [6] and marketing [7]. Although these multitudinous studies, academic research is at an early stage and lacks a homogeneous and comprehensive definition [8]. However, the subject retains a constant interest since cities are receiving more and more residents who require living services of quality while financial and physical resources are getting scarce and scarce [9].

In the recent article, [10], asks the questions: Will the real smart city stand up? According to the Holland all the cities often claim to be a smart but do so without either defining what this means or offering any evidence to support such proclamations. [10] state that, validity of any claim to be smart must be based on something more than their use of information and communication technologies (ICTs). [10; pp315] claims that, to the state, smart cities, by definition, appear to be weird cities, although this cannot be the sole defining criteria due to progressively smart cities must seriously start with people and the human capital side of the equation, rather than blindly believing that IT itself can automatically transform and improve cities. Defining the smart solutions relevant to a city involves studying the actual interactions that citizens have with the city, leveraging the city's natural strengths, and co-creating the smart city vision and roadmap to align all constituents [11]. Cities around the world are increasingly experimenting with geographically concentrated innovation ecosystems as innovation testbeds and hubs for knowledge exchange [12]. A city only becomes truly "smart" when all citizens are ready for it. Cities risk excluding entire sections of their population from the smart city practice. Teaching people how to navigate the digital world is a critical aspect of a digital inclusion plan [13].

3. Understanding of smart city and its significance

Through the past decade, the smart city concept has altered primarily in terms of the approaches that cities or communities have chosen for urban transformation. Driven by technology providers in the early years, governments as leaders of the smart city movement have later understood that technology is only the enabler for reaching governmental, economic and societal goals. Today, smart city strategies still consider technology as an enabler, but governments have learned that top-down initiatives or a master planned approach are not the determinants of success [14].

A simplistic understanding of the Smart City concept outlines it as applications and technologies which choose cities and communities as target groups, rapidly improve the way of living and working in the region, increase use of information and communication technologies (ICT), and at the same time achieve long term sustainability. For the following article, however, I will use the definition given by Infocomm Media Development Authority (IMDA), an entity which exclusively for supporting the Smart City concept in Singapore. IMDA also 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 [15].

The first and foremost question that arises regarding the necessity of the Smart Cities. According to the United Nations Population Fund’s latest statistics illustrate, the vast majority of the world’s population reside in cities. However, this figure keeps increasing sharply and is expected to reach 70% by the year 2050 [16]. Enormous urbanization mostly leads to huge consumption of resources, which results in negative worries for the natural environment [17]. 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, civil society unions, etc. Cities urgently need innovative organizational and institutional arrangements to solve emerging technical, physical, and social problems.

4. Concept and implementation of Smart City” and “Smart village” in the Azerbaijan context

As of the year 2021, there was not well defined concept and implementation plan for smart city and villages. Therefore, president has issued an order on the development of “Smart City” and “Smart village” concepts. According to the order, improvement of the quality, safety, and efficiency of services provided in cities and villages of the Republic of Azerbaijan, the application of information technology in these services, as well as ensuring the effective use and management of available resources for these services are one of the key priorities of the sustainable development in sustainable in urban and rural areas.

In the concept, it is mentioned that the use of modern telecommunications, sensors, big data, and other digital and artificial intelligence technologies, as well as innovation and knowledge, makes socio-economic relations more productive and efficient, creates new income opportunities in the value chain of the economy. Improving the quality of decision-making and management based on the formation, collection, storage, processing, and analysis of digital data using the abovementioned technologies in an integrated manner opens up a wide range of opportunities for effective and quality services. These opportunities pave the way for the transition to functional, large-scale “Smart City” and “Smart Village” services in the next stage of development of services provided in cities and villages [18].

Azerbaijan started to be seen among the list of countries attempting to develop the Smart City/Village approach. Right after the war with Armenia back in 2020 autumn and having succeed to gain control over those territories, serious task has set in front of Azerbaijan which is massive reconstruction and resettlement of the population are seen based on the Smart City/Village model. Government of Azerbaijan declared in January 2021 that “settlements recently liberated from Armenian occupation will be re-established based on the concept of smart city/village” [19]. But while in Karabakh region where territories liberated, the Smart city model will be applied to return refugees back once displaced during 1991-1994, provide sustainable and long term development for the territories, and resuscitate the region, in established cities in Azerbaijan the situation is entirely not same. The largest towns of Azerbaijan, particularly the capital city of Baku, have several ageing unsolved questions that need to be seriously tackled.

4.1. Rapid pace of urbanization: Azerbaijan which undergoing impressive urban growth at the rate of 1.5% annually that makes Azerbaijan the fastest urbanizing place in the South Caucasus comparing with its two other neighbours Armenia (0.3%) and Georgia (0.5%) [20]. However, the development of infrastructure and industries has not kept pace with the growth in urban population specifically in the capital city of Baku.

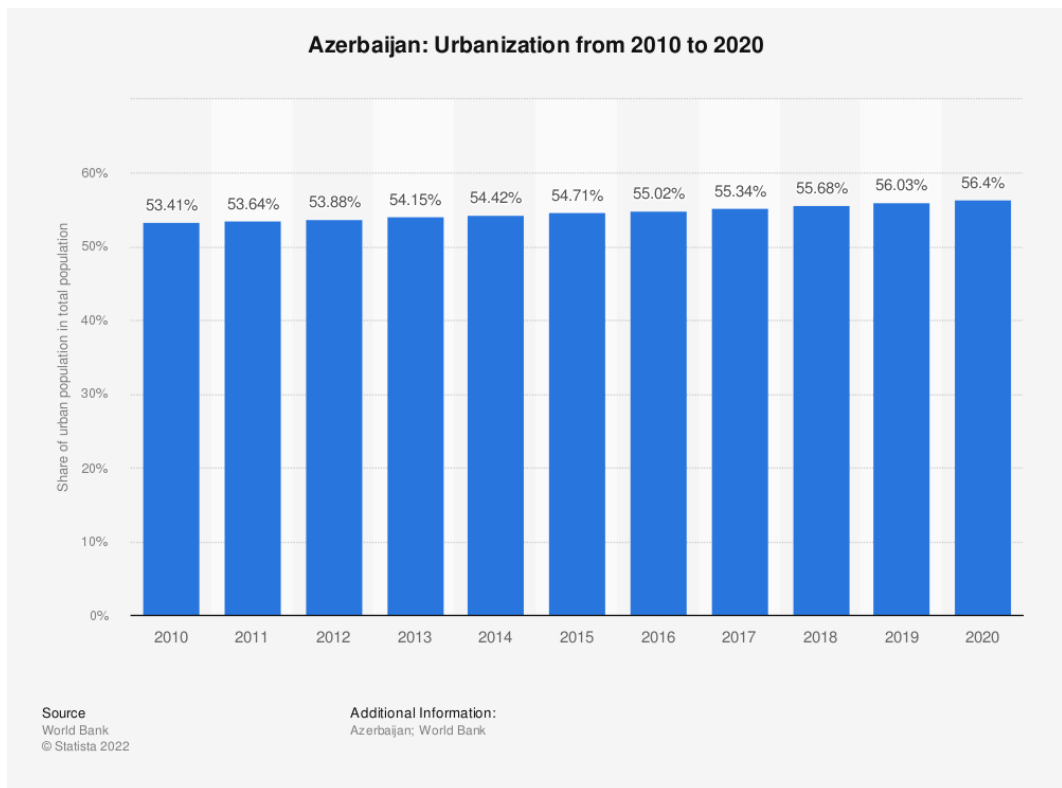
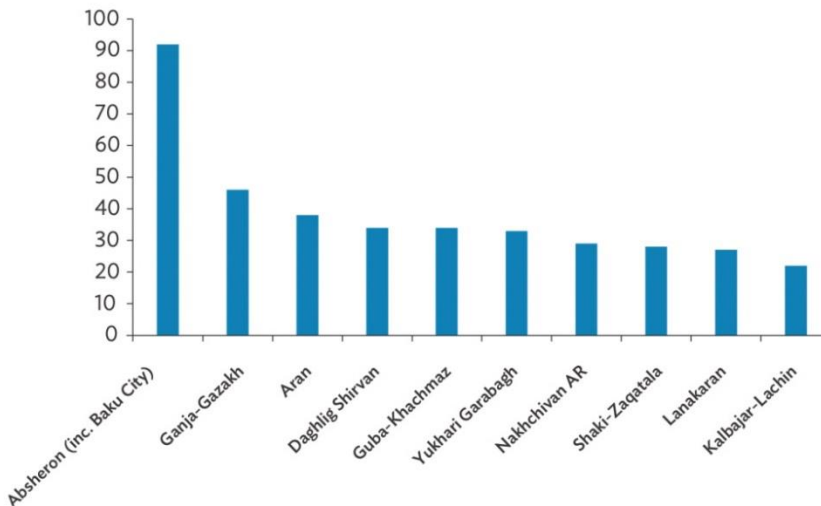


Fig. 1. Azerbaijan: Urbanization’s indicators between 2010 to 2020
 Source: Statista. (2022, January 22). Urbanization in Azerbaijan 2020. <https://www.statista.com/statistics/455781/urbanization-in-azerbaijan/>

Population of Azerbaijan reaching to 11 million already, and urbanization continues to increase. 56% of the total population lives in urban areas or cities [20], 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.

4.2. Economic inequality

Economic and social disparities among the cities of Azerbaijan are major significant issue. The capital city, Baku, accounts for 70% of GDP due to the oil and gas 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 [20], have led to this difficult situation. The disparity in income generating abilities between Baku and the rest of country is another problem that needs to be seriously dealt.



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 to make 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.

Fig. 2. Level of Urbanization by Economic Region, 2015(%)

The certain reports indicate that Tokyo with a population of 35 million people is much less polluted than Delhi with roughly 16 million. Indeed, albeit the twice of population, a better urban management has allowed the Japanese capital to be 4.3 less times polluted than Delhi. Cities have also had a profound impact on the economic competitiveness of a country, performing much better than the national indicators average [21].

4.3. Increasing car ownership

In number of residents who owns car in the capital city can be considered one of the crucial problems of urban development. During the last two-decade, car ownership has increased from 55 to 143 per 1,000 residents [22]. 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 causes. At the same time, still developing transportation sector, mostly in the capital's area, has become one of the most vital 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" [23]. 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.

4.4. 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 [24]. 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.

5. 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.

5.1. 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 [25].

5.2. 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 neighbourhood 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 [25].

5.3. Land Mines in Karabagh region

The main and rather expected problem, at least for the next several years, is the issue of land mines. The Azerbaijani Mine Action Agency (ANAMA) which deal with the demining process, announced that it more than a decade needed in order fully demine liberated territories. Idris Ismayilova, who is head of the operation, stated that approximately seven hundred unexploded rockets as well as five thousand anti-personnel and two thousand anti-tank mines have thus far been removed in only a small area of Karabakh [26]. The preliminary estimated price for the reconstruction process given by Azerbaijani experts amounts to more than US \$20 billion [27]. Meanwhile, some displaced people cannot wait to return to their homes and are willing to invest in this rebuilding and demining process. Next, the government should understand what kind of population it wants in smart villages. While it is it is not difficult to predict the interested strata in urban populations, i.e., mostly the young, the potential makeup of the rural smart village population is at this point impossible to anticipate. Most of Azerbaijan's rural population is involved in traditional agriculture including cattle ranching, farming, etc. It would take great efforts to educate these people on how to properly utilise data and make data-driven decisions. In this regard, the Korean model of training young people in smart agricultural technologies seems more feasible. The government could already at this point begin preparing the relevant plans with academic institutions and think tanks. Finally, smart villages in Karabakh may be the first example in the world where such concept will be introduced from scratch, and not to an already-existing village. The success of smart villages in Karabakh can shift paradigms not only in Azerbaijan, but in the greater region as well, helping breathe new life into countless dying villages.

6. Possible challenges to counter

6.1. Lack of digital literacy and ICT infrastructure

There is considerable digital infrastructure gap between the capital and regions. 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 [28]. 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 [29]. 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 [30]. 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. Information and Communication Technology (ICT) has become an integral part of our lifestyle. Without the internet and digital technology modern lifestyle is unimaginable. Whether it is transportation, telecommunications, healthcare, security, education, almost every segment of society is dependent on ICT.

6.2. 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 [25].

6.3. Smart Public Safety

Smart streetlights with cameras, microphones, and sensors are using computer vision to gather intelligence about traffic, accidents, and crime. In a crisis, they can call for help and direct people to safety.

Smart traffic signals are improving urban mobility by analysing traffic conditions, changing their timing, and easing congestion. During emergencies, they can automatically give first responders the right of way. Smart intersections are capturing and analysing traffic patterns, detecting risks, and warning against imminent accidents, reducing crashes and injuries.

Smart emergency vehicles are capturing and sharing video, audio, and vehicle telemetry, giving dispatchers a real-time view of the field and invaluable data for training and planning. Smart buildings are monitoring access, reviewing video feeds, and running environmental systems. In an emergency, they can share camera feeds and building data with public safety officials.

According to Juniper Research, smart cities may see up to a 15 percent improvement in emergency response times and a 10 percent reduction in violent crime. Smart cities integrate these public safety IoT devices using a common framework and shared data pools. This gives every agency a single pane of glass and shared view of situations as they unfold. It also opens the doors to APIs that can connect public safety technology stacks to citizen data sources like social media, news feeds, even smart building systems [26].

7. 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 [27].

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.

8. Conclusion and recommendations

Nowadays, there is urbanization boom in the south Caucasus. Government and policy makers might acknowledge the critical role that well-managed urbanization will play a critical role in realizing their ambitious national and global development goals and achieve sustainable development goals (SDGs). In this regard, Smart cities can aid the rapid urbanization of Azerbaijan and improve the quality of life of the new city dwellers, solving some of the biggest challenges of the urban environment, such as high-cost, low-quality, and inaccessible services. However, in order for the continent to reap the benefits, planners and policymakers must keep the big picture in mind when promoting smart cities, emphasizing well-implemented infrastructure and citizen needs. Obviously, developing a truly smart city is urges putting people at the heart of any city which requires a venture demanding immense scale, complexity, and commitment. However, lacks clarity in smart cities, undeveloped local governance system, poor urban planning and design practices, poor participation & the challenge of inclusion, mindset problem, lack of resources to

finance urban infrastructure and undeveloped information technology system are among the numerous challenges that they are facing in smart city design and implementation. Despite all lacks clarity in smart cities, undeveloped local governance system, poor urban planning and design practices, poor participation & the challenge of inclusion, mindset problem, lack of resources to finance urban infrastructure and undeveloped information technology system, smart city design and implementation, the establishment of Smart Cities or Smart Villages in Azerbaijan is doable and possible. The state entities and the business sector can mutually 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.

References

- [1] Barzilai-Nahon, K. (2009), *Gatekeeping: A critical review*, Annual review of information science and technology 43, no. 1 (2009): 1-79.
- [2] Malik, S., Rouf, R., Mazur, K., Kontsos, A. (2020), *The Industry Internet of Things (IIoT) as a Methodology for Autonomous Diagnostics in Aerospace Structural Health Monitoring*, Aerospace, 7(5), p.64.
- [3] Hannan, M.T., Freeman, J. (1977), *The population ecology of organizations*, American journal of sociology, 82(5), pp.929-964.
- [4] Bunnell, T.G., Coe, N.M. (2001), *Spaces and scales of innovation*, Progress in Human geography, 25(4), pp.569-589.
- [5] Zygiaris, S. (2013), Smart city reference model: Assisting planners to conceptualize the building of smart city innovation ecosystems. Journal of the knowledge economy, 4(2), pp.217-231.
- [6] Allwinkle, S., Cruickshank, P. (2011), Creating smart-er cities: An overview. Journal of urban technology, 18(2), pp.1-16.
- [7] Caragliu, A., Del Bo, C., Nijkamp, P. (2011), Smart cities in Europe. Journal of urban technology, 18(2), pp.65-82.
- [8] Doel, M., Hubbard, P. (2002), Taking world cities literally: marketing the city in a global space of flows. City, 6(3), pp.351-368.
- [9] Sawaya, A.L., Martins, P.A., Jose, V. (2004), Impact of globalization on food. Globalization of food systems in developing countries: Impact on food security and nutrition, 83, p.253.
- [10] Hollands, R. (2008), *Will the Real Smart City Stand Up? Creative, Progressive, or Just Entrepreneurial?*, City, 12(3): 302–320. [Taylor & Francis Online], [Google Scholar]
 Hollands, R. (2008), *Will the Real Smart City Stand Up? Creative, Progressive, or Just Entrepreneurial?*, City, 12(3): 302–320. [Taylor & Francis Online], [Google Scholar]
 Hollands, R. (2008), *Will the Real Smart City Stand Up? Creative, Progressive, or Just Entrepreneurial?*, City, 12(3): 302–320. [Taylor & Francis Online], [Google Scholar]
- [11] Schaffers, H., Komninos, N., Pallot, M., Aguas, M., Almirall, E., Bakici, T., Barroca, J., Carter, D., Corriou, M., Fernandez, J., Hielkema, H. (2012), *Smart cities as innovation ecosystems sustained by the future internet*.
- [12] Schaffers, H., Komninos, N., Pallot, M., Aguas, M., Almirall, E., Bakici, T., Barroca, J., Carter, D., Corriou, M., Fernandez, J., Hielkema, H. (2012), *Smart cities as innovation ecosystems sustained by the future internet*.
- [13] Fasil, C.B., Biagi, F., Boden, M., Christensen, P., Conte, A., Nepelski, D.P., Szkuta, K., Vertesy, D., Zacharewicz, T. (2017), Current challenges in fostering the European innovation ecosystem (No. JRC108368). Joint Research Centre (Seville site).
- [14] Townsend, A.M. (2013), Smart cities: Big data, civic hackers, and the quest for a new utopia. WW Norton & Company.
- [15] Gascó-Hernandez, M. (2018), *Building a smart city: Lessons from Barcelona*, Communications of the ACM, 61(4), 50-57.

- [16] IMDA Singapore, “iN2015 Masterplan” (2012), <https://www.imda.gov.sg/> Jiang, Huaxiong, Stan Geertman, and Patrick Witte . “Smart Urban Governance: an Alternative to Technocratic ‘Smartness,’” November 9, 2020.
- [17] WHO, U., UNFPA, W. (2007), *Maternal mortality in 2005*, Geneva, Switzerland.
- [18] Veselitskaya, N., Karasev, O., Beloshitskiy, A. (2019), *Drivers and barriers for smart cities development*, Theoretical and Empirical Researches in Urban Management, 14(1), pp.85-110.
- [19] “What do the concepts of "smart city" and "smart village" promise us?.” Azertag. Accessed January 08, 2022. https://azertag.az/xeber/Agilli_seher_ve_agilli_kend_konsepsiyasi_bize_ne_ved_edir-1794275
- [20] “Azerbaijan Accelerates Development of ‘Smart Village’ and ‘Smart City’ Projects.” Caspian News. Accessed July 18, 2021. <https://caspiannews.com/news-detail/azerbaijan-accelerates-development-of-smart-village-and-smart-city-projects-2021-4-20-0/>.” Azerbaijan Accelerates Development of ‘Smart Village’ and ‘Smart City’ Projects.” Caspian News. Accessed July 18, 2021. <https://caspiannews.com/news-detail/azerbaijan-accelerates-development-of-smart-village-and-smart-city-projects-2021-4-20-0/>.
- Statista. (2022, January 22). Urbanization in Azerbaijan 2020. <https://www.statista.com/statistics/455781/urbanization-in-azerbaijan/>
- “Azerbaijan Accelerates Development of ‘Smart Village’ and ‘Smart City’ Projects.” Caspian News. Accessed July 18, 2021. <https://caspiannews.com/news-detail/azerbaijan-accelerates-development-of-smart-village-and-smart-city-projects-2021-4-20-0/>
- [21] DEUSKAR, CHANDAN (2015), “What Does ‘Urban’ Mean?” World Bank Blogs, June 2, <https://blogs.worldbank.org/sustainablecities/what-does-urban-mean>.
- [22] Grimaldia, D.C., Shallab, C.F.K., Fontanalsc, I. (2021), From smart city to data-driven city. Implementing Data-Driven Strategies in Smart Cities: A Roadmap for Urban Transformation, p.1.
- [23] (www.anarsamadov.net), Anar Samadov. “Information Society.” The State Statistical Committee of the Republic of Azerbaijan. Accessed July 18, 2021. https://www.stat.gov.az/source/information_society/?lang=en.
- [24] Guliyev, F., Valiyev, A., Sadigov, T., Jafarli, F., Azimli, N. (2018), Urbanization and Urban Public Policy in Baku. Caucasus Analytical Digest (CAD), 101.
- [25] Marzouk, M., Othman, A. (2020), Planning utility infrastructure requirements for smart cities using the integration between BIM and GIS. Sustainable Cities and Society, 57, p.102120.
- [26] Valiyev, A. (2021), Building Smart Cities and Villages in Azerbaijan: Challenges and Opportunities 06 August 2021.
- [27] Anadolu Agency (2020), *Azerbaijan clears mines from areas freed in Karabakh*, <https://www.aa.com.tr/en/azerbaijan-frontline/azerbaijan-clears-mines-from-areas-freed-in-karabakh/2059833>, date: 21.09.2021.
- [28] Crisis Group interviews, *Azerbaijani economists and experts*, Baku, date: 11.2020.
- [29] Asian Development Bank (2017), *Strengthening Functional Urban Regions in Azerbaijan*, date: 15.04.2021.
- [30] Dudycz, H., Piątkowski, I. (2018), *Smart mobility solutions in public transport based on analysis chosen smart cities*, Informatyka Ekonomiczna. Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu, 2(48).