The next level of the urban innovation: from the 15 minute city to the synergic smart city

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Abstract

Colombian urban planner Carlos Moreno, who first introduced the concept of the "15-minute city", brought a new vision and perception to the metropolis of the last decade, realigning the urban experience to ensure that every essential service is accessible within a short walk or a bike ride. This concept encouraged a sustainable lifestyle, reducing dependence on cars and promoting the principles of smart mobility. The concept emphasizes the importance of creating human-centered cities where residents' well-being and convenience are paramount, supporting ecological sustainability by reducing pollution and promoting greener urban spaces. Implementing this concept in metropolises such as Paris, Melbourne, Milan, Bogotá, Portland, and Shanghai posed several challenges, thus announcing, 10 years later, the next stage of urban innovation: "Synergic Smart City". This new paradigm, which combines advanced technologies with a holistic design philosophy based on sustainable development and infrastructure, aims to create cities that are not only intelligent but also deeply adapted to the rhythms of human life. The ultimate goal is to recreate urban environments where technology and humanity coexist harmoniously, enhancing everyday life through seamless integration. This article presents how the transition from the 15-minute City to the Synergic Smart City is achieved through innovative strategies that introduce and explain new concepts such as Predictive Urbanism, which uses artificial intelligence and big data to anticipate and respond to the evolving needs of residents, and sustainable infrastructures are powered by renewable energies and form the backbone of these cities. Autonomous mobility and smart resource management ensure efficiency, while collaborative digital platforms create a framework for citizens to actively participate in their urban experience. The key message of this article is that the adoption of this innovative synergistic smart city model represents a shift towards sustainable urbanism, highlighting the transformative power of technology in synergy with the essence of human experience, thus proposing a prototype of cities that are not only smart but also deeply human.

Keywords: ecological transformation of the city, quality of life, predictive urbanism, synergic smart city model using advanced tehncologies, 15-Minute City concept

1. Introduction to the 15-Minute City concept

At the recent Climate Neutrality Forum M100 held in Bucharest, Carlos Moreno, a distinguished Colombian urbanist and professor at Sorbonne University in Paris, introduced his latest book, "The 15-Minute City – A Solution to Saving Our Time & Our Planet" [1]. This publication delves into the multifaceted concept of the 15-Minute City, presenting a thorough examination of its potential to revolutionize urban living. Moreno's work investigates the ways in which ensuring the proximity of essential services within a 15-minute walk or bike ride can significantly enhance urban quality of life, foster sustainable living practices, and reduce dependence on automobiles. By highlighting the importance of human-centered urban planning, the book underscores the need for creating ecologically sustainable, accessible, and vibrant urban spaces. Through a blend of theoretical insights and practical examples, Moreno's book [1] serves as a pivotal resource for understanding how the 15-Minute City model can contribute to the broader goals of environmental sustainability and urban resilience.

With these considerations in mind, in this article, I will explore the next echelon of urban innovation, the concept of the "Synergic Smart City". This advanced model incorporates the principles of the 15-Minute City and extends them by integrating cutting-edge technologies and holistic design philosophies. The Synergic Smart City aims to create urban environments where technology and humanity perfectly coexist, improving everyday life through smart infrastructure, predictive urbanism, and sustainable resource management. This paradigm shift represents a transformative approach to urban life, positioning cities at the forefront of environmental sustainability and human-centered design.

The 15-Minute City concept was born more than 8 years ago when Carlos Moreno proposed the idea that most essential services, such as work, shopping, school, sports, hospital, or leisure, should be accessible within a 15-minute bike or walk from any point in the city.

The roots of the concept go back to pre-modern urban planning traditions, where walkability and community life were the main objectives before the advent of street networks and cars.

The 15-Minute City concept gained popularity after Paris Mayor Anne Hidalgo included a plan to implement it during her 2020 reelection campaign, thus reducing traffic congestion and vehicle emissions in Paris, contributing to improving air quality and reducing the urban carbon footprint. From a sustainability perspective, the concept encourages a healthy lifestyle, reduces car dependency, and promotes the principles of smart mobility.

This vision and perception that Carlos Moreno has brought to the metropolis of the last decade, redefines the urban experience in a new paradigm in which every essential service is accessible within a short walk.

2. The impact of the 15-minute city on urban life and smart mobility
2.1. Implementing the concept in major cities
The 15-Minute City concept emphasizes the importance of creating people-centered cities [1], where the well-being and convenience of residents are paramount, environmental sustainability is supported by reducing pollution and promoting greener urban spaces.

The implementation of this concept over the past decade has influenced urban life, sustainability, and e-mobility [2] in other metropolises around the world, bringing a series of benefits and positive changes in the lives of communities and redefining the urban planning model. The promotion of green spaces and pedestrian-friendly infrastructure in cities such as Milan and Melbourne has further improved environmental sustainability by creating more livable and ecologically balanced urban areas.

In terms of smart mobility, the 15-Minute City concept has encouraged the use of alternative modes of transport. Thus, we can exemplify how cities can facilitate sustainable mobility options, through the high-performance bicycle infrastructure in Bogota or the efficient public transport network in Portland. These cities have integrated smart mobility

solutions to optimize transit efficiency, reduce environmental impact, and promote a healthier lifestyle.

Through these examples, we see that this concept achieves a balance between professional and private life for both citizens and the community, which is reflected in the increase in the quality of life, through quick access to daily facilities such as schools, parks, care, and health centers. The promotion of a healthy lifestyle is encouraged by the use of bicycles or walking due to proximity, which automatically leads to a reduction in pollution and an increase in air quality. Reducing the time spent in traffic automatically leads to a reduction in stress and an increase in available free time, thus improving general well-being, and increasing diversity by joining living spaces with recreational ones, office buildings, and shopping.

2.2. Limitations and challenges of implementing the 15-minute City
Referring to Carlos Moreno's book [1], several limitations and challenges of the 15-Minute City concept are highlighted. We will focus on those that determined the need to develop the innovative concept of a synergic smart city.

The 15-Minute City concept faces several significant limitations that determined the need to develop the innovative concept of a synergic smart city. A limitation in implementing in existing urban areas of 15-minute city concept determinates substantial infrastructure modifications, leading to high costs and extended implementation periods. Strict district regulations in cities like Bucharest, which separate residential, commercial, and office areas, further complicate the creation of mixed-use neighborhoods. Ensuring equal access to essential services across all neighborhoods can be particularly challenging, especially in economically disadvantaged areas.

Moreover, the integration of smart mobility and other advanced technologies requires considerable investment and ongoing maintenance. Existing environmental issues, such as pollution and a lack of green spaces, can hinder the effective implementation of the concept. Finally, maintaining the benefits of the 15-Minute City demands continuous efforts and adaptation to the evolving dynamics of urban living. These factors collectively illustrate the complexities and challenges inherent in realizing the vision of the 15-Minute City.

The challenges associated with the 15-Minute City concept are multifaceted and significant. Cultural resistance is a notable issue, as some residents may oppose changes to their urban environment, preferring the status quo over new urban planning models. Effective implementation also demands active participation and support from residents, which can be difficult to achieve. Furthermore, aligning policies across various governmental levels and agencies can be complex and may slow down progress. Although the concept works well in certain urban contexts, it may not be as effective in very large or highly dense cities where distances are greater. Ensuring equitable access to essential services for all demographic groups requires well-thought-out policies to avoid social exclusion.

These limitations and challenges underscore the need for careful planning, community involvement, and sustainable practices to successfully implement the 15-Minute City concept. Addressing these aspects is crucial for achieving sustainable and resilient urbanization.

Because this concept raised numerous challenges, we can talk about the next stage of urban innovation: "Synergic Smart City".

3. The evolution towards the Synergic Smart City

As urban populations continue to grow, in the previous chapter we describe that the limitations of the 15-minute city model are becoming increasingly evident, foreshadowing the need for a new phase of urban innovation. These models, while effective in improving accessibility and sustainability, face challenges related to scalability, technological integration, and equitable distribution of resources. In addition, the rapid pace of technological advances offers unprecedented opportunities for urban development that can address these challenges more effectively. The emergence of new technologies, such as artificial intelligence, big data analytics, and the Internet of Things, provide tools to create more responsive, adaptive, and efficient urban environments. We are thus faced with a challenge and it is essential to evolve beyond traditional frameworks and embrace the innovative Synergic Smart City model, which integrates these technologies to create urban spaces that are not only smart but also deeply aligned with the rhythms of human life. This new approach aims to promote sustainable, resilient, and inclusive cities that can better meet the evolving needs of their residents.

The concept of the Synergic Smart City represents a progressive evolution in urban planning, advancing beyond the foundational principles of the 15-Minute City. This paradigm integrates cutting-edge technologies with a holistic design philosophy to create urban environments that are not only intelligent but also deeply attuned to the rhythms of human life. The Synergic Smart City leverages the latest advancements in artificial intelligence, big data analytics, and the Internet of Things, facilitating real-time data collection and analysis. This enables cities to anticipate and respond to the dynamic needs of their inhabitants with unprecedented efficiency and precision.

Moreover, this approach emphasizes the seamless integration of technological infrastructure with the human and environmental elements of urban life, prioritizing the creation of interconnected urban systems that promote sustainability, resilience, and inclusivity. Unlike traditional models, the Synergic Smart City places the well-being of its residents at the core of its design principles, optimizing access to essential services, enhancing the quality of life, and fostering a sense of community.

3.1. Main goals of the Synergic Smart City

The primary goal of the Synergic Smart City is to create environmentally sustainable cities. This involves reducing carbon footprints through the use of renewable energy sources, promoting green spaces, and implementing smart resource management systems. By ensuring that essential services are accessible within a short distance, the Synergic Smart

City aims to improve the daily lives of its residents, facilitating easy access to healthcare, education, work, and recreational activities.

The city is designed to be resilient to various challenges, including climate change, natural disasters, and socio-economic shifts. Adaptive infrastructure and predictive urbanism play crucial roles in allowing the city to evolve in response to emerging needs and conditions. The aspiration is to create urban environments that are inclusive of all demographics, ensuring equitable access to services and opportunities, and designing spaces that cater to the needs of diverse populations, including the elderly, children, and people with disabilities.

Lastly, fostering a strong sense of community through participatory planning processes and collaborative digital platforms is another key objective. Residents are encouraged to actively participate in shaping their urban environment, enhancing social cohesion and civic engagement. This comprehensive approach aims to create cities that are not only technologically advanced but also profoundly human, supporting sustainable urbanization and enhancing the overall urban experience.

3.2. Proposed a Synergic Smart City model using advanced tehnologies

The proposed model for a synergic smart city uses real-time data from sensors, public transport systems and environmental monitoring as input data sources.

As Data Processing Algorithms we propose AI and machine learning models for predictive analysis and big data analytics for trend analysis.

For Output Applications we will develop intelligent resource management systems, adaptive infrastructure models and community engagement platforms.

In the synergistic smart city model, advanced technologies such as Artificial Intelligence, Big Data or the Internet of Things, and sustainable infrastructures play an essential role in creating a coherent and adaptable urban environment to the needs of residents. The integration of these technologies is fundamental to achieving effective urban governance [3] and achieving sustainability goals.

Artificial Intelligence [4] through data analytics plays an important role in analyzing and interpreting data collected from various urban sources, such as traffic, energy consumption, and resident behavior. These analyses allow cities to anticipate the needs of residents and optimize the use of resources, being able to manage traffic flows to reduce congestion and adjust street lighting in real time to save energy.

With the IoT technology, the interconnection of devices and sensors in the city is achieved, creating a data network that monitors and controls urban infrastructures. Sensors can collect information on air quality, noise levels, energy use, and other critical aspects of urban life. This data is used to make evidence-based decisions and improve the efficiency and sustainability of the city.

Big Data analytics will allow cities to manage and interpret large volumes of data to identify trends and behavioral patterns. This is essential for the development of predictive urbanism, which uses historical and real-time data to anticipate future changes and needs of the city. This allows cities to implement proactive measures to improve quality of life and reduce negative environmental impacts.

This comprehensive approach aims to create cities that are not only technologically advanced but also deeply human, supporting sustainable urbanization and improving the overall urban experience.

4. Predictive urbanism

Predictive urbanism is an innovative approach within synergistic smart cities, using artificial intelligence and big data analytics to proactively anticipate and respond to citizen' needs. By collecting and interpreting vast amounts of real-time data, this method allows cities to take preventive measures and optimize resource use, creating more efficient and sustainable urban environments.

Artificial intelligence plays a central role in predictive urbanism, allowing cities to analyze resident behavior and consumption trends to anticipate citizens' needs. Machine learning algorithms can detect patterns in energy use, mobility, and public services, providing recommendations for optimizing these resources. The use of big data analytics also allows for the rapid collection and processing of enormous amounts of information from various sources, such as air quality sensors, noise sensors, social networks, and connected IoT devices.

4.1. The benefits of implementing the Synergistic Smart City concept

Singapore and Barcelona are two cities where predictive urban planning is being used to monitor and manage traffic flows [5]. IoT sensors collect data on traffic density, and AI analyzes this information to predict congestion and adjust traffic lights in real-time. This system reduces travel times and carbon emissions, improving air quality and the comfort of residents.

The city of Amsterdam has implemented smart systems for efficient electricity management, using artificial intelligence algorithms to monitor consumption and optimize the distribution of renewable energy. By analyzing data collected from smart meters, artificial intelligence can predict peak periods and adjust energy delivery to prevent grid overload and maximize energy efficiency.

In Toronto, big data analytics are also used to monitor air quality and identify sources of pollution. Through these analyses, the city can take preventive measures, such as restricting traffic in areas with high pollution or promoting the use of public transportation. These interventions contribute to protecting the health of residents and creating a healthier urban environment.

Predictive urbanism helps authorities plan urban expansion and develop infrastructure. By analyzing demographic trends and housing demands, cities can anticipate future needs and

develop projects that meet those needs [6]. For example, in cities in Finland, artificial intelligence is being used to predict population growth and plan the expansion of transportation networks and educational facilities.

The use of renewable energy sources, is crucial to reducing dependence on fossil fuels and reducing carbon emissions. These energy sources are integrated into urban infrastructure to power buildings, public transport and other essential services, thus promoting a sustainable urban environment.

Green infrastructure, parks, green roofs and urban gardens, contribute to improving air quality and reducing the urban heat island effect. These green spaces also provide residents with recreational areas and enhance urban biodiversity.

Eco-friendly public transport systems, cycle paths and electric vehicle infrastructure are integrated to encourage the use of sustainable transport modes. These measures reduce traffic congestion and greenhouse gas emissions, contributing to a cleaner and healthier urban environment.

4.2. Conclusion
The new Synergistic Smart City paradigm combines advanced technologies with a holistic design philosophy based on sustainable development and infrastructure, aiming to create cities that are not only smart, but also deeply adapted to the rhythms of human life. The ultimate goal is to recreate urban environments where technology and humanity coexist harmoniously, improving everyday life through seamless integration.

By adopting predictive urbanism, cities can become more adaptable and resilient, able to respond quickly to demographic, economic and environmental changes. With the help of advanced technologies we can have more efficient urban governance, reducing resource consumption and improving the quality of life of citizens, thus providing an advanced way to anticipate and manage urban needs and contributing to the creation of sustainable and future-oriented cities.

In conclusion, the integration of advanced technologies and sustainable infrastructures is essential for realizing the vision of the synergistic smart city. By adopting a holistic and sustainable approach, these cities can become models of urban development that harmoniously combine technology with human needs, thus promoting a superior quality of life and a positive impact on the environment.

References

[1] C. Moreno, The 15 minute city – a solution to saving our time & our planet, New Jersey: John Wiley & Sons, 2024.

[2] I. Petcu and A. Radu, "Intrinsic aspects of e-Government consolidation across the European Union. Case study: Romania," *The Romanian Journal of Information Technology and Automatic Control,* vol. 31, no. 4, 2021.

[3] F. Pop, I. Petre, . M. Bălănescu, C. Dobre, A. Vevera and C. Cîrnu, Guvernanţa oraşelor inteligente şi neutre din punct de vedere climatic, Bucuresti: ICI, 2024.

[4] C. Vrabie, "Artificial Intelligence Promises to Public Organizations and Smart Cities.," *Digital Transformation. Lecture Notes in Business Information Processing,* vol. 465, 8 12 2022.

[5] S. Carboni, "Smart Cities in comparison:An analysis of the best Smart Cities," *Smart City and Regional Development (SCRD) Journal,* vol. 8, 2024.

[6] S. Verovsek, M. Juvancic and T. Zupancic, "Data-driven support for smart renewal of urban neighbourhoods," *Smart City and Regional Development (SCRD) Journal,* vol. 2, no. 2, 2.