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*Editorial*

# Innovative cities as cathedrals governing sustainable-digital-energy transitions. An Introduction

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**Abstract:** This special issue, through various contributions from distinguished scholars in the field, attempts if not to provide exhaustive answers then at least to delineate the perimeter of the issues and scientifically circumscribe the contours of the questions that still exist regarding smart cities. Specifically, the ambition of this special issue is to fuel a multidisciplinary debate on the role of cities—especially innovative ones—in the ongoing (sustainable digital energy) transition processes. The contributions in this special issue will certainly stimulate an exchange of ideas and perspectives on this topic.

**Keywords**: smart cities; sustainability; digital; energy transition

## 1. Framework

Cities, sustainability, and innovation form a dynamic nexus that intertwines the present and shapes the future. As urban centers keep growing, the need for sustainable practices becomes increasingly crucial. Cities, acting as epicenters of human activity, hold immense potential to drive positive change and foster innovation. Through the integration of sustainable technologies, urban planning, and community engagement, cities can become incubators for innovative solutions to address

environmental challenges. By embracing renewable energy, efficient transportation systems, green infrastructure, and circular economy principles, cities can create a harmonious relationship between urbanization and the natural environment. Moreover, cities serve as vibrant hubs of knowledge exchange and collaboration, bringing together diverse perspectives and expertise to tackle sustainability issues [1].

The disruptive effects of the COVID-19 pandemic brought profound changes to all areas of life, introducing new professional, social, and personal scenarios, largely definitive. Just think of remote working, a Copernican revolution for companies and employees, who from one day to the next had to drastically rethink their daily lives in a context marked first by the health emergency and then by extreme uncertainty. If citizens, their models, and behaviors change, cities inevitably change too. Never before have cities faced such a rapid and radical transition toward new hybrid models, including the redefinition of urban spaces and times, as well as the relationship between work and non-work activities, which are increasingly fluid and flexible. At the same time, citizens are increasingly willing to recover a sense of community and to live in more sustainable, inclusive, and digital cities. In this sense, it seems essential to rethink urban spaces in a multifunctional way, abandoning the traditional work/leisure time dualism. In a citizen-led design, digital technology has a pivotal role as an enabling factor for the integration and accessibility of all.

The types of implementations of smart dynamics are still very varied. The American smart city model hinges on the axes of research, technology, and globalization. In fact, the concept of smart cities often overlaps with that of metropolises or megacities, i.e., very large cities or agglomerations of different centers, which exceed the monstrous figure of ten million inhabitants. It is no coincidence that, at present, the United States holds the record for the number of megacities in absolute terms: ten out of the total global twenty. The Asian model of the smart city instead hinges around the axis of experimentation, automation, and the so-called "new town": new cities characterized by widespread mobility and the availability of heterogeneous services. The Asian model also operates on megacities and even gigapolis and is promoted by both national governments and private enterprises. European smart cities still present many differences in terms of impacts, not only on the automation of services for citizens but also on local development. Therefore, highly advanced smart cities coexist with smart cities in the process of consolidation or in search of an urban identity.

The global smart city scenario, according to various rankings compiled by various bodies, for example, the latest report by the IESE Business School in Barcelona, ranks cities such as London and New York at the top. London is the most advanced smart city in the world, both for its outstanding integration of technological advances as well as for its role in the national economy—it produces around 20% of UK GDP—as well as global economy. 5G coverage in London is highly widespread and allows for a very fast circulation of large quantities of data. Data circulation becomes available thanks to a remarkable open data policy, which is generating innovation from multiple points of view: mobility, health, and education. New York, perhaps the global capital of the Internet of Things, shows IoT devices now perfectly integrated into the Big Apple. For example, they monitor the quality of all the water in the city in real-time.

The interplay between cities, sustainability, and innovation could thus pave the way for a brighter, more resilient, and inclusive urban future. For some authors [2], it is worth asking "What makes a city 'smart' in the Anthropocene?". What will the cities of the future be like? More digital, ecological, and inclusive? Or will the complexity of the problems that technological evolutions entail be increased? Antithetical externalities in comparison, toward which scenario will they lean—a win-win game with

a positive sum or dynamics that still highlight critical impacts of smart cities, such as the urban/rural dichotomy, not yet resolved by smart dynamics?

The United Nations has estimated that by 2050, 68% of the global population will reside in urban areas [3]. Currently, cities consume a substantial share of the world's resources, with urban centers responsible for approximately 75% of global energy consumption [4]. Cities serve as hubs of economic activity, driving growth and generating wealth. However, they also present significant challenges for governments. Along with the benefits of urbanization come issues such as unchecked development, traffic congestion, waste management problems, limited access to resources, and rising crime rates. In response to these challenges, some cities are experimenting with innovative approaches to urban planning, infrastructure, governance, and public services, often grouped under the concept of smart cities [5–7]. Advancements in technology now allow urban authorities to collect real-time data, and when combined with artificial intelligence, this information helps manage public services more effectively and efficiently. For example, by monitoring road conditions, traffic flow, and commuter patterns, authorities can identify and resolve bottlenecks, easing traffic congestion, reducing pollution, and creating a cleaner, more sustainable urban environment. Technology has the potential to improve prosperity, health, urban livability, and social equity—provided it is paired with sound policies, strong institutions, and responsible governance [8]. Yet, the question remains: is the smart city the optimal solution to the challenges brought about by rapid urbanization, population growth, resource depletion, and environmental degradation?

## 2. Specific topics

These questions critically feed this special issue, which, through various contributions from distinguished scholars in the field, attempts if not to provide exhaustive answers then at least to delineate the perimeter of the issues and scientifically circumscribe the contours of the questions that still exist regarding smart cities. Specifically, the ambition of this special issue is to fuel a multidisciplinary debate on the role of cities—especially innovative ones—in the ongoing (sustainable digital energy) transition processes. The contributions in this special issue will certainly stimulate an exchange of ideas and perspectives on this topic. The research by Giuseppe Borruso and Ginevra Balletto [9], focusing on the Italian urban system, its capitals, and innovative medium-sized cities, aimed to observe the most recent urban dynamics between spatial changes, urban demographics, innovation, and digital transitions. The authors analyzed urban dynamics in terms of demographic change, income, and innovation, observing their characteristics and evolutions in recent times (2019–2023). This enabled us to highlight the formation of smart urban "champions" and to observe their characteristics in terms of their ability to attract people and skills. The research was developed by combining an analysis of innovative cities in Italy according to an innovation index (ICity Rank) with the demographic aspect, considering metropolitan cities and their urban functional areas (FUAs) together with a set of medium-sized cities as "innovative" and dynamic cities. The analysis was conducted by classifying cities according to the urban life cycle model and using LISA - Local Moran's I as the clustering and analysis method. The findings are intended to provide suggestions for possible urban policies, recognizing medium-sized cities as centers of innovation, and showing that targeting urban innovation policies in these areas can be a viable option for urban revitalization.

Hongtao Wang, Jiajun Xu, Noor Hashimah Hashim Lim, Wanying Liao, and Chng Saun Fong [10] highlighted the opportunities given by smart cities to face the effects of global change. Particularly, the

authors focused on the changing climatic conditions in China, under the influence of global climate change. Their study analyzed the spatiotemporal pattern of grain production in China's central region from 2010 to 2020 and constructed a climate regressive model to explore its doubled impact on grain production, as a reference for formulating scientific grain security policies in localized regions. In the results, the authors argue that smart city dynamics could serve as targeted adaptation strategies to strengthen resilience and also ensure agricultural security.

Yin Jun, Youling Li, and Zijun Xin [11] focused on the relationship between environmental awareness and employees' eco-friendly behaviors in the smart city perception dynamics. Their findings demonstrate that the perception of smart cities positively impacts employees' green behavior and corporate environmental responsibility; thus, corporate environmental responsibility positively influences employees' green behavior. It is also highlighted that the employees' perception of smart cities positively affects their green behavior through the intermediary function of corporate environmental responsibility.

Fully grasping the guiding principle of this special issue, namely the desire to highlight and address the criticalities of smart cities, the work by Teresa Graziano and Valentina Albanese [12] sets out to critically explore the smart village paradigm. The authors highlight the absence of the "rural" in conceptual and operational dimensions of planning studies and practices. More specifically, the authors highlight how the notion of smart villages conceptually mobilizes a broader meaning of smartness. However, beyond the techno-driven vision of growth and the micro-scale of enterprises, the key criticality lies in the characterization of rural smartness itself. This characterization, marked by the novelty of the paradigm, has not yet undergone broad and solid analyses apart from sporadic cases. The result of this work, as also highlighted in the past by De Falco, Angelidou, and Addie (2018) [13], reveals the need to further problematize the relationship between rural areas and new technologies, going beyond the urban–rural dialectic and broadband/digitization connection as main themes.

## Author contributions

Conceptualization, Stefano de Falco (SdF); Chiara Certomà (CC); methodology, SDF and GF; writing—original draft preparation, SDF and GF; writing—review and editing, SDF,GF;CC; supervision, SDF, GF, CC. Particularly, section 1, SDF; section 2, GF and CC; Authors have read and agreed to the published version of the manuscript.

## Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in the creation of this article.

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## Conflict of Interest

Stefano de Falco, Giulia Fiorentino and Chiara Certomà are guest editors for AIMS Geosciences and were not involved in the decision to publish this article. All authors declare that there are no competing interests.

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