Citizen opinions on the organization of a smart city for housing, urban structures, and quality of life: The case of Kos Island, Greece

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Abstract. The growing urban population worldwide and the consequent need to improve urban dwellers’ living conditions have increased the research interest in issues related to urban development and their ability to manage emerging challenges. In this context, it is observed that the concept of the smart city includes perspectives that may help modern cities face their problems, especially as cities are being shaped and intensified, for example, due to the current situation of the COVID pandemic crisis. This paper attempts to highlight the characteristics of the smart city with an emphasis on the following triptych: housing, urban environment structures, and quality of life. To achieve its goal, the paper, through pilot research in a representative small-sized Greek city (study area, island of Kos), evaluates whether the smart city characteristics have been met successfully and then it investigates the perceptions of Kos inhabitants regarding the quality-of-life benefits resulting from the model of a smart city. To achieve this, it collects quantitative data through questionnaires in the study area. The results of the analysis can be used as a basis to help a city to become a smart city.

1. Introduction
From the beginning of the new millennium, the exponential growth of city populations has created particularly serious social, environmental and economic consequences; as a result, it is necessary to redefine the design and development of cities. With the help of innovative applications and cutting-edge technologies, the smart city model aims to overcome the critical issues that have arisen. By investigating of smart cities’ elements, housing, and the structures of the urban environment, this article aims to highlight the benefits smart city design offers for residents’ quality of life. Four key hypotheses were developed, on which the research is based:
- The development of smart cities is synonymous with the use of technology and innovative tools.
- Smart cities are not created from scratch; rather, they are built on existing structures.
- Visionary leadership—that is, policies and governance with vision (including leadership in local government)—is one of the key success factors for the development of smart cities.
- The development of smart cities is a participatory process requiring well-coordinated collaborations; its success requires the participation and cooperation of agents in the public and private sectors, including citizens and governors.
2. Literature review

The term “smart city” became very popular in 2009, standing out among many others such as “intelligent city,” “digital city,” “sustainable city,” “technocity,” and “well-being city” [1] and it was used to denote the ability of cities to solve their problems and adapt to changes [2]. The term “smart city” is also based on the use of technology to make urban planning more efficient. There are many definitions of “smart city,” and some of the most important are presented below:

- A smart city is a city that seeks to solve public issues through information and communication technology, with the cooperation of many stakeholders as the main axis [3]

- It is a city that performs well in the “smart” areas—environment, economy, mobility, governance, living, and people—through the combination of skills and activities developed by determined, independent, and sensitized citizens [4]

- It is a city that monitors and integrates the conditions of all its important infrastructure (roads, tunnels, metros, airports, seaports, communications, energy facilities, large buildings, etc.), to optimize the exploitation of its resources, to establish preventive maintenance programs, and to expand the services provided to its citizens.

- It is a system of systems; these interact, communicate, and share information, and the changes that take place in one system affect and change all the other components [5]

- The smart city places humans at the center of development and invests in human capital and social development. It integrates information and communication technologies in resource management and urban planning and emphasizes collective planning and citizen participation. It aims to sustainably develop and improve the quality of life of citizens through the innovation, competitiveness, attractiveness, and resilience of the city [6]

According to the U.S. National Institute of Standards and Technology, the smart city model is based on the synthesis of six important elements, the environment, the economy, mobility, governance, living, and people [3]

- Smart environment: sustainable resource management, attractiveness of natural environment
- Smart economy: innovative entrepreneurship
- Smart mobility: accessibility, information and communication technology infrastructure, sustainable and secure transport systems
- Smart governance: participatory, provision of public and social services
- Smart living: facilities of culture, health, safety, housing, education, social cohesion
- Smart people: with specialization, creative, with a will for continuous learning

There is no specific design model for a smart city. Comparative studies of examples of smart cities have found that the creation of smart cities can be achieved through different approaches to sustainability models, planning principles, and governance. Most of the studies and articles that have been prepared with the aim of analyzing the design of smart cities and drawing conclusions regarding the design, goals, resources, and development results using this model are led to the processing, through the classification areas of application (natural resources, energy, transport, mobility, buildings, living, government, economy, and people) [7]

The design of the smart city should include the following:
- experience and knowledge of digital technology
- wide stakeholder involvement
- promotion of projects that are attractive to citizens and businesses
- utilization of own resources
- creation of a platform for the development of new products and applications
- creation of research parks
- development and maintenance of a collaborative community

3. Methodology

The present work was conducted based on a questionnaire, which was designed to investigate the views and perceptions of the people of Kos regarding the possibilities, functions, and benefits that
could result from the implementation of the smart city model. Emphasis was placed on whether residents believe that smart city planning would contribute to improving their quality of life, how necessary they consider the implementation of smart city interventions in various city structures to be, and whether political planning is considered adequate.

The questionnaire included four parts. The first concerned citizens’ knowledge and opinions regarding the smart city model, and it included questions about the location of participants’ residences, the smart city data they do or do not have, and participants’ opinions about the necessity of interventions in various sectors of the city. The second part contained questions about the Internet and the use of technology, and the third part was related to the state-subsidized programs for the energy upgrade of the houses. The fourth and final part contained questions about the demographic and personal data of the sample. The questionnaires were distributed mainly electronically; 80% were distributed through social networking groups and e-mail, and 20% were distributed in printed form. Particular attention was paid to the electronic distribution points of the questionnaire because the sample had to have a specific place of residence, the study area, Kos.

4. Results

4.1. Sample Features
The survey sample consists of 119 inhabitants of Kos; 48.7% are men, 47.9% are aged 35–44, and 47.9% are higher education graduates. The sample mainly includes freelancers, public and private employees. Of the participants, 59.7% are married, and most stated that they are more or less satisfied with their financial situations. Finally, almost half of the participants in the sample are residents of the city of Kos.

It is important to mention that one in six respondents of the survey ignored the term “smart city,” and almost one in three did not know of a city that is characterized as a smart city. Although the entire research sample stated that they are familiar with technology and use the Internet daily, they were not familiar with the smart city model, which is based on the use of the Internet of Things, information and communication technology, and free data transfer. This testifies to the reduced promotion of the smart city model in general but also specifically in the place of residence of the sample as well as the lack of smart city data in it.

4.2. Exploration of views
Results of the research reveal that the majority of the inhabitants consider the development of cities toward the model of the smart city (Graph 1) to be very important, and they believe that it would contribute positively to their living (Graph 2). This proves that the inhabitants recognize that it is critical to develop the cities according to the smart city model and that it is necessary to use new, innovative practices when designing the urban environment.

The vast majority of the sample highlighted low-energy housing and reduced air and environmental pollution as the main desirable characteristics of smart cities (Graph 3), which shows that citizens are aware of the benefits a smart city would have for their quality of life.
Graph 1. Do you think it is important for the cities of the future to follow the model of the smart city?

Graph 2. How do you think living in a smart city will affect your life?
Graph 3. How important do you think it is for a smart city to have one of the following characteristics?

Despite the difficult economic conditions due to the health crisis, residents believe that implementing interventions in smart cities is worth the financial cost (Graph 4), and they are willing to pay for it (Graph 5), regardless of how satisfied they are with their financial situation.

Graph 4. Do you believe that it's worth the financial cost to build smart cities?

Graph 5. Are you willing to pay to implement interventions in your city that will make it a smart city?
Residents believe that their area of residence does not have elements of a smart city (Graph 6) but believe that it is possible to perform interventions aimed at transforming the area into a smart city through altering several aspects of their urban environment, such as public transport, housing, government, resident participation in decision-making, and environmental pollution levels (Graph 7).

**Graph 6.** Do you believe the city you live in, has elements of a smart city?

**Graph 7.** In your opinion, how easy is it for your city to implement the following in the context of its transformation into a smart city?
The design of smart cities is applied in an already structured environment, with existing structures and depends on them, a fact that the majority of participants consider to play the most important role regarding the application of smart city technologies. Residents consider it necessary to intervene in the development of their city in all the sectors they were asked about—in the economy, education, housing, open spaces, security, public services, transport, natural resources, the participation of citizens in the public, and most of all in the field of health. The health sector may have stood out from the rest due to the timing of the research during the COVID-19 pandemic (Graphs 8, 9).

Graph 8. How necessary is it for your city to implement interventions in the context of smart city, in the following areas?

Graph 9. How much do you think the application of smart city technologies is affected by the following elements?
Finally, an analysis of the research found a lack of state interventions and the allocation of limited resources to energy upgrade programs of private buildings. Residents considered supportive policies to have a very large impact on the application of smart city technologies, and these were considered insufficient in terms of supporting actions in the field of housing (Graph 10).

Graph 10. Do you agree that the state should have more resources in energy upgrading programs of private buildings?

5. Conclusions
The smart city model does not merely utilize technology in the design of urban spaces. Rather, is a comprehensive plan to upgrade the structures of the urban environment with the help of modern technologies, innovative tools, and supportive policies through a participatory process, with the primary concern of improving the quality of life of residents. The present research could provide an impetus for the promotion of smart city applications in urban areas in two ways: a) it could increase state financial resources for the implementation of smart city interventions for housing and urban structures, and b) it could increase resident and private sector interest, thereby increasing their participation in the process of planning and implementing interventions for the development of smart systems in their areas to improve their quality of life.

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