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Article

Perspectives on public safety in smart cities: a review of the literature from 2002 to 2022

ERIC RODRIGUES DE SALES [1]
LIZANDRO LUI [1]

[1] Fundação Getulio Vargas (FGV EPPG) / Escola de Políticas Públicas e Governo, Brasília – DF, Brazil

Abstract

The concept of smart cities and their innovative technologies contribute to the enhancement of public security and crime prevention. This study aims to analyze how literature presents the development of projects focused on smart cities in the field of public security. An integrative review of Brazilian and international literature was conducted, examining articles published between 2002 and 2022 to identify how public security and smart cities converge and benefit society. The review indicates that the discourse surrounding these fields is relatively new and still emerging within academia. Nonetheless, there have been significant advances, especially concerning the use of systems based on artificial intelligence, technological development, software reliant on big data, machine learning, and the interoperability of data and algorithms, which could substantially impact public safety policies. The study reveals that the primary areas of research within the broad scope of public safety in smart cities are combating crime, civil defense, and combating and preventing natural disasters such as fire, floods, and inundations, as well as traffic and urban mobility, crime prevention through environmental design, and tools aimed at reducing violence against vulnerable populations. The article concludes by proposing directions for a future research agenda in Brazil.

Keywords: Security. Public safety. Smart cities. Technology. Crime prevention.

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Perspectivas sobre segurança pública em cidades inteligentes: uma revisão da literatura de 2002 a 2022

Resumo

O conceito das *smart cities* e suas tecnologias inovadoras contribuem para a discussão no campo da segurança pública e da prevenção criminal. O objetivo deste artigo é abordar a forma pela qual a literatura apresenta evidências relativas ao desenvolvimento de projetos voltados às *smart cities* no campo da segurança pública. Para isso, foi realizada uma revisão integrativa da literatura brasileira e internacional, por meio de uma extensa pesquisa bibliográfica sobre publicações científicas entre os anos 2002 e 2022, a fim de identificar como estes dois campos, segurança pública e *smart cities*, convergem e podem trazer benefícios para a sociedade. O levantamento indica que esse é um assunto relativamente novo e ainda emergente no campo das discussões acadêmicas. Foi verificado que existem avanços significativos nessa área, principalmente no que tange ao uso de sistemas baseados em inteligência artificial; desenvolvimento de tecnologias; programas eletrônicos dependentes de *big data* e *maching learning*; interoperabilidade de dados e algoritmos, os quais podem resultar em impactos relevantes nas políticas de segurança pública. Identificou-se que os principais campos de pesquisa referentes à segurança pública em *smart cities* estão vinculados à área de combate e prevenção da criminalidade, bem como estudos na área de defesa civil, combate e prevenção de desastres naturais, estudos sobre tráfego e mobilidade urbana e pesquisas que visam combater a violência de populações em vulnerabilidade. Por fim, propõe-se uma agenda de pesquisa sobre o assunto para o Brasil.

Palavras-chave: Segurança. Segurança pública. Cidades inteligentes. Tecnologia. Prevenção criminal.

Perspectivas de la seguridad pública en ciudades inteligentes: una revisión de la literatura desde 2002 hasta 2022

Resumen

El concepto de *smart cities* y sus tecnologías innovadoras contribuyen al debate en el ámbito de seguridad pública y prevención de la delincuencia. El objetivo de este artículo es abordar la forma en que la literatura presenta evidencias sobre el desarrollo de proyectos centrados en ciudades inteligentes en el ámbito de la seguridad pública. Para ello, se realizó una revisión integradora de la literatura brasileña e internacional a través de una extensa búsqueda bibliográfica en publicaciones científicas entre los años 2002 y 2022 con el fin de identificar cómo estos dos campos, seguridad pública y *smart cities*, convergen y pueden aportar beneficios a la sociedad. El estudio indica que se trata de un tema relativamente nuevo y aún emergente en el campo de las discusiones académicas. Se verificó que hay avances significativos en esta área, especialmente en lo que se refiere al uso de sistemas basados en inteligencia artificial; desarrollo de tecnologías; programas electrónicos dependientes de *big data* y *maching learning*; interoperabilidad de datos y algoritmos, que pueden resultar en impactos relevantes en las políticas de seguridad pública. Se identificó que los principales campos de investigación dentro de la macroárea de seguridad pública en ciudades inteligentes se revelaron en el área de combate a la criminalidad, y también en el área de defensa civil, combate y prevención de desastres naturales como incendios, inundaciones y anegamientos, tránsito y movilidad urbana y en la prevención de la criminalidad por medio del diseño ambiental, así como herramientas cuyo objetivo es el combate a la violencia de poblaciones en vulnerabilidad. Finalmente, se propone una agenda de investigación sobre el tema para Brasil.

Palabras clave: Seguridad. Seguridad pública. Ciudades inteligentes. Tecnología. Prevención del crimen.

INTRODUCTION

As stated in the Federal Constitution, public security is a duty of the State, a right and responsibility of all, being exercised to preserve public order and the safety of people and property. This definition, present in the Constitution of the Federative Republic of Brazil (BRASIL, 1988), in its article 144, *caput*, can be extended to many other countries. In Brazil, since the mid-1990s, the sector has experienced a reorganization of intergovernmental relations in a context in which the federal government, while taking responsibility for addressing the phenomena of crime, violence, and human rights violations, has been stimulating intergovernmental coordination and decentralization of specific programs (SCHABBACH, 2014).

According to Spaniol, Moraes Júnior, and Rodrigues (2020), in recent electoral campaigns, at the federal, state or municipal levels, the planning and implementation of public security policies are among the main proposals of the candidates, as well as the concerns of voters in choosing their representatives. The topic is complex and gains the spotlight in everyday affairs, in the news, in newspapers, and on the internet, especially when it comes to crimes against life.

The way of doing public security varies according to local demands and the existing institutional arrangement. In Brazil, police and criminal justice institutions have not recently experienced significant reforms in their structures (SCHABBACH, 2014). Eventual advances in police management and reforms in criminal legislation have proved insufficient to reduce the incidence of urban violence, in solid evidence of a lack of coordination and control (LIMA, BUENO, and MINGARDI, 2016).

According to Sá and Silva (2012), governments have been trying to build more efficient public security, with public policies implemented based on trial and error, copying models from elsewhere and increasing the number of security forces, seeking standardization of professional training and production of new legislation, among others.

Faced with the rapidly accumulating urban challenges in this field, the use of technology linked to the idea of a smart city has gained popularity and appeal among local authorities and academics. The first wave of the smart city concept focused on technology-driven urban management led by the government, often in alliance with corporations, to improve cities for inhabitants (BELLA, CORSI, and LEPORATTI, 2014). Thus, a fact present in the everyday world is the progressive advance of modern technologies. Security forces have been experimenting with new technological tools as allies in their activities, and their emergence in society also optimizes techniques that facilitate prevention and security measures, making them less costly and more efficient.

Technology can be a great ally in combating and preventing violence (LIMA, OLIVEIRA, and COSTA, 2016). The development of information and communication technologies (ICT), as well as their definitive entry into society, whether through smartphones and long-range data connections or in public administration via electronic portals and the use of other online functionalities, are today one of the pillars in the construction of an information society (FERREIRA et al., 2020).

The aim of this article is to discuss how the literature presents evidence on the development of projects for smart cities regarding public safety. For this, a systematic review of the literature on the two fields of knowledge and how they intertwine was conducted. The research is justified by the need to advance in constructing a public security system in Brazil in line with international discussions and experiences.

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The article is divided into three sections, along with an introduction and conclusion. Firstly, we will introduce the ongoing discussion about public safety in relation to smart cities. Then, we will outline the approach used in our study before delving into the discussion and findings.

THE DEBATE ON PUBLIC SAFETY AND SMART CITIES

The debate on smart cities emerged in the United States in the 1980s amid other discussions, such as urban planning. The subject gained momentum in Brazil in the late 1970s and early 1980s thanks to the growing debate on urban issues and problems, driven by the 1988 Federal Constitution, which pioneered urban policy. As a result, the phenomenon of smart cities found fertile ground in urbanism, allowing various actors to propose multidisciplinary actions and programs. However, concerning public safety, the use of cameras, sensors, and various software must be done in a planned, transparent manner and with respect for the individuality of citizens, as their indiscriminate use can compromise the security of information of users and citizens (ARAÚJO, 2019).

The concern about violence and public safety mobilizes the attention of citizens and elected representatives, being part of the debate and the government agenda, as Azevedo (2009) points out. In 2018, the Unified System of Public Security (Susp - Sistema Único de Segurança Pública) was created, whose approval aimed to react to the peak of crimes that made 2017 the most violent year in Brazil's history. This was found to give more efficiency and integrate actions (FBSP, 2021).

According to Schabbach (2014), the growing attention of the public authorities to deal with crime is due to the fact that this is one of the problems that affect the entire population and is collectively understood as a public problem. The consequences of this social problem are reflected in people's everyday imagination and in the figures represented by the direct costs of violent crime (BEATO FILHO, 1999).

For Barborza (2018), there has been an increase in the number of people who use economic explanations to discuss issues related to crime, criminals, and penal treatment in Brazil. This phenomenon has also affected the field of public security, where sociologists, jurists, anthropologists, educators, and other researchers who do not adhere to the new paradigms of management, the massive use of statistics and the economic theory of crime are being replaced by those who consider themselves more scientific. The technological tools in the digital environment of smart cities can contribute to the creation of scientific evidence and data for better public safety policies.

In Brazil, as in other Latin American countries, the issue of social inequality highlights the economic and social problems in urban areas. Accelerated urbanization, persistent poverty and inequality, political violence, the more organized nature of crime, and the emergence of illegal drug use and trafficking are often cited as being the root of this increase. Crime and violence affect everyone: rich and poor, women and men, young and old (BANCO MUNDIAL, 2003).

Since the early 1990s, the problems of violence, insecurity, and crime have been central issues in large and medium-sized urban centers in South America. In the case of Brazil, homicide rates have been on the rise since the early 1980s, reaching the 50,000 deaths per year mark in the early

2000s and a rate of around 25 homicides per 100,000 inhabitants, but in some capitals reaching the level of an impressive 90 homicides per 100,000 inhabitants (AZEVEDO and CIFALI, 2015).

Beato Filho (1999) points out that a problem that should be considered is that violence and crime are concentrated in large urban centers. Thus, it is important to explore which technologies present in smart cities can contribute to public safety policies since criminal issues are part of the urbanization of our society.

The knowledge management process has impacted public safety. There are numerous actions in which public security managers have sought, through knowledge, the implementation of projects with the insertion of new technologies to support police activity (CRUZ, 2008). The initiative to improve the lives of citizens in a smart city includes mobility and urban transportation, public libraries, public leisure areas, and public safety (BRASIL, 2021). Based on security indicators, Brazil spends a lot but has little return in this area. According to Xavier (2020), several cities face chronic public safety problems, and the use of intelligence aims to assist in the decisions of government officials and security agents, aiming to obtain better results in the attendance of occurrences and crime prevention.

The smart city term is associated with developing technology-based solutions to urban problems. Thus, it is stated that smart cities depend on technological infrastructure; the set of hardware, software, networks, internet, services, and applications; and the management that local governments make of this collection (PRZEYBILOVICZ, CUNHA, and MEIRELLES, 2018). Thus, the concept can potentially be appropriated by the public security area.

In Brazil, various agents - government, civil society, and private initiatives - have made a wide range of efforts around the theme. In 2021, the publication of *Carta brasileira para as cidades inteligentes*, integrated with the Ministry of Regional Development, has sought to relate the concept of smart cities to a varied set of public policies, such as mobility, infrastructure, and public safety, among others (BRASIL, 2021).

This concept presented in *Carta brasileira para cidades inteligentes* makes it clear that the use of technology is one of the pressing factors behind the idea of smart cities. It must be done to solve concrete problems, create opportunities and offer services efficiently. Thus, initiatives aimed at developing policies for smart cities impact public safety. At the international level, studies such as Security and the Smart City (LAUFS, BORRION, and BRADFORD, 2020) and Video Structured Description Technology-based Intelligence Analysis of Surveillance Videos for Public Security Applications (XU, HU, and MEI, 2016) already highlight the use of smart technologies to assist in the construction of security policies, as we will see in the following sections. The debate has also started in Brazil.

Thus, using technology is an ally of public security policies. Carnevali and Alcantara (2020) argue that, among other qualities, smart cities are safer. Although cities are increasing the number of surveillance cameras, many uncovered points and poor image quality remain. The integration of cameras from private locations, such as shopping centers, and the police structure is also not a reality in Brazil, which would make it difficult, for example, to identify a person under investigation who is in these closed-circuit TV environments (HAMADA and NASSIF, 2018).

Initiatives that seek to unite technology and public safety are still incipient in Brazil. However, in Santa Catarina, a tool used by the Military Police has optimized processes within the corporation. It has become a reference and model for other federation units that seek to adopt it (FERREIRA

et al., 2020). This is PMSC Mobile, a technological innovation that replaces paper forms and part of the functions performed by the radio transmitter with an application installed on a tablet. Mobile optimizes police incident management by recording all data on the spot and allowing the cataloging of evidence and other elements through audio and video. In the end, the police report (TCO - Termo Circunstanciado de Ocorrência) is delivered to those involved, which is printed by a thermal printer attached to the tablet.

The police activity is also subsidized by access, via the application, to data from information systems of other administrative bodies, such as the Traffic Department, Public Security, etc. (FERREIRA et al., 2020). Among other results, we can mention the better management in the registration of criminal occurrences, the greater accuracy in the registration of these occurrences, and the qualitative improvement in the service provided to citizens, increasing the preservation of their rights.

Although this initiative is not conceived in a smart city, since, as Ferreira et al. (2020) argue, it covers the entire territory of Santa Catarina, and we can take it as an example of a concrete technological innovation in our country applied in the field of public security. According to the authors, the results contribute to the reflection on the effects of technology on the rationalization of administrative processes, the discussion of disputed practices and concepts, and a potential articulation between police agencies for strategic decision-making in prevention and police investigation.

In the same vein, we can mention the study by Silva and Silva (2019) that evaluated the implementation of facial recognition technologies for surveillance and public security purposes in Brazil. The authors found that, if precautionary measures are not taken, automated facial recognition technologies can significantly contribute to the perpetuation of racism in Brazilian social structures. Hence, transparency measures are essential in the audit systems of learning algorithms to identify possible discriminatory biases and seek solutions to this issue.

In addition, it is necessary to make a change in public security policy, especially concerning the distribution of the budget for investment in technology and the improvement of the technological apparatus of the federal and civil police. As mentioned, using high-resolution and quality cameras can be fundamental to reducing inaccuracy during automated facial recognition (SILVA and SILVA, 2019). The research concluded that although technology can be used as an ally, it has limitations and must be monitored to avoid automated errors.

We can also mention the case of Sinesp Cidadão, used by several people across the country. For Teixeira (2014), the application is described as a tool of the National Public Security, Prison, and Drug Information System (Lei nº 12.681/2012). It allows citizens direct access to the National Secretariat of Public Security services of the Ministry of Justice. This description seems intentional to consolidate the most significant impact of the spread of communication technologies: the ability to transfer the concentration of power from states and institutions to individuals.

The application is aimed at citizens, but public security professionals should refrain from restricting their research to it. Its legitimacy is based on the constitutional provision (Article 144 of Chapter III, Title V, of the 1988 Federal Constitution), which establishes public security as a duty of the State and as a right and responsibility of all. Partially, this constitutional provision justifies the transfer of attribution from the State to the citizens.

METHODS

The literature review process requires elaborating a synthesis based on different topics capable of creating a broad understanding of knowledge. The literature review is the first step to building scientific knowledge because it is through this process that new theories emerge, and gaps and opportunities for the emergence of research on a specific subject are recognized (BOTELHO, CUNHA, and MACEDO, 2011).

Accordingly, it is a skillful, effective, and appropriate instrument to systematize the knowledge desired in this article. As a guide for this research, the integrative review model proposed by Botelho, Cunha, and Macedo (2011) was adopted, which, according to the authors, summarizes the past empirical or theoretical literature to provide a more comprehensive understanding of a particular phenomenon. This procedure aims to analyze the knowledge already built in previous research on a given topic.

Thus, the steps listed were followed consecutively: identification of the theme and selection of the research question; establishment of inclusion and exclusion criteria; identification of pre-selected and selected studies; categorization of selected studies; analysis and interpretation of results; presentation of the review/synthesis of knowledge.

The initial bibliographic survey was conducted through the Web of Science (WoS) and Scientific Electronic Library On-Line (SciELO) portals, platforms that bring together renowned, indexed, and reviewed journals, in order to ensure greater quality of the selected studies, which were subsequently subjected to predetermined filters and, finally, included or excluded in the review. According to Almeida and Gracio (2019), the WoS database, under the responsibility of Clarivate Analytics, was a pioneer in measuring the impact of scientific journals. Today, it comprises a wide variety of databases, including more than 10,000 journals from different areas of knowledge, reports, books, conferences, and other editorial materials. It is the oldest and most comprehensive source of citation and bibliographic data.

In Brazil, SciELO, created in 1996, is considered the most crucial database and is maintained in partnership with the São Paulo State Research Foundation (Fapesp), the Latin American and Caribbean Center on Health Sciences Information (Bireme), and the National Council for Scientific and Technological Development (CNPq - Conselho Nacional de Desenvolvimento Científico e Tecnológico). It is a network of collections of journals published on the Internet, with direct access, whose objective is to promote visibility, national and international credibility, and accessibility to scientific publications from Latin America and the Caribbean. The search was carried out in March and April 2022.

The keywords used in the search were: "Smart Cit*" + "Security Polic*"; "Smart Cit*" + "Public Security"; "Smart Cit*" + "Crime Prevention"; "Smart Cit*" + "Security Technology*." Regarding the inclusion criteria, we considered: articles published and fully available and accessible in print or a scientific database, articles published from 2002 onwards, articles dealing with empirical research and bringing the intersection of the themes of smart cities and "public security." Regarding the exclusion criteria, we considered: duplicate articles; articles prior to 2002; articles that do not directly address the theme "public safety in smart cities,"; articles that are not fully available in the databases searched; articles that do not deal with empirical research.

Initially, the search resulted in a total of 151 published papers. Following the third stage of the integrative review, the titles, keywords, and abstracts of the publications were read. The entire reading was conducted in case of doubts about including or excluding the work in the bibliographic review only with this method.

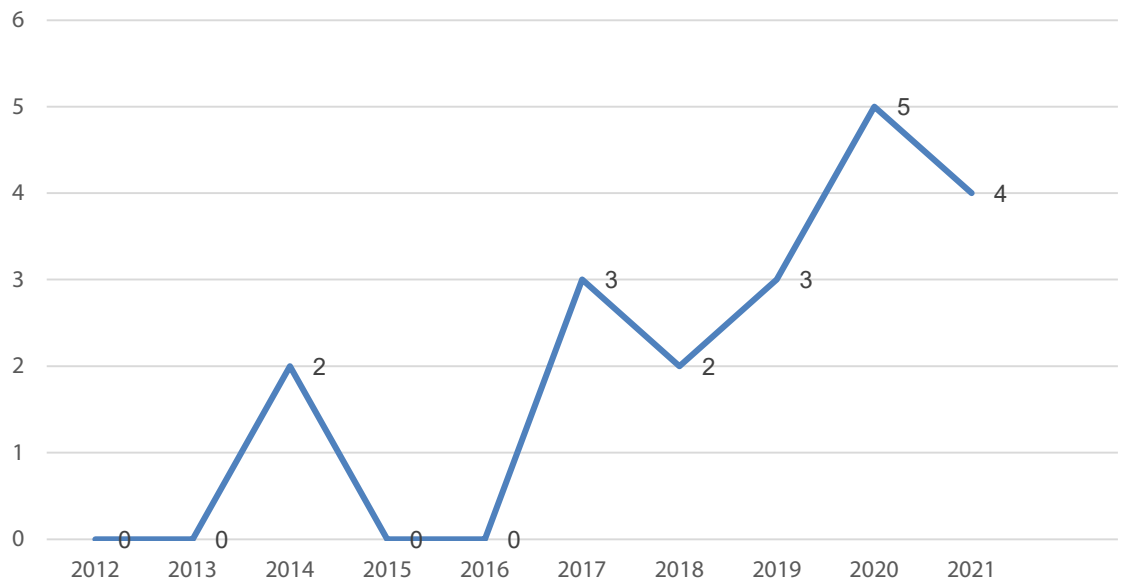
The papers selected after the screening that met all the requirements were separated into a bibliographic portfolio totaling 20 articles. For a graphic visualization of the most discussed topics in the selected texts, a word cloud was made with the content of all the works on the Wordclouds.com platform.

RESULTS AND DISCUSSION

According to the search criteria, after all the established selection steps, the search resulted in 20 articles that met all the requirements. Analyzing the selected articles, the discussion on smart cities and public safety has gained space since 2012, the year in which the first work was published, and has been on an increasing trend until 2020, as indicated in Figure 1.

FIGURE 1

Articles published by year



Source: Elaborated by the authors.

There was also considerable diversity in the countries publishing on the topic. China emerges as the nation with the most considerable number of published works - with a total of seven articles -, followed by South Korea and Brazil - with three publications each - as well as by Italy, Greece, India, Portugal, Russia and the United Kingdom, with a smaller number of publications.

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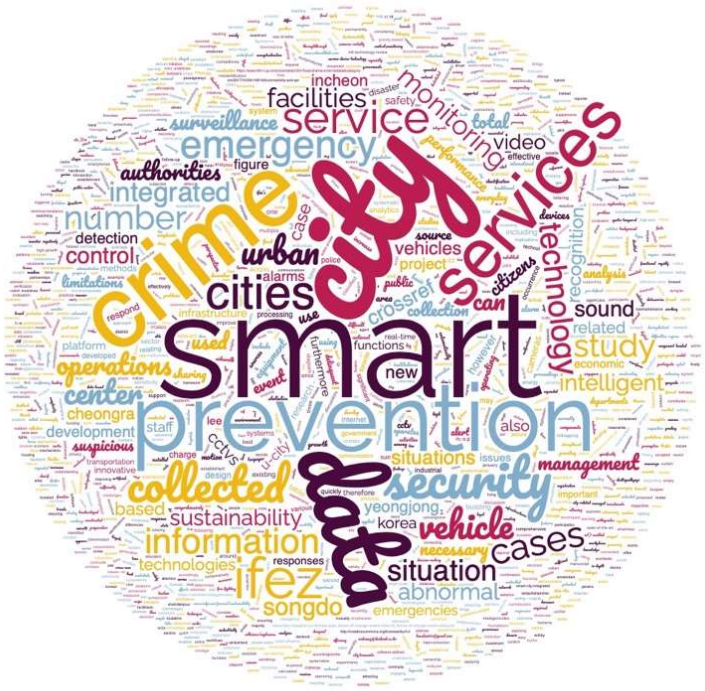
With the help of Wordclouds.com, to obtain evidence on the main points discussed in the papers, an analysis of the most cited terms was made, and a word cloud was created according to the frequency with which they appear. Thus, it was verified that the presence of some of the keywords of this study and several others related to the theme.

FIGURE 2

Word cloud of the articles selected for the review



Source: Elaborated by the authors.

After conducting the analysis and initial discussion, we will present the main findings thematically. This is due to the convergence of the main results found in the reviewed articles. Two analytical categories were built based on analyzing the selected material: the first referring to civic engagement and state surveillance initiatives, and the second related to constructing predictive models and using artificial intelligence.

Civic engagement and state surveillance initiatives for building public safety policies in the context of smart cities.

The literature review concludes that the idea of incorporating citizen participation in the formulation of solutions for public services and for the construction of smart cities is understood as beneficial, given that it brings valuable resources to decision-making, such as information, expectations, and perceptions of citizens (DENHARDT and DENHARDT, 2000). A city can be seen as smart when investments in human and social capital, as well as in modern information and communication technologies (ICTs), contribute harmoniously to sustainable economic

development and improvements in the quality of life of citizens through participatory and engaged actions (MOREIRA et al., 2017).

Not only do safety and security significantly affect whether and how citizens interact with urban spaces, but, as shown in the discussion above, there are a variety of tools that can be used for citizen engagement in different areas of city services (LAUFS, BORRION, and BRADFORD, 2020).

A strand of joint work exists between society and the state, creating collaborative security and co-production for the common good. The studies analyzed bring experiences of building technological solutions that depend on the engagement of citizens to operate. The Safe Citizen (MOREIRA et al., 2017), Onde Fui Roubado (LOURENÇO et al., 2018), and a women's protection application developed in India (SHENOY et al., 2021) are identified as effective in building technological solutions aimed at the field of security.

On the other hand, the research developed by Chinese researchers (XU et al., 2017; SHI et al., 2017; CHEN et al., 2020; WU, XU, and LI, 2020; LIU, ZHANG, and WANG, 2021) presents proposals for the development of facial recognition technologies, recognition of weapons in public places, strange movements and other events understood as anomalies. Thus, unlike technologies that depend on the engagement of application users, these present a more invasive perspective regarding the right to privacy and provide the State with the possibility of monitoring the geolocation of individuals in addition to performing facial recognition. In the sense attributed by Foucault (1987), this set of devices enables the State to build an omnipresent system of surveillance of subjects.

Although this technology offers exciting applications for society, especially concerning the search for missing persons and the tracking of those wanted by justice, its application depends on an institutional framework that regulates its use by the state agent so as not to run the risk of suppressing the freedom and the right to anonymity of citizens. In the case of the discussion of importing this type of technology to Brazil, it is understood that the Brazilian institutional arrangement still needs to build a system that constrains the use of this technology for political persecution purposes and guarantees social control over the use of data from the technology.

Therefore, technological solutions that add to the field of public security and smart city initiatives vary according to the country's institutional and legal framework. The studies developed by Chinese researchers reflect the country's institutional arrangement and build instruments to give the State greater power over citizens.

Construction of predictive models and use of artificial intelligence

When analyzing the selected works, there was an emphasis on building predictive models based on the construction of algorithms and artificial intelligence (SHI et al., 2017; LOURENÇO et al., 2018; CATLETT et al., 2019; GUOWEI et al., 2020; LIU, ZHANG, and WANG, 2021; TULUMELLO and IAPAOLO, 2021; VIEGAS et al., 2021). The solutions for constructing public security policies for smart cities depend heavily on constructing spatially referenced crime databases. The studies indicated propose to formulate predictive models, compare them with the existing state of the art and propose their incorporation into public policies. Apart from a few exceptions (CATLETT et al., 2019; TULUMELLO and IAPAOLO, 2021), no application of these models was identified.

Alternatives have been observed that use the so-called Internet of Things (IoT), an emerging smart city technology that interconnects various digital devices through the Internet, providing various innovative facilities (SODHRO et al., 2019). This type of innovation does not require active community participation but sometimes uses smartphones, cell phones, and other sensors to generate data to help direct police forces (VIEGAS et al., 2021), firefighters to prevent disasters (GUOWEI et al., 2020) and even to monitor social networks to detect and monitor crowds (XU et al., 2017).

These innovations make use of artificial intelligence and intelligent algorithms that incorporate new data into their learning and evolve the so-called machine learning, a field of artificial intelligence that focuses on the development of algorithms and statistical models that allow computers to learn to perform specific tasks without being explicitly programmed to do so. Machine learning is based on recognizing patterns in large amounts of data, allowing the algorithm to identify and learn from these patterns in order to perform specific tasks, such as classification, prediction, and image recognition, among others. Several of these studies (CERMAKOVA et al., 2018; CHEN et al., 2020; WU, XU, and LI, 2020) address the topic of intelligent video surveillance. Other authors (WOOCHUL and JOONYEOP, 2017; WU et al., 2017; CATLETT et al., 2019; LIU, ZHANG, and WANG, 2021) included spatial positioning systems with the use of uncrewed aircraft, such as drones and GPS.

Another noteworthy innovation is the issue of predictive policing, which can fundamentally change how the application of state force reacts to illegal and dangerous activities, making our smart cities safer (TRUNTSEVSKY et al., 2018). Supporting the concept of predictive policing, Park and Lee (2020) conducted a study, while Shi et al. (2017) developed an approach for forecasting natural disasters. As a case of experience understood as not effective, we can mention the experience of the city of Memphis in the United States, where the BlueCrush application did not generate enough evidence to prevent crimes.

In the specific case, BlueCrush (crime reduction utilizing statistical history) is a predictive policing program that has demonstrated an inability to prevent crime and has added skepticism to the role of policing as a policy solution (TULUMELLO and IAPAOLO, 2021). Based on data generation in a smart city environment, new tools and alternatives emerge to deal with this volume of information and become part of this new reality.

Thus, finally, a series of works are aimed at dealing more efficiently with big data, being called back-office works, without the direct perception of those involved, such as the use of Blockchain technology for greater data security (NOH and KWON, 2019; KHAN, BYUN, and PARK, 2020). It is a distributed registry technology that allows data storage in a secure and decentralized way without the need for an intermediary.

This technology is based on the digital recording of transactions, which are grouped into blocks and connected in a blockchain, or blockchain. There are also approaches to data transmission and mining (BOURMPOS, ARGYRIS, and SYVRIDIS, 2014; LI, 2017), use of super-resolution video (REN et al., 2021), big data management (ZHOU and LUO, 2017; JUNG et al., 2020) and proposition of an intelligent security management system (ZHAOXIA, 2017) and based on multi-indicators (DI BELLA, CORSI, and LEPORATTI, 2014).

Innovation in the public safety field that advances with digital technologies depends on data extraction as a requirement for the functioning of applications designed to achieve a goal (NOH and

KWON, 2019; JUNG et al., 2020). Thus, the construction of initiatives aimed at smart cities depends both on an institutional framework to legitimize the processes of collecting, processing, and using data and on the very existence of robust, integral, and interoperable databases (TRUNTSEVSKY et al., 2018; KHAN, BYUN, and PARK, 2020; PARK and LEE, 2020).

All these technologies proposed by the articles analyzed depend on data input flows to produce results supporting decision-making. This is another crucial point that needs to be highlighted. No qualitative study was identified that investigated managers' understanding - in the specific area of public security or general - regarding incorporating the knowledge generated by the technological apparatus developed.

The transposition of technical knowledge generated by using big data into a manager's decision-making is not an apparent or automatic activity. As pointed out by the literature on decision-making (LIMA, AGUIAR, and LUI, 2021), several elements inform the manager, such as prior knowledge on the subject, political and bargaining relationships, personal interests, etc. Thus, developing technologies identified by the articles concerned with building predictive models for crime is a necessary, but not sufficient, condition for constructing policies aimed at the field of smart cities. It is necessary to understand how society and public managers govern and use this knowledge. However, no studies were found that investigated this relationship.

Accordingly, given the Brazilian case, we argue that technology based on blockchain, algorithms, and programming may not be a miracle tool for solving the problems of violence and crime strongly linked to inequality, racial and gender issues (BULLOCK et al., 2022). In this case, a combination of extensive use of technology with policies based on violence prevention and reducing social inequalities could be a fruitful path.

In another area, it is necessary to initially consolidate the National Public Security System (Susp) towards what Bichir, Simoni, and Pereira (2020) define as the construction of a national system that, on the one hand, presents robust coordination instruments and, on the other, respects the autonomy of subnational entities.

Future research should focus on the governance process of the Brazilian public security system, especially on how technologies are incorporated for data production and decision-making. In the Brazilian case, public security data will be collected by the state and, in some cases, municipal agencies (PAZINATO, KERBER, and DAL SANTO, 2013).

The Brazilian Public Security Forum currently works with data from the State Public Security Secretariats (FBSP, 2021). However, it is necessary to foster the development of systems that seek data integrity and interoperability for their application. The innovative aspect of digital technologies depends on the greater availability and capacity for data extraction and storage, referred to as the big data revolution. This field deals with ways to analyze and deal with extensive sets of data collected from various sources quickly and complexly. Among its properties, big data demands methodologies and technologies to collect, store, process, and share data from various sources to create an expanded information domain for deploying different computational technologies (ABRAHAM, SCHNEIDER, and VOM BROCKE, 2019).

FINAL CONSIDERATIONS

This article aimed to identify how existing and applied technologies in a smart city can contribute to public safety. Through an exploratory literature review, we were able to answer the research objectives by stating that technologies are essential tools in the decision-making of public safety policymakers.

The international literature on these two areas of knowledge is primarily concerned with developing technologies and electronic programs dependent on big data, machine learning, data interoperability, and algorithms. No discussions were identified regarding managers' management of technology and knowledge for decision-making or preventive public policies aimed at reducing social inequality.

As Ruha (2019) pointed out, algorithm-based solutions reproduce biases of those who feed the database, potentially reproducing relations of racism and social exclusion. Incorporating solutions brought by international literature into the Brazilian context cannot be done uncritically; otherwise, we will import ineffective models to solve public security problems.

The main fields of research within the macro-area of public safety were revealed around crime fighting. However, studies were found on civil defense, combating and preventing natural disasters such as fire, overflows, and floods, as well as in traffic and urban mobility and crime prevention by environmental design.

The most significant difficulties listed are related to the management of the enormous amount of data generated by the technological apparatus of smart cities; the issue of financial resources to implement and maintain active and operational technologies; some problems that innovation itself creates, such as information security and violence on the internet; and, above all, the privacy of citizens. With such advanced technologies, a fine line is created between the limit for the State to make its interventions and generate data from monitoring without invading the privacy and intimacy of citizens. For this, building an institutional arrangement that guides action and imposes limits on managers and the State itself is necessary.

Still, on the findings, it was found that there is research aimed at defending women's rights (SHENOY et al., 2021). The emerging technologies appear as vectors and facilitators, tools that can be allied and enhance public security policies to combat violence against vulnerable populations. In addition, it has become clear that technologies are a tool to enhance the rational and intelligent use of resources in favor of public security and that they alone will not generate any results. Innovations have no effect or impact without an adequate public safety policy, as shown in the case of Memphis (TULUMELLO and IAPAOLO, 2021).

Finally, this work focused on smart cities and their dialog with public safety. Throughout the research, it was found that there is a vast field of technologies applicable to public safety that was discarded when there was no relation to smart cities. Future research can address this gap. Another point that can be specifically focused on is the work in which there is active participation and engagement of citizens in public safety.

In summary, the text highlights the importance of existing and applied smart city technologies for public safety, pointing out that these tools can significantly contribute to policymakers' decision-making. It emphasizes the need for a critical and careful approach in incorporating

these solutions into the Brazilian context to avoid the reproduction of biases and relations of social exclusion that may accompany policies from other countries when disseminated in Brazil. It was found that it is relevant to pay attention to a multidisciplinary and critical approach in the application of smart city technologies to public safety and that innovative tools themselves are not the solution to problems; on the contrary, they can be considered allies in the construction of more efficient public safety policies.

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ERIC RODRIGUES DE SALES
ORCID: https://orcid.org/0000-0001-9806-9046
Master Student in Public Policy and Government from the School of Public Policy and Government of the Getulio Vargas Foundation (FGV EPPG). E-mail: ericrsales@hotmail.com

LIZANDRO LUI
ORCID: https://orcid.org/0000-0002-9276-247X
Ph.D. in Sociology from the Federal University of Rio Grande do Sul (UFRGS); Professor of the Graduate Program in Public Policy and Government at the School of Public Policy and Government at Fundação Getulio Vargas (FGV EPPG). E-mail: lizandrolui@gmail.com

AUTHORS' CONTRIBUTION

Eric Rodrigues de Sales: Conceptualization (Equal); Data curation (Equal); Methodology (Equal); Project administration (Equal); Writing - original draft (Equal); Writing - review & editing (Equal).

Lizandro Lui: Conceptualization (Equal); Data curation (Equal); Methodology (Equal); Project administration (Equal); Writing - original draft (Equal); Writing - review & editing (Equal).

DATA AVAILABILITY

The entire dataset supporting the results of this study was published in the article itself.