DESCRIPTION OF THE CONCEPTUAL-ARCHITECTURAL MODEL OF THE SMART CITY

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Abstract: Today, cities have become the main drivers of economic development, standing at the forefront of production and consumption networks. They shape social and economic relations and contribute a significant portion of the gross domestic product (GDP) in many countries. Cities play a central role in national, regional, and global development, and the quality of life for people depends on them. As a result, there are growing demands on cities that were unprecedented in the past, including the need for accessible urban infrastructure, high mobility, urban security, environmental cleanliness, and the development of local self-government.

Keywords. Information and Communication Technologies, smart city,

Introduction. Through this study, it was discovered that municipal government models are not necessarily required to ensure a high quality of life and to find efficient ways of using natural resources.

Researchers from various countries and interdisciplinary groups have identified several decisive factors for creating an intelligent approach to urban development. These factors, based on international literature, are grouped into eight key categories:

- Political Structure
- Economy
- Management and Organization
- Information and Communication Technologies (ICT)
- Society and People
- Built Infrastructure and Environment
- Management
- Governance

The intelligent solutions for cities and the emerging potential within these categories can be used to implement an integrated smart model in urban governance, effectively laying the foundation for a smart city. This integrative model is illustrated in Figure 1.

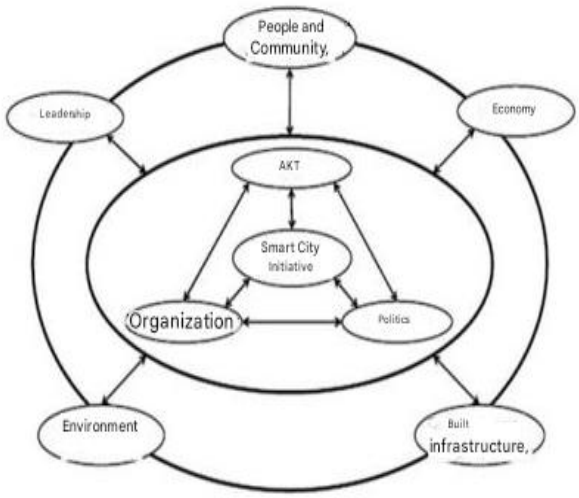

Figure-1 is an integrative model of the Smart City

At different times and in different situations, some factors in a Smart City model may become more important than others, as shown in Figure 1. However, it's important to remember that all of these factors are interconnected and affect each other. For example, Information and Communication Technology (ICT) is a key factor in creating a "smart city," and its main advantage is improving economic efficiency. ICT helps balance costs by providing essential services to city residents, improving the efficiency of existing infrastructure at a low cost.

In a "Smart City," communication with each resident should be ongoing, and ICT tools like the Internet, mobile apps, mobile phones, and public Wi-Fi networks are vital for connecting everyone. These technologies make it easier for people to access services and information.

According to the National Association of R&D of Saudi Arabia, resource consumption in cities costs about 15 trillion USD per year, or 28% of a country's GDP. By using ICT tools, cities can reduce these costs. For example, ICT can simplify things like market design, traffic management, and business analysis, even in large urban areas.

Some practical examples of ICT solutions include:

- In Kazakhstan, a "smart" electricity network reduced energy costs by 25% by optimizing the distribution of electricity.
- In transportation, smart systems reduced traffic violations and accidents by 15-50%, cutting the number of incidents by 20-40%.

The Smart City model focuses on ensuring that everyone in the city, especially in key groups, has access to information technologies. These include installing sensors and tools for advanced systems like:

- Smart homes
- Health care centers
- Smart energy systems
- Roads and transport systems
- Water supply systems
- Oil and gas transportation systems

Other benefits of a Smart City include better mobility, improved quality of life, faster services, and quicker deliveries. Research based on sources like Google and IEEE shows how these technologies are being used in cities around the world to make them "smart."

Examples of Successful Smart City Models:

- Vienna: Known for being a green city with a high quality of life. It uses digital innovations in regional management to enhance city operations.
- Toronto: A city with a low-carbon economy, efficient use of natural gas, and an active underground transportation system.
- Seoul: Offers free public Wi-Fi across the city for maximum coverage. The "E-Net" system integrates public institutions, and the "U-Seoul" security service includes a smart mapping system housed in a community intelligence center.
- Amsterdam: Known for the "iHome" smart life system and a smart control center that manages things like parking.
- Zurich: Impresses with intelligent solutions in the areas of environment, mobility, and urban transport.

- Barcelona: Awarded the "Smart City 2015" title, Barcelona has intelligent food management systems, successful city traffic management, and high-quality city lighting. The city also has a high level of ICT access for its residents.
- Hong Kong: Uses a wide range of smart solutions, including smart management systems, smart check-ins for public transport with smart cards, and RFID technology for tracking agricultural supply chains.
- Rio de Janeiro: Rio's open data system, Rio Datamine, provides a wealth of information to the public. The city uses intelligent transport networks and smart management technologies.

Characteristics of a Smart City:

A "Smart City" must provide a high quality of life for all its residents. This includes:

- Clean air
- Quality education
- Safety
- Affordable, high-quality healthcare
- Recreation and sports facilities
- Efficient urban mobility

These factors are all essential for a Smart City, ensuring that it supports its residents in many aspects of daily life.

The Smart City concept includes the following key features:

- Competitiveness: Attracting investment and creating job opportunities.
- Sustainability: Focusing on social, environmental, and financial sustainability.
- Quality of Life: Providing safety, beauty, healthcare, education, and accessibility.

Smart City Models from Major Companies:

To design a Smart City, a single definition is not enough. After studying various models, three major companies – IBM, Accenture, and Microsoft—have proposed their own versions of the Smart City concept. Though these companies

are based in different parts of the world, their models are based on similar principles and provide insights into the key elements of a Smart City.

For instance, IBM's model is called the "Experiential Business Architecture of a Smart City" and focuses on seven key areas:

1. Urban services
2. Residents
3. Businesses
4. Transport
5. Communication
6. Water
7. Energy

These areas are the foundation of a Smart City, aiming to improve the quality of life and make cities more efficient, sustainable, and connected.

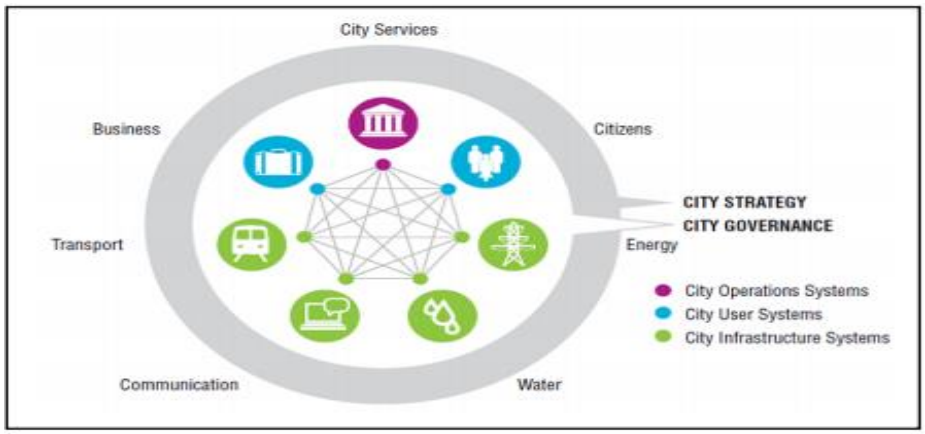

Figure 2 - Architecture model o\f a "Smart City" according to IBM

According to Accenture, the Smart City model can be described as an "open platform" that integrates the tested components of the city (office and residential buildings, natural resource management, transportation, health and safety, waste management, education and culture, public administration and services) (Figure 3).

Figure 3 – Smart City architecture model according to Accenture

"The Fashion of Territories" in the Buenos Aires architecture company Siemens Green Index City, based on extensive research conducted by the Regional Center for Science at the University of Vienna. Figure 4 shows the transformation of the architecture below, a circle called "Smart City" and 1000 indicators in each sector (Intelligent control, smart environment, smart residents, smart mobility, smart lifestyle). Indicators are used to implement smart city models, to evaluate the effectiveness of initiatives and activities.

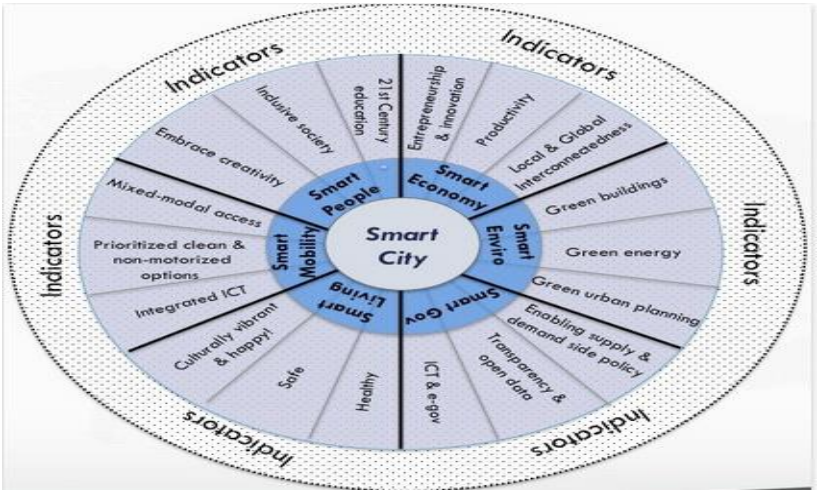

Figure 4 - "Smart City" wheel

According to Microsoft, the Smart City model, unlike IBM and Accenture, focuses on Smart Citizens and includes them in all management decisions (Figure 5).

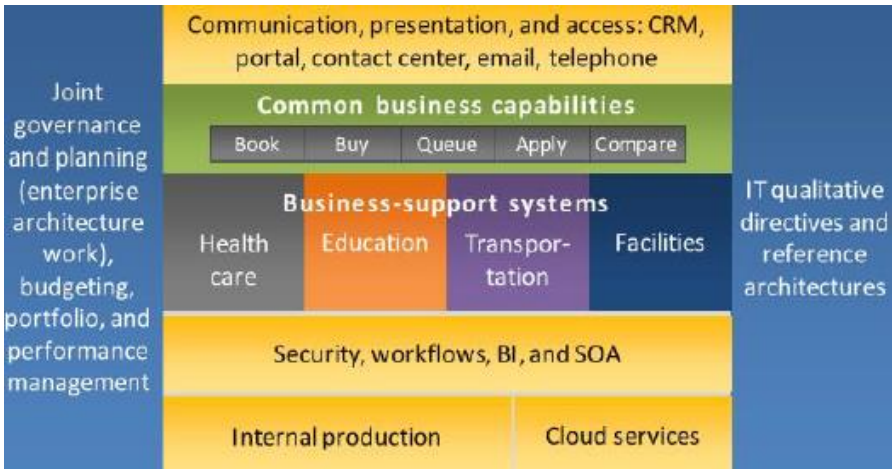

Figure 5 is a model of the "Smart City" architecture according to Microsoft

Choosing the right ICT model for smart urban design and architecture is crucial for the success of a Smart City project, especially in the long term (5-10 years). While the technology itself is important, it is also essential to have "smart" people in the city—those who can effectively use and manage these technologies. The involvement of various stakeholders is also key, as the use of intelligent systems in city management greatly impacts the city's success.

In the Smart City model, ICT (Information and Communication Technology) plays a central role. This is a very important step because the real value of these technologies will become clearer over time. It is not just about finding technical solutions, but also about how these solutions integrate with the city's architecture and systems. The effectiveness of ICT in the future will depend on how well it is implemented and adapted.

According to Gartner, an international consulting firm, the method of "expert" analysis is used to understand the development of technology over time. Gartner uses a technology hype cycle graph (Figure 6) to represent how new technologies evolve. In this graph, the Y-axis shows the "height" or popularity of the technology, while the X-axis shows the "level of maturity" of that technology. The curve shows

that technologies can become very popular quickly, but this popularity may be short-lived and unstable. The cycle helps to visualize how technologies rise, peak, and then decline, providing a realistic view of their potential lifespan and impact.

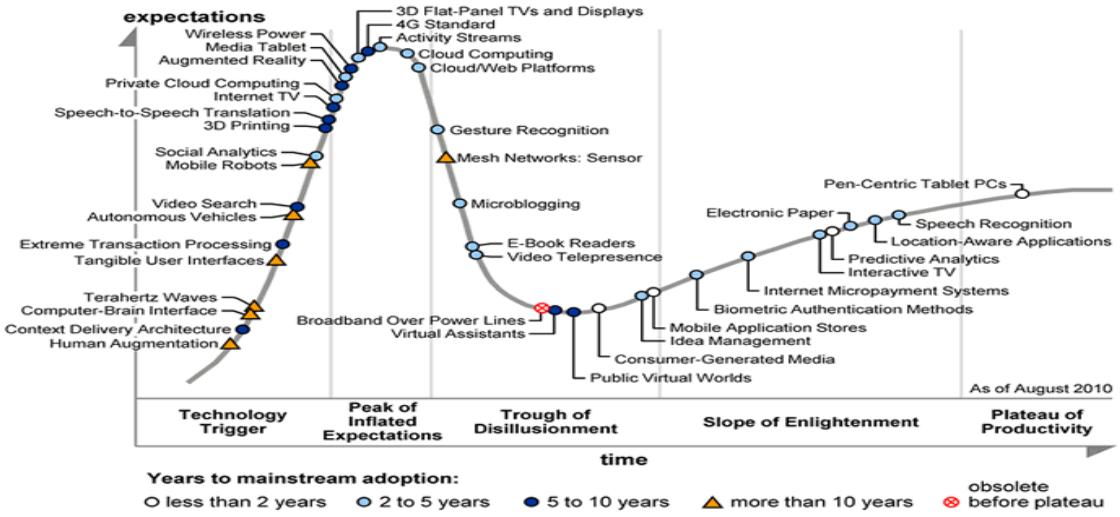

Figure 6 – Technology Popularity Cycle

Conclusion. Currently, there is no single, clear definition or standard method for measuring a Smart City. However, it is important to note that different ICTs (Information and Communication Technologies) have developed various ways to evaluate the Smart City model.

The concept of the "Smart City" model is essential because it focuses on improving urban life through technology and innovation. In this study, we focused on the European model of Smart Cities, which provides a useful framework. This model can serve as a tool for more efficient urban development. By adapting aspects of this model, we can apply successful strategies from European cities to other areas. This approach encourages a detailed analysis and comparison between cities, especially those with middle to high levels of development, helping to guide progress toward smarter and more sustainable cities.

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