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SMART CITY AND INNOVATION: A GEOGRAPHIC ANALYSIS BASED ON PUBLIC SECURITY IN SOBRAL, CEARÁ

Cidade inteligente e inovação: leitura geográfica a partir da segurança pública em Sobral, Ceará

Ciudad inteligente e innovación: lectura geográfica desde la seguridad pública en Sobral, Ceará

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ABSTRACT

Over the past three decades, the municipal administration of Sobral, Ceará, has promoted the modernization of strategic areas through public policies for urban development guided by technological, institutional, and social innovation. Concerning public security, the use of information and communication technologies, combined with intelligence-driven actions, has provided essential data and information for urban planning. This paper analyzes Sobral from the perspective of smart cities, with a focus on innovation and particular emphasis on public security. The methodology adopted is based on a literature review and fieldwork, enabling an exploratory approach to both primary and secondary data and information. The research findings indicate that the modernization of public administration in Sobral has significantly contributed to the city's development through urban planning. The technological and social innovations present in public security policies have emerged from dialogue with local higher education institutions, revealing innovative practices concerning the relationship between public administration and academia.

Keywords: Smart city. Innovation. Public security. Public administration. Sobral.

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RESUMO

Na cidade de Sobral/CE, a gestão municipal, ao longo das últimas três décadas, tem promovido a modernização de áreas estratégicas via políticas públicas para o desenvolvimento urbano, orientadas pela inovação tecnológica, institucional e social. No tocante à segurança pública, a utilização de Tecnologias de Informação e Comunicação aliadas às ações de inteligência, tem fornecido dados e informações vitais para o planejamento urbano. O presente artigo tem como objetivo geral analisar a cidade de Sobral (CE) sob a ótica das cidades inteligentes, pelo aspecto da inovação, com destaque para a segurança pública. A metodologia adotada parte da revisão bibliográfica e trabalhos de campo, permitindo uma abordagem exploratória de informações e dados secundários e primários. Os resultados da pesquisa mostram que a modernização da gestão pública em Sobral tem contribuído de forma significativa para o desenvolvimento da cidade via planejamento urbano. As inovações tecnológicas e sociais presentes nas políticas públicas de segurança têm sido resultado de diálogo com instituições de ensino superior presentes na cidade, denotando ações inovadoras no que se refere às relações entre gestão pública e academia.

Palavras-chave: Cidade inteligente; Inovação; Segurança Pública; Gestão Pública; Sobral.

RESUMEN

En la ciudad de Sobral/CE, la administración municipal, durante las últimas tres décadas, ha promovido la modernización de áreas estratégicas mediante políticas públicas de desarrollo urbano, guiadas por la innovación tecnológica, institucional y social. En materia de seguridad pública, el uso de las Tecnologías de la Información y la Comunicación (TIC), combinado con acciones de inteligencia, ha proporcionado datos e información vitales para la planificación urbana. Este artículo tiene como objetivo analizar la ciudad de Sobral (CE) desde la perspectiva de las ciudades inteligentes, con un enfoque en la innovación y un énfasis en la seguridad pública. La metodología adoptada se basa en una revisión bibliográfica y trabajo de campo, lo que permite un enfoque exploratorio de información y datos secundarios y primarios. Los resultados de la investigación muestran que la modernización de la administración pública en Sobral ha contribuido significativamente al desarrollo de la ciudad a través de la planificación urbana. Las innovaciones tecnológicas y sociales presentes en las políticas de seguridad pública son resultado del diálogo con instituciones de educación superior de la ciudad, lo que demuestra acciones innovadoras en la relación entre la administración pública y la academia.

Palabras clave: Ciudad inteligente; Innovación; Seguridad pública; Gestión pública; Sobral.

1 INTRODUCTION

Over the past four decades, the city of Sobral has been consolidating itself as an economic, political, and social center, playing a prominent role in the northwestern region of Ceará. According to the study *Regiões de Influência das Cidades* (REGIC), the municipality is a regional capital of level C, which indicates that it exerts significant influence and command functions over this portion of Ceará's territory. These findings reinforce the recognition of Sobral as a medium-sized city, as identified by the *Rede de Pesquisadores*

sobre Cidades Médias (RECIME). According to Sposito (2004, p. 10), “a medium-sized city must be understood based on its relationships with other cities and with the regional space that it organizes.”

The significant urban development of Sobral, driven by public policies and private investments and marked by modernization and innovation across multiple sectors, has positioned the municipality as a reference point for a network of adjacent cities located in the northwestern portion of Ceará. This progress is also notable at the national level, as public managers from different regions of Brazil—particularly from the Northeast—visit Sobral to learn from its successful experiences in education, as well as from its urban development projects focused on mobility and sustainability. These initiatives result from coordinated efforts between the public sector and researchers from the universities established in the city.

Focusing on the city of Sobral, this study examines the implementation of public policies—particularly those related to public security—which encompass several urban-planning-based regulatory actions, such as the use of Information and Communication Technologies (ICTs) and a modern video surveillance system. These initiatives were part of the modernization policy that began in 1997 within the municipal territory, when Cid Ferreira Gomes assumed the mayoralty and remained in office for two consecutive terms (1997–2000 and 2001–2004).

Over the past three decades, the city of Sobral has undergone a complex process characterized by the growth of the urban population in the municipal seat, the expansion of service provision, and the strengthening of commercial activities. Alongside these developments, peripheralization has intensified, resulting from the concentration of people in neighborhoods distant from central areas — an outcome of rural – urban migration and intra-urban expansion. During this same period, levels of urban violence have also increased, marked to a significant extent by rising homicide rates.

Still in the 1990s, the public security modernization initiatives introduced information and communication technologies in Sobral. One of them was the installation of fiber-optic cables to improve communication activities within the city and to enhance coordination with state-level public security agencies.

Thus, as a guiding question, this study seeks to answer the following: to what extent can Sobral be considered a Smart City, given its relationship with innovation and the urban modernization process developed over the past three decades, beginning in 1997 with the implementation of digital technologies in urban spaces, particularly in the field of public

security? Furthermore, what role does the implementation of video surveillance technologies play in urban planning in Sobral?

Accordingly, the general objective of this article is to analyze the public policies directed toward urban development – particularly those focused on public security – within the context of modernization and innovation initiatives in public administration, seeking to understand the extent to which Sobral is a smart city.

For clear comprehension, this paper follows the sequence: introduction, which presents the context, problem statement, and objective; methodology, which outlines the procedures adopted in the research; two thematic sections; and, finally, the concluding remarks and references.

2 METHODOLOGY

The procedures adopted in this research aim to demonstrate how the city of Sobral, located in the interior of Ceará, Brazil, has been shaping itself as a smart city, particularly through initiatives related to public security. This process unfolds through modernization and innovation, with the incorporation of technologies implemented by the Integrated Security Operations Cell (CIOPS), which brings together a set of fundamental elements for establishing a modern public security system in the city.

The research is exploratory in nature, employing a qualitative approach and field activities. It is grounded in the observation of elements through direct experience in the study area, as proposed by Gil (2002), Moresi (2003), and Turra Neto (2019).

The qualitative approach prioritizes the analysis of empirical data and information gathered throughout the research process and is structured in three stages: (I) a literature review, with an in-depth examination of the central guiding themes; (II) field research, involving observations and interviews with public agents; and (III) the compilation and analysis of data and information for the preparation of the final article, as outlined by Moresi (2003).

In this regard, the research draws on bibliographic materials used as primary sources, such as scientific articles, books, undergraduate theses, dissertations, and doctoral theses. These materials provide the conceptual foundation for the main themes under investigation, encompassing a wide range of discussions and approaches related to Sobral, Smart Cities, and Innovation.

The studies of Fariniuk (2020), Lima (2024), Sutti (2020), Tunes (2019, 2020), and Weiss (2020) contributed to this paper. Additionally, normative and conceptual sources were used, including the guidelines of the *Carta Brasileira para as Cidades Inteligentes* and the *Oslo Manual*.

During fieldwork, the researchers visited the *Célula Integrada de Operações de Segurança* (Integrated Security Operations Cell – CIOPS) to gather information about its role and verify its operational functioning. During this visit, it was notable that the center integrates service responses from state public security institutions, such as the Military Police, the Fire Department, the Mobile Emergency Service (Samu), and Civil Defense, as well as municipal entities such as the Municipal Civil Guard, which represents a coordinating body connected to several municipal secretariats.

The CIOPS has a link to the national security database[1] of the *Sistema Nacional de Informações de Segurança Pública, Prisionais, de Rastreabilidade de Armas e Munições, de Material Magnético, de Digitais e de Drogas* (*National Information System on Public Security, Prisons, Firearms and Ammunition Traceability, Genetic Material, Fingerprints, and Drugs* – SINESP).

After the fieldwork phase, the information collected was organized and systematized for analytical purposes. After completing the research stages and compiling the data, several elements demonstrated the use of technologies for public security through a modern and intelligent system.

3 THE CONCEPT OF A SMART CITY AND ITS RELATIONSHIP WITH INNOVATION

The term *smart city* has become increasingly common in urban development. Many cities have sought to integrate technologies, information, and innovations to promote improved management of urban spaces and their associated services (Carli and Ribas, 2021).

[1] The *National Information System on Public Security, Prisons, Firearms and Ammunition Traceability, Genetic Material, Fingerprints, and Drugs* (Sinesp) is an integrated information platform that enables operational, investigative, and strategic consultations related to public security, implemented in partnership with federal entities. It was created by Law No. 12,681 of July 4, 2012, and with the enactment of Law No. 13,675 of June 11, 2018, Sinesp was consolidated as one of the mechanisms and instruments for implementing the *National Public Security and Social Defense Policy* (PNSPDS), thereby establishing the *Unified Public Security System* (Susp) (Sinesp, n.d.).

Due to its widespread use, the concept of a Smart City has indeed become polysemic. This polysemy becomes even broader when examined through the lens of innovation, which encompasses technological, social, economic, and territorial dimensions.

Authors such as Aune (2017), Camacho (2017), Cury and Marques (2017), Dallabrida (2017), Fariniuk (2020), Lima (2024), Michelotto (2019), Rodrigues and Tartaruga (2020), Sutti (2020), Weiss (2020), and Weiss et al. (2017), among others, emphasize the polysemic nature of the Smart City concept.

Lima (2024), in her studies on smart cities, highlights the lack of consensus surrounding this concept and asserts that:

> Although there is no consensus on the meaning of *smart city*, it is undeniable that all definitions share a common point: the development of the urban environment through technological innovation. It is based on this idea that various organizations have established rankings to assess how 'smart' a city is. Generally, the criterion used to distinguish a traditional city from a smart city is the development of sectors such as mobility, health, and security through technology. Thus, there is no better way to differentiate them than by examining examples of sectoral urban development classified as 'smart' in contrast to those of a traditional city (Lima, 2024, p. 18).

For Lima (2024), there is a direct and fundamental relationship between smart cities and technology. In addition**,** smart cities adopt Information and Communication Technologies (ICTs) in pursuit of better quality of life for the population, efficient public services, and sustainable development (Cury and Marques, 2017).

In geography, the concept of a smart city relates to the analysis of urban space, land use, and digital technologies for planning and performing essential activities (Rodrigues and Tartaruga, 2019).

Understanding the role of technologies and information is essential for geographic analyses of urban space, given that the complexity and dynamism of urbanization increasingly require the use of technological tools in the planning of public policies necessary for its development.

Returning to the discussion on smart cities, numerous elements have clear recognition for their qualification. Indeed, there is no single or rigid definition. However, there are generally accepted criteria and characteristics that help to classify a city as smart.

Although the concept of a smart city lacks an established definition, it remains clear because the criteria, elements, and guidelines frame the discussions about it. This search for parameters is notable in the work of Camacho (2017), who states:

> The term *smart* cannot be understood merely as the application of new information and communication technologies to cities. Beyond this technical aspect, it is necessary to consider the term in its sociopolitical sense; that is, a smart city must incorporate an approach oriented toward an organizational framework that prioritizes governance and the role of social capital, as well as social and economic relations, in urban development (Camacho, 2017, p. 7).

In light of the author's argument, a smart city is composed of specific qualifications closely related to modes of governance. Its fundamental premise should be attention to the population, rather than a mere focus on the application of technologies in the urban environment. In other words, the city must provide conditions that ensure comfortable permanence, everyday livability, and functional usefulness for its residents, encompassing areas such as education, mobility, security, and overall quality of life.

To realize these desirable conditions, robust governance is essential for a smart city, as it ensures the primary focus remains on society and its well-being. To this end, the development of such a city must articulate various forms of innovation, whether technological, entrepreneurial, educational, social, or otherwise.

A city is essentially an organism composed of complex, dynamic ways of life. Through innovation and technology, cities modernize, exhibiting new characteristics in urban planning and mobility.

However, it is not only these characteristics that drive their transformation. To effectively enhance urban quality of life and qualify a city as smart, social development must represent the foundational and ultimate objective. This entire urban dynamism gives rise to factors that stimulate scholarly inquiry into cities, such as their origins and the purposes underlying their designation as smart cities.

In this sense, Weiss et al. (2017) argue that:

> Creating smart cities is not about a revolution, a systems-oriented organization, a technological concept, or a municipal phenomenon. Rather, it is about an evolution, a service-oriented approach, socioeconomic development, and a global phenomenon that seeks not the replacement of physical structures, but the harmonization of the material world with the virtual world in the best interest of the actors operating within cities,

> considering their particular characteristics and the healthy proximity of cities" (Weiss et al., 2017, p. 4).

The complexity faced by modern cities drives the development of new pathways designed to improve urban spaces and the population's quality of life through more efficient services and tools. Consequently, the search for more immediate solutions for urban challenges fosters new characteristics in the meaning, structures, and configuration of urban space through innovation (Silva, 2019).

With the metamorphosis driven by innovation, cities establish relationships with multiple agents in their transformation, encompassing experiences ranging from the enjoyment of everyday life in a place to the dynamism of work, commercial activities, traffic flows, and other uses of urban space.

Cury and Marques (2017) state that the immersion of technologies in the modern world drives relevant debates. These concern not only paradigm shifts in human life but also how cities integrate into this thematic field (Baden, 2023).

The transition from the twentieth to the twenty-first century, marked by the advent of new technologies, the dissemination of scientific knowledge, and the economic growth of developed countries, triggered a boom in economic development. This impact also drove cities to consolidate themselves as major arenas of industrial and population growth over recent decades. Consequently, innovations are clearly instruments of territorial development in this context (Rodrigues and Tartaruga, 2020).

During this same period of intense transformation, the rise of Information and Communication Technologies (ICTs) gave prominence to the concept of Smart Cities. A Smart City is, fundamentally, one that appropriates knowledge and collective intelligence in its management and operational processes.

Although they are grounded in innovation, Smart Cities still lack a fully consolidated conceptualization and a concrete definition in the academic literature, as previously noted. From this perspective, Michelotto (2019) further elaborates by stating:

> Defining and conceptualizing a Smart City is a process that is still underway. Worldwide, there are different terminologies, contexts, and meanings, with conceptual variations arising from the replacement of the word *smart* with synonyms such as *digital* or *intelligent*, which has, for some, become a phenomenon of 'urban labeling.' The use of technology to enhance sustainability and to better manage natural resources is fundamental to the concept of a smart city (Michelotto, 2019, p. 29).

In light of the diverse nomenclatures found in the literature, it is worth emphasizing that each characteristic – even when considered in isolation – may contribute to the concept of a smart city, since the core objective is to connect systems and provide new conditions for urban living.

In view of the multiple definitions discussed above, it becomes evident that defining what constitutes a smart city remains a challenging task. At times, different perspectives converge, while at others they diverge. Nevertheless, the principal common element among them is the understanding that a smart city must provide habitability grounded in essential pillars: sustainability, human capital, and the use of diverse technologies – digital or otherwise (Aune, 2017).

The city, as a concept, is therefore a field of debate across different areas of knowledge. A smart city thus represents an understanding of the contemporary city as one that is being transformed and enriched through the presence of technologies and innovations, becoming more capable and better prepared to respond to social demands (Fariniuk et al., 2020).

Smart cities are also regarded, as described by Cury and Marques (2017), as spaces with a high capacity for learning and innovation, built upon the creativity of their communities, institutions, and digital infrastructure for communication and knowledge management.

Therefore, a smart city rises through a collective effort across three dimensions of intelligence: human, collective, and artificial (Cury; Marques, 2017; Lima et al., 2020). In this sense, the Smart City emerges from the interaction of multiple components aimed at establishing a paradigm shift in urban development in the age of technology and information.

It is worth highlighting that the strategies employed in smart cities involve a range of actors who promote development in these spaces, including the population, public administration, and investors. Moreover, the concentration and strategic use of technologies become essential to the implementation and success of such development.

> Currently, several cities around the world define themselves as smart cities; however, there is no single criterion linking urban architecture to the adoption of this designation. The smart designation sometimes merely denotes projects that involve the application of information technologies within communication initiatives. However, such initiatives often lack strategic vision, failing to include an implementation roadmap, clear definitions of desired city characteristics, or performance indicators for legitimate evaluation and classification as a smart city (Panhan et al., 2016, p. 15).

Despite the relevance of urban evolution as a space of development in contemporary contexts, the widespread use and implementation of smart cities is often reduced to a trend, bordering on a fetishization of the term. At the global scale, Smart Cities generate extensive debate, particularly in developed countries. In Brazil, however, the movement addressing this theme in greater depth is still relatively recent (Lazzaretti et al., 2020).

Smart Cities, in addition to being a necessity that emerges from the evolution of society and its increasingly large urban agglomerations, are also an intensive product of capitalism. In turn, capitalism vigorously seeks to market platforms, programs, and software as solutions to local problems, wherever cities may be situated (Mozorov and Bria, 2019).

As Rodrigues and Tartaruga (2020) note, they propose smart cities as a model for efficient territorial governance. It is because, through territorial studies, policies aimed at economic progress and technological development are implemented, thereby fostering regional development and local economies. In this sense, the authors emphasize territory as a core category of geography and as a substantial environment for Smart Cities and innovation in the creation of new forms of modernity.

Lazzaretti et al. (2019, p. 2) state that the concept of a smart city was introduced as a strategic mechanism to integrate modern urban production factors and emphasize the critical role of ICTs in enhancing a city's competitive profile. This perspective reflects a new paradigm of territorial development closely linked to innovation. In Brazil, this approach has become institutionally evident through the *Carta Brasileira para as Cidades Inteligentes* (Brazilian Charter for Smart Cities).

This movement, centered on innovation, technology, and development, has driven the expansion of the concept in Brazil. Such expansion occurred with the involvement of the Ministry of Integration and Regional Development (MDR), in partnership with public and private institutions, the Ministry of Science, Technology, and Innovation (MCTI), the Ministry of Communications (MCom), and 126 other institutions. Together, these actors developed the *Brazilian Charter for Smart Cities* (MDR, 2021). The Charter outlines strategies for implementing more modern cities and provides the following definition of smart cities:

> Smart cities are those committed to sustainable urban development and digital transformation across economic, environmental, and sociocultural dimensions. They operate in a planned, innovative, inclusive, and networked manner; promote digital literacy, collaborative governance, and

> management; and use technologies to solve concrete problems, create opportunities, deliver services efficiently, reduce inequalities, increase resilience, and improve the quality of life of all people, while ensuring the safe and responsible use of data and information and communication technologies (Brazil, 2021, p. 28).

The Brazilian Charter for Smart Cities is of paramount importance, as it establishes the necessary concepts, guidelines, objectives, and principles to provide a secure framework for implementing smart cities in Brazil. Among the Charter's main emphases is digital infrastructure, recognized as an integral component of the city's urban infrastructure. Robust methodologies, data, and indicators must drive the development of this infrastructure, ensuring it can respond effectively to societal demands and adapt to future environmental and climate-related changes.

The Brazilian Charter sets forth guidelines as a fundamental premise for developing Smart Cities in Brazil. An institutional elaboration process created these guidelines to operationalize real needs and adapt cities to this new paradigm through innovative actions, such as environmental conservation, improved quality of life for residents, and greater access to digital means. Its ultimate objective is to foster community protagonism by generating effective responses to local problems.

Within the context of Smart Cities, innovation stands out as a central pillar, driven by the emergence of a new knowledge-based society. In this scenario, access to information, science, and technologies is essential for promoting not only individual development but also collective progress. Thus, innovation is a driving force for the creation of more efficient, connected, and sustainable urban solutions, transforming urban management and citizens' quality of life.

Tunes (2017) emphasizes that innovation involves directly creating novelty, which can manifest as an original product or service. Such creation (innovation) requires the mobilization of prior knowledge, which, according to the author, occurs through different channels and in articulation with multiple agents.

In this sense, innovation is the capacity to introduce significant changes in processes, products, services, or management practices, to improve efficiency, quality, and the impact of actions. While utilizing advanced technologies, urban innovation fundamentally involves new social, organizational, and governance practices. These practices are crucial for driving sustainable development, social inclusion, and enhancing the population's quality of life.

The relationship between innovation and the smart city is direct and essential, according to Lima et al. (2020) and Fariniuk (2020). A city becomes smart only through innovation – specifically, technological, social, and public management changes – aimed at improving the services it provides. Rodrigues and Tartaruga (2020) further argue, along the same line of reasoning, that the smart city therefore represents the outcome of the practical application of innovation to address urban problems in a coherent, efficient, sustainable, and people-centered manner.

Within Geography, authors such as Gomes (2019, 2020), Tunes (2019, 2020), Pereira (2021), and Vale (2009) stand out in studies on innovation. These scholars emphasize that innovation is a continuous process of improving economic production through the use of knowledge and its applications in social, business, industrial, and technological contexts. Thus, to innovate is to act resiliently in the pursuit of efficient solutions to everyday activities. This concept extends far beyond the mere creation of tools or products.

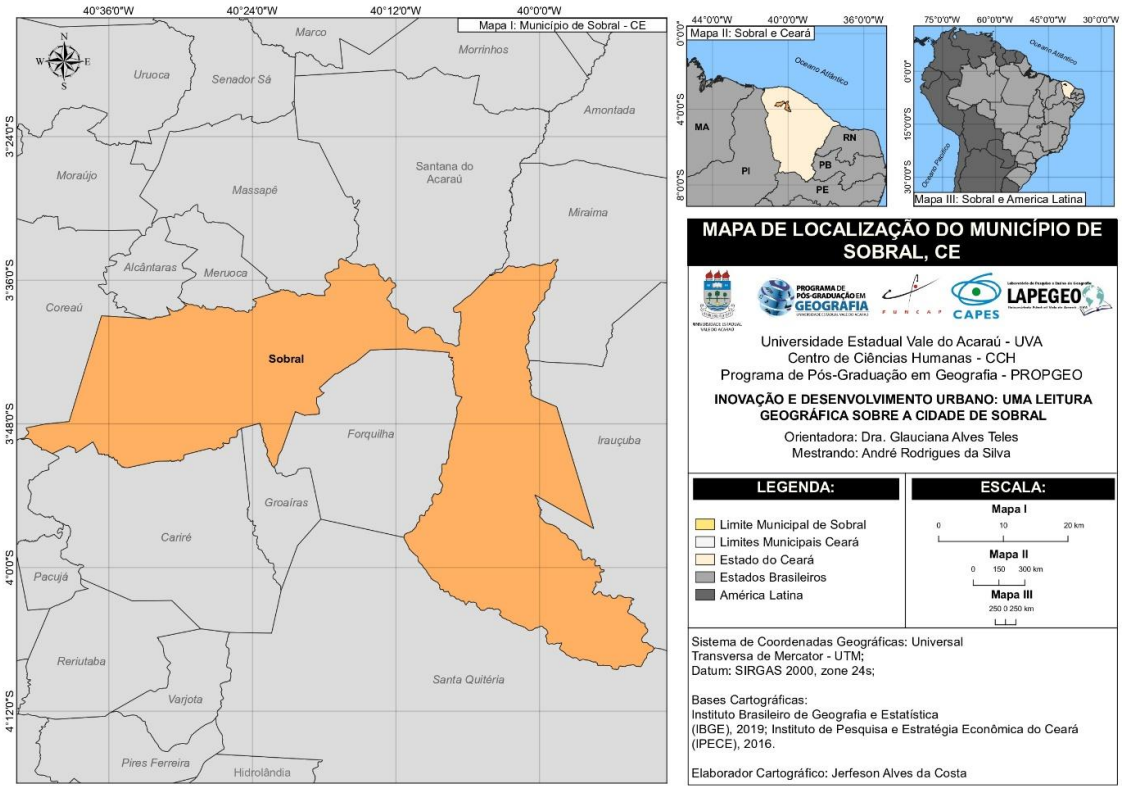
Joseph Schumpeter, through his concept of creative destruction, initially brought innovation into economic studies. However, the meaning of this term exceeds the industrial and digital technology perspective. This understanding dispels the notion that innovation must be exclusively technological. Innovation occurs in education, health, housing, cities, transportation, energy, public policies, and many other areas and sectors that are subject to and conducive to significant change, without technology necessarily being present at every stage of the process.

Silva (2019) argues that urban complexity increasingly requires cities to become engines of innovation to address complex challenges. This necessity drives investment in creative and technological solutions for issues such as mobility, sustainability, and quality of life. These solutions emerge from active interactions among all innovation agents, including citizens, companies, research institutions, and public administration.

4 SOBRAL, INNOVATION AND THE SMART CITY

The city of Sobral, the administrative seat of the municipality, is located 243 km from the state capital, Fortaleza (see Figure 01). According to the 2025 estimate by the Brazilian Institute of Geography and Statistics (IBGE), the municipality is the most populated in the Northwestern region of Ceará, with approximately 216,000 inhabitants.

Figure 01 – Location map of the municipality of Sobral, Ceará



Source: Silva, 2025.

Holanda and Gonçalves (2025) note that Sobral's municipal administration developed a crucial understanding during its city modernization project, initiated in the 1990s: partnerships with local teaching and research institutions were essential for advancing social and territorial development. Over the past three decades, this strategic insight has driven a significant expansion of public policies and private investments in sectors such as education, public security, and health.

Successive administrations consolidated these partnerships, maintaining continuity in the modernization of public actions. This commitment, sustained over three decades, successfully strengthened municipal administrations and drove multiple projects. Simultaneously, the sustained effort established higher education institutions as key agents of modernization and innovation. This relationship between public management and academic research, in itself, constitutes an innovative action, as this institutional partnership successfully materialized many ideas in the city.

In everyday discourse, the labeling of innovation in Sobral is widespread, encompassing a range of activities from investments and projects to ideas and concrete

actions. Sectors such as education, urban mobility, social development, culture, science, and technology, among others, are frequently associated with the notion of innovation through municipal public policies (Holanda; Gonçalves, 2025). Nevertheless, contradictions are evident, and there remains considerable room for improvement in the aforementioned areas.

In any case, with the advent of new technologies, the large-scale circulation of information, the refinement of existing urban techniques, and the needs generated by societal demands to keep pace with this evolution, Sobral has sought to be guided by innovation to mitigate and address local problems more swiftly.

Sobral's geographic space is continuously subject to improvement demands, driven by action plans implemented since the 1960s. The goal remains the increasing development of local and regional specificities. In his master's dissertation, Araújo (2008) records the following assessment: "in our view, Sobral today appears, in part, as the result of the planning paradigm and of public policy actions that operate at the regional scale, present in Brazil and in Ceará since the 1960s" (p. 36). This organization, manifested as a mode of planning, represents a dividing milestone between the Sobral of the past and the city of the future.

Currently, the city exhibits several characteristics that render it singular. Areas such as education, health, mobility, environment, security, public policies, private investments, and innovation environments have endowed Sobral with new attributes through the introduction of novel elements throughout the municipality. These are sectors that still require substantial investment and are essential for development—not only of the city itself, but of the population as a whole.

Local basic education is distinguished nationally by student performance, learning outcomes, the use of digital technologies, and the presence of modern laboratories (Silva & Teles, 2022). In the environmental domain, the creation of biofiltration gardens is noteworthy; these are "solutions based on natural dynamics that aim to address environmental, social, and economic challenges through actions inspired by natural processes" (Sousa et al., 2024, p. 328).

In light of these examples, Sobral exhibits several key characteristics that shape the understanding of a smart city. Indeed, to comprehend the distinctions within which the municipality is, it is necessary to interpret the smart city through the lens of innovation, requiring the systematization of key components to better understand innovation as a mechanism for interaction among the principal elements.

These features that gradually distinguish Sobral are contextualized within the Smart City framework and are associated with the preservation of local culture, much as occurred at the onset of modernity. Such factors must be considered, particularly given that the incorporation of technologies is already tangible, as exemplified by the integrated public security system, which operates as a means of enhancing public protection through the use of Information and Communication Technologies (ICTs).

5 THE VIDEO SURVEILLANCE SYSTEM IN SOBRAL AND ITS RELATIONSHIP WITH THE SMART CITY AND INNOVATION

With the advent of public modernization policies initiated in the 1990s, as previously highlighted, Sobral has been strengthening its public security sector through the implementation of technological infrastructure linked to a modern internet network. In this context, video surveillance emerged as one of the municipal administration's projects aimed not only at territorial regulation, but also at articulating different sectors of public management, such as municipal departments and coordinating bodies.

Modernization efforts began in Sobral as early as 2001 with the installation of the first cameras. Concurrently, the city introduced internet access via fiber-optic cables, replacing the older radio-based connectivity system. Such an initiative established a key milestone, positioning the municipality as one of the pioneers in the state to adopt these services. The project resulted from a partnership between the Municipality of Sobral and the telecommunications company Telemar (now defunct), as documented in the September 2001 edition of the Municipal Bulletin:

> As a result of an agreement between the Municipality and Telemar aimed at expanding the telecommunications system, Sobral is acquiring 42 kilometers of fiber-optic cable, reaching strategic points in the city where 20 Internet kiosks and 15 image capture and transmission cameras will be working. These will enable residents to have free access to the worldwide computer network and allow monitoring of the city's main areas, both for viewing by internet users anywhere in the world and for the supervision of those responsible for local security (Sobral, *Municipal Bulletin*, 2001).

These elements represented a significant step in modernization, particularly in initiatives developed by the municipal public administration to promote public access to the digital world, as well as to innovate security equipment.

The city government installed security cameras at strategic locations throughout the city. With this equipment, the municipality gained the ability to control and monitor urban movement at different points. Moreover, this infrastructure enabled the integration of information across various municipal departments, becoming a significant tool for spatial organization by generating updated data on public works and services, as well as on daily flows of different modes of mobility.

In 2013, the municipal government carried out a revitalization of the video surveillance system, replacing analog technology cameras with more modern equipment.

In addition, the Municipal Civil Guard was integrated into the Integrated Security Operations Cell (CIOPS), consolidating joint work between state-and municipal-level public security agencies.

Currently, the operations center incorporates services from the following agencies: the Military Police, the Fire Department, the Mobile Emergency Service (SAMU), Civil Defense, and the Municipal Civil Guard. The latter represents coordination with several municipal secretariats, in addition to the center's connection to the national public security database.

According to the Municipal Government (2023, n.p.):

> The Municipality's Video Surveillance System is integrated with Alerta Brasil, a Federal Government database that monitors stolen and robbed vehicle license plates, enabling the identification of vehicle make, model, and license plate through image analysis.

The video surveillance system operated by the Municipal Civil Guard of Sobral enables real-time monitoring through a large number of security cameras. This visualization happens via the "VideoWall" (a series of monitors physically connected in 23 arrangements to form a single large screen) installed at CIOPS (Municipality of Sobral, 2023). In this way, video surveillance security systems provide both enhanced public safety and rapid response capacity within the city.

Figure 02 – Video surveillance control room in Sobral

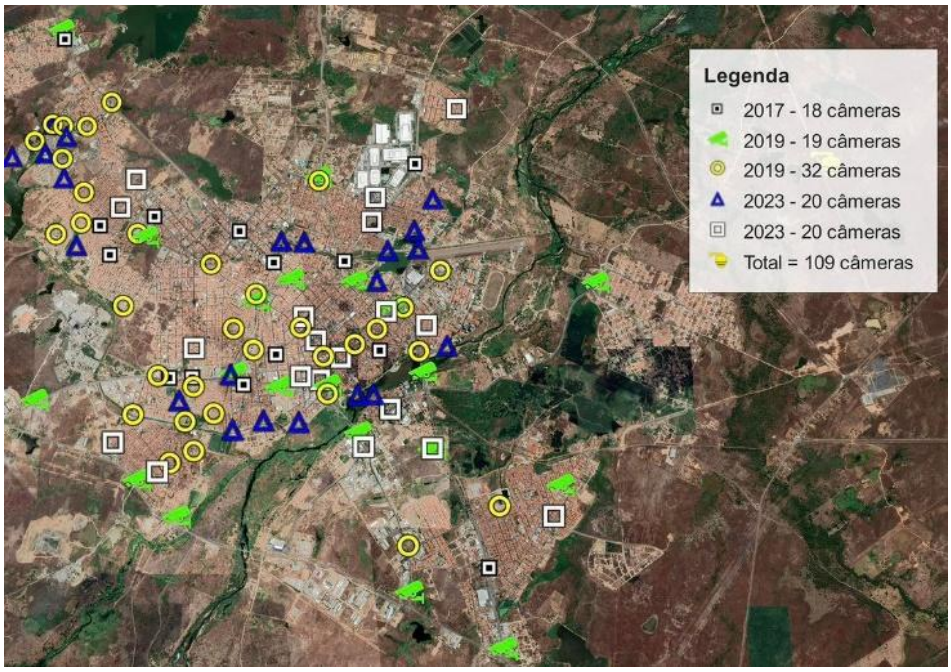
Source: Municipality of Sobral (2021).

Alves and Sabará (2014), when addressing this topic, highlight that the use of security systems in Brazil emerged in the late 1990s, with strong military influence, as they describe:

> The first appearance of surveillance cameras in the daily life of the Brazilian population occurred with Law No. 1,034 of October 21, 1969, as a product of the Military State, authorizing private initiative under the justification of combating bank robberies associated with opposition movements to the Military Regime. Legal recognition and the diffusion of security services intensified from 1996 onward, when surveillance cameras became mandatory in various institutions, with several initiatives in the form of bills aimed at making the installation of cameras compulsory in different types of establishments or in locations with high flows of movement (Alves; Sabará, 2014, p. 7).

As these technological tools became widespread across the country, municipalities and states began to adopt them, progressively refining their use through the incorporation of new mechanisms. By 2025, Sobral will operate a system of 109 cameras installed at strategic locations. According to the municipal government, investments totaling two million Brazilian reais were made in recent years (2023 and 2024). The camera system operates through video surveillance, and its network connects it to public security agencies and municipal secretariats (as shown in Figure 03).

Figure 03 – Location of security cameras in Sobral



Source: Social media of former Mayor Ivo Gomes (2024).

The planning and security teams distributed cameras to strategic points - locations associated with an intense flow of people and vehicles or critical situations of violence. Figure 4 shows a camera at a highly trafficked avenue intersection at the city entrance.

Figure 04 – Video surveillance camera in central Sobral

Source: Author's archive (2024).

The innovations implemented by CIOPS are primarily technological in nature and support public security initiatives through an integrated service involving multiple agencies. This characteristic of the model adopted in Sobral is directly linked to the Smart City paradigm, which is grounded in modernization and the creation of networks and systems—including urban security systems—through the use of modern technological equipment.

Freitas (2018) emphasizes that planning preventive actions and monitoring security-related aspects maximizes services provided to citizens in a smart city. In line with this perspective, Sobral demonstrates evident smart city characteristics by using cutting-edge technology. This technology, which includes the city's cameras and video surveillance control center, connects directly with the operational centers of other facilities under the Ceará State Secretariat of Public Security.

The Municipal Government of Sobral, through the Municipal Secretariat for Citizen Security, and the *Universidade Estadual Vale do Acaraú* (Acaraú Valley State University – UVA) created the Violence Observatory as part of public security innovations. Funded by the *Fundação Cearense de Apoio ao Desenvolvimento Científico e Tecnológico* (Ceará Foundation for the Support of Scientific and Technological Development – Funcap), the facility relies on personnel from both UVA researchers and municipal public servants. The video surveillance system serves as essential operational support for the project.

According to information published on the UVA website on May 13, 2024[2], the Violence Observatory highlights the use of research and intelligence to guide and implement violence prevention policies. Its primary objective is to articulate and strengthen preventive actions, as well as to promote a culture of peace in the municipality through innovative approaches.

Through projects such as the Violence Observatory, the partnership between municipal public management[3] and the university drives the development of innovative, science-backed products for urban advancement. This advancement utilizes a strategic blend of technological resources and social actions. In this sense, the Violence Observatory represents a new initiative, launched in 2024, which combines academic research, technology, and public management to address public security challenges in Sobral.

[2] **CEARÁ.** Vale do Acaraú State University (UVA) inaugurates the Violence Observatory. Available at: https://www.uva.ce.gov.br/2024/05/13/uva-inaugura-observatorio-da-violencia/. Accessed on: December 20, 2024.
[3] **SOBRAL.** Violence Observatory Room is inaugurated this Thursday (May 9). Available at: https://www.sobral.ce.gov.br/informes/principais/sala-do-observatorio-da-violencia-e-inaugurada-nesta-quinta-feira-09-05. Accessed on: December 20, 2024.

The partnership between UVA and the Municipal Government demonstrates that integrating science and public policy effectively promotes preventive strategies, which in turn strengthen the culture of peace and significantly contribute to the municipality's social development.

Beyond the video surveillance system, the municipality has also invested in complementary security equipment to improve the quality of life for the population. However, the investments have yielded mixed results, as the city continues to record high levels of violence. The reality indicates the need to implement additional measures in conjunction with existing initiatives to achieve more effective public safety outcomes.

The case examined clearly manifests the characteristics of a smart city. However, the initiatives developed in public security extend beyond this sector. To ensure the effective functioning of its technologies and consolidate its security model, the Municipality innovated and complemented the existing system by creating the Integrated Citizen Security Plan. This plan strategically supports municipal development and aligns with the State Government's Ceará 2050 Plan. Among its stated objectives, the following stand out:

> The Integrated Citizen Security Plan seeks to improve and optimize the actions of the Municipal Secretariat of Citizen Security (SESEC), in conjunction with the Sobral Municipal Civil Guard (GCMS), local communities, other bodies of the municipal executive branch, and the security forces operating in the municipality. Thus, the plan aims to mobilize efforts, equipment, and resources to, through priority prevention strategies, promote, ensure, and maintain social peace, with a view to reducing crime rates and the various manifestations of violence within the municipal territory (Sobral, 2022, p. 6).

Security emerges as a central element for urban innovation in Sobral. Such an innovation encompasses both technological and social dimensions. Through integration with the community, the Citizen Security Plan (see Figure 05) implements preventive actions aimed at addressing violence.

Figure 05 – Cover of the Sobral Citizen Security Plan.

Source: Sobral Citizen Security Plan (2024).

This form of social innovation positions Sobral as the only municipality in the interior of Ceará to design a municipal security plan aimed at solving or mitigating public security challenges through actions focused on the Sobral territory. The initiative encompasses an agenda for community transformation, particularly in the city's peripheral areas. These actions are developed jointly by the Municipality, through the Municipal Civil Guard, and the local population, who contribute their in-depth knowledge of their communities.

Despite the plan's implementation, vulnerabilities in local public security remain evident, documented by the persistent sense of insecurity that residents report daily on social media, in public spaces, and in news coverage.

6 FINAL CONSIDERATIONS

This article examines the analytical elements that characterize Sobral as a smart city by relating public security policies to the broader context of modernization and innovation implemented over the last three decades.

The modernization of public management in Sobral has contributed significantly to the city's development, particularly with the advent and consolidation of Information and Communication Technologies (ICTs).

The installation of video surveillance cameras contributes to the generation of accurate, real-time data and information related to monitoring and public security. Such data

are used not only by municipal departments and research institutions located in the city, but also by agencies of the State of Ceará and the federal government of Brazil.

As innovation and transformation expand within urban spaces, cities are clearly trending toward increasing the technification of processes and services. This dynamic encompasses new demands in areas such as public security, health, education, mobility, housing, and other urban dimensions. Within this context, actions aimed at solutions based on creativity and intelligence have expanded, as identified in the literature on smart cities.

Another relevant aspect highlighted in this study is the continuous dialogue between the municipal public administration and higher education institutions (HEIs) in Sobral, particularly in the implementation of projects and urban planning instruments. Such a relationship is a significant pillar of innovation-driven actions and of the consolidation of a smart city model. Historically, the pronounced separation between academia and public administration in urban planning has caused a significant mismatch between academic research and the outcomes of planning actions executed by public authorities.

The Violence Observatory, based at UVA, brings together public managers, researchers, and members of municipal departments responsible for public security. Its shared objective is to promote actions grounded in technical and academic research on urban violence in Sobral. This initiative creates a relevant space for dialogue that directly links innovation-oriented practices to the city's public security strategies.

Although Sobral exhibits characteristics associated with a smart city – particularly by adopting innovative strategies adapted to its local context rather than merely replicating universal models – this condition alone does not, in itself, ensure fully effective urban functioning.

Despite the technological apparatus identified within the public security model, the city of Sobral ranks among the most violent in the country, with still alarming levels of violence. This issue is highly compelling; however, it did not constitute the central objective of this article. The task of understanding the impacts that these ongoing innovations have had on actual violence rates is therefore left to future studies.

The disparities between urban discourse and practice demonstrate that, despite notable advances, Sobral continues to face structural and operational limitations that compromise the effectiveness of its public policies. Such gaps indicate that the consolidation of a truly smart, inclusive, and functional city model requires continuous improvement, active listening to the population, and critical evaluation of the strategies adopted.

Sobral's experience should thus be understood as a dynamic process, marked by both achievements and innovations, as well as by persistent tensions and contradictions. In this regard, it is important to emphasize the analytical potential of interpreting territorial innovations through the lens of geographic science, particularly in medium-sized cities. Consequently, further studies are necessary to assess the real impact of innovations on public security in the city of Sobral.

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