Smart cities and innovation: video surveillance in the public security of Recife, Brazil

Cidades inteligentes e inovação: a videovigilância na Segurança Pública de Recife, Brasi

Dannielly Leandro de Sousa Ferreira [I]
Sueli Menelau de Novaes [II]
Francisco Guilherme Lima Macedo [III]

Abstract

This paper analyzes the influence of government support on the implementation of video surveillance, one of the tools usable in smart cities, and the effect of this technology on the performance of public security in the city of Recife. With a qualitative approach, the study locus was the Integrated Center (CIODS), which encompasses the public security forces and provides the video monitoring service in Recife. Interviews were conducted with video surveillance operators. The results show that government support is essential; however, in Recife, it is understood as insufficient for the use of innovations in public security, especially concerning the technology analyzed here. It is concluded that integration between agencies in the video surveillance system favors the expansion and applicability of the concept of smart cities to Recife.

Keywords: smart cities; innovation in the public sector; innovation in the police; video monitoring; CIODS.

Resumo

Este trabalho analisa a influência do apoio governamental na implementação da videovigilância, uma das ferramentas utilizáveis em cidades inteligentes, e o efeito desta no desempenho da segurança pública de Recife. De abordagem qualitativa, o locus foi o Centro Integrado (CIODS), que abarca as forças de segurança pública e oferta o serviço de videomonitoramento em Recife. A partir de entrevista com os operadores empregados na videovigilância, os resultados encontrados demonstram que o amparo governamental é essencial, porém, em Recife, ele é entendido como insuficiente ao emprego de inovações na segurança pública, em especial na tecnologia analisada. Ainda assim, conclui-se que a integração entre os órgãos no sistema de videovigilância favorece a expansão e a aplicabilidade do conceito de cidades inteligentes a Recife.

Palavras-chave: *cidades inteligentes; inovação no setor público; inovação na polícia; videomonitoramento; CIODS.*

Introduction

Public security is a crucial responsibility of the State and is considered a fundamental human right, as stated in the Universal Declaration of Human Rights (1948).[1] It represents one of the primary challenges faced by governments (Alves and Santos, 2018). In general, the concept of public security encompasses a range of organizations that directly or indirectly contribute to resolving issues related to maintaining public order, controlling, and preventing violence and crime, and safeguarding the physical well-being of individuals and their property (Brasil, 1988; Costa and Lima, 2014).

In Brazil various agencies are involved in achieving these objectives, including the federal police, federal highway police, federal railway police, civil police, military police (MP) and military fire department, as well as state, federal, and district criminal police (Brasil, 1988). The states bear the responsibility for ensuring the safety and well-being of society through the activities of the MPs and fire departments (Aguiar and Santana, 2018).

The primary role of the MP is to prevent and deter crimes, violence, and disruptions to public order, acting both proactively and visibly in response to any threats that may compromise the physical safety of individuals or their property (Brasil, 1988; Mathias, 2010). However, it is important to note that the public security system, even after the enactment of the 1988 Constitution in Brazil, should not be limited to police activities alone (Lima, Bueno and Mingardi, 2016).

Data on public security reveals the challenges of combating violence and crime, which often affect the performance of the MPs.

Key indicators such as Violent and Intentional Deaths (VIDs), Intentional Lethal Violent Crimes (ILVCs), and Violent Crimes against Property (VCPs), compiled by the Brazilian Forum of Public Security (FBSP, in Portuguese), provide insights into the state of public security in the country.

In Brazil, although there were successive reductions in VIDs in 2018 and 2019, data from 2020 indicate a 4% increase in this rate compared to the previous year, amounting to 23.6 occurrences per hundred thousand inhabitants (CNN Brasil, 2021; FBSP, 2021). Pernambuco (PE), the focus of this study, was ranked as the fifth state with the highest number of VIDs in 2020, with a rate of 38.3 per hundred thousand inhabitants, while its capital, Recife, recorded a rate of 33.4 per hundred thousand inhabitants, surpassing the national average (23.6 per 100,000) (ibid.). The incidence of ILVCs also witnessed an increase of 8.4% compared to the previous year, with Recife experiencing a 14.46% rise in this rate (G1 PE, 2021).

However, in 2020, Recife reported the lowest number of thefts since 2005, marking 40 consecutive months of declining monthly theft rates in the city (Folha PE, 2021). Regarding VCPs, there was a decrease in thefts reported in The Greater Recife Area (GRA) between 2019 and 2020. Nonetheless, crime continues to expand across various levels and segments in PE, leading to a heightened sense of insecurity among the population, thereby demanding more effective actions from the government and public security agencies.

To offer the police agility and better results in the provision of their services, reinforcing the fight against crime and the safety of citizens, the Secretariat of Social Defense of Pernambuco (SDS-PE, in

Portuguese) developed a project to implement, in principle, surveillance cameras capable of recognizing criminals and stolen vehicles through technologies and equipment (Folha PE, 2020). The video surveillance system of Recife is the responsibility of SDS-PE, more specifically the Integrated Center for Social Defense Operations (CIODS, in Portuguese), responsible for coordinating the operational means of public security agencies – military and civil police, fire department and institute of criminalistics – and for monitoring the GRA and the interior cities of Caruaru and Petrolina (Unodc, 2021).

At CIODS, there is the Integrated Center for Regional Command and Control (CICCR, in Portuguese), responsible for managing public security operations in Recife on days of major events. The execution of video surveillance in the GRA was decentralized to some battalions of the military police of Pernambuco (PMPE, in Portuguese) for better control and visualization of the perimeter that surrounds it; performed in a specific room for this service with instruments necessary for video surveillance in Recife.

When dealing with the interoperability of services and the use of technologies that enable the tangibility of urban life data, with projects aimed at capturing and treating them in real-time, the concept of smart cities emerges, in the sense of equating the problems that affect the world's cities (Weis, 2019). The effects of this popularity come from the concept being associated with improvements in the management of cities, in terms of mobility, education, health, public safety, and standard of living (Angelidou, 2015). And, for a good performance in the construction of smart cities, it must be based on six pillars (economy, people, governance, mobility, environment,

and way of life) associated with combinations that involve several areas of activity (Giffinger and Gudrun, 2010).

These pillars help to verify how smart a city is, the sixth being associated with quality of life and involving issues related to health, culture, housing, tourism, and public safety (ibid.). In smart cities, or in initiatives that seek to align the urban center to this evolution, public security appears to citizens as one of the public services of greater importance and concern (Rathore et al., 2016), which needs improvements in aspects of police effectiveness, public lighting, surveillance, stricter legislation, and citizen awareness (Cunha et al., 2016).

However, the increase in the migratory flow of people to urban centers has caused an overload in the systems of supply of public goods and services, such as public security (Santos Filho and Coêlho, 2018). Thus, one way to solve the issues brought by the rapid expansion of urbanization is the implementation of the smart city premise associated with the use of technological innovations (Weiss, Bernardes and Consoni, 2017). The use of technological innovations for surveillance and prevention purposes is part of the construction of smart cities (Batista, Fariniuk and Mello, 2016).

The term innovation encompasses several interpretations but was initially portrayed by Schumpeter (1997) as the production process by which products and methods capable of fostering economic and social development are created. Thus, for there to be economic and social change, this author qualifies innovation as a key process. In the Brazilian context, innovation in the public sector presents challenges to be overcome by

its administration due to the lack of scientific knowledge that approaches the reality and experiences lived by its organizations (Carvalho et al., 2019). And there are sectors in the public service where innovations are better discussed and structured – such as health, education, transport and logistics and regulation – but in public safety, innovation is not among the most studied and widespread elements (Isidro Filho, 2017; Menelau, Vieira and Fernandes, 2016).

However, the use of technological innovations aimed at public security favors the exchange of information between institutions, citizens, and governments, in addition to providing improvements in operational and administrative management (Dias and Souza, 2019; Ferreira, Menelau and Macedo, 2019). Thus, the importance of technological innovation in this area is highlighted to enhance the efficiency of the instruments used by public security agents, also enhancing the beneficial results to the population, particularly in crime control (Dias and Souza, 2019; Magron, 2020; Nascimento and Teixeira, 2016).

It is assumed that the government, at different levels, acts as the main influencer and seeks to adopt the technology of surveillance cameras in favor of maximum economy, since they replace the number of police on the streets (Alves and Sabará, 2015; Costa, 2017). Specifically, state, and municipal governments, through laws, create projects to install surveillance cameras in places of greater public circulation, aiming to contain the increase in violence and crime (Franze, Maloa and Maloa, 2022). Video surveillance technology, also known as video surveillance,

is a technological innovation for public security that assists police officers in the execution and modernization of their work (Cardoso, 2012; West and Bernstein, 2017).

It is reported that, in public security, police institutions are resistant to change and lack significant innovations to promote a safe society that guarantees rights (Lima, Bueno and Mingardi, 2016). However, as much as one has the view that innovation in public security is difficult to occur, police forces are in constant operational, technological, political and cultural change (Allen and Karanasios, 2011; Menelau, Vieira and Fernandes, 2016).

More structured and mechanized organizations are considered rigid and inflexible for change, however, from the point of view of some authors (Ferreira, Menelau and Macedo, 2019; Menelau, Vieira and Fernandes, 2016; Prislan and Lobnikar, 2019; Randol, 2014), hierarchical and complex police organizations are prone to invest in innovation due to the fact that they are specialized and are aware of the benefits of innovating for police management.

Scientific work and analytical observations have been instrumental in introducing innovations in public safety, and it has been found that academic relationships drive innovation in policing (Fenn, Marks, Christoforides and Coupar, 2020; Rolim, 2007). The collaboration and co-production of academic work with agents in public security provide better guidance for police innovation, making its occurrence important so that best practices that provide opportunities for innovation are explored (Fenn et al., 2020).

Given these empirical and theoretical justifications, it was observed the need to study this theme, since there are few published works on the technological innovation of video surveillance in public security, mainly directed to the scope of construction of smart cities (Laufs, Borrion and Bradford, 2020). In addition, in research conducted in June 2022 in databases (Spell, Scielo, Scopus, Periódicos Capes and Google Scholar) with the keyword innovation associated with the terms police, policing, public security, there was the absence of studies that address the theme of technological innovation of video surveillance in public security.

In view of this scope, we sought to analyze the influence of government support on the implementation of video surveillance and its effect on Recife's performance as a smart city. With this in mind, this study may contribute to the optimization of video surveillance in Recife, as it provides an updated overview of the city's public security and, thus, can serve as an input for public security agents, city managers and other stakeholders.

Theoretical foundation

The intention of the applicability of the concept of smart cities is to improve urban functioning using data and technological innovations to provide more efficient services to citizens (Marsal-Llacuna, Colomer-Llinàs and Meléndez-Frigola, 2015). The optimization of urban infrastructure through the collaboration of various economic actors in the public or private sphere becomes a valuable asset (ibid.).

Despite the number of existing studies, a consensus definition on smart cities is difficult to summarize (Alves, Dias and Seixas, 2019; Angelidou, 2014). However, in general, a smart city is monitored and is integrated by technological innovations (Neirotti, 2014). In summary, the conceptualization of smart cities figures in a union between city management, local businesses, value creation for the citizen, urban big data, development and application of technological innovations, economy, and other areas (Lim, Kim and Maglio, 2018).

The main objective of a smart city is to provide improvements in the quality of life of citizens, who become the main actor (ABDI, 2018). The debate about the conceptual approach of the term smart cities aligns with the Sustainable Development Goals (UN, 2015), in particular the 11th goal that concerns sustainable cities and communities. The attribution of this goal to smart cities favors: economic development, connectivity, promotion of clean energy and technology, digitalization and zeal for inclusive, safe, resilient and sustainable human settlements (Botton et al., 2021).

In the researched definitions on smart cities, the role of information and communication technologies (ICTs) is emphasized. Chart 1 presents the definitions – and the emphases of the proposed concept – of some authors about the term with nature in technological innovations.

Chart 1 – Definitions of smart cities based on technological innovations

Author	Definition	Emphasis
Kanter and Litow (2009)	Connects physical and ICT infrastructures to organizational, normative, social, and technological aspects to increase people's quality of life and sustainabilitye	Innovation, sustainability and quality of life
Toppeta (2010)	It combines the use of ICTs and Web 2.0 with the organizational, design and planning areas, accelerating bureaucratic processes, and implementing innovative solutions for city management	Planning, cutting red tape, innovation and management
Washburn and Sindhu (2010)	It uses smart computing to make the city's critical public infrastructures and services – such as management, education, health, public safety, transport – smarter, interconnected, and efficient	Basic infrastructure, management, education, health, security and integrateds
Harrison and Donnelly (2011)	It makes use of ICTs to promote efficiency in the planning, execution and maintenance of public services and urban infrastructures	Basic infrastructure, planning and maintenance
Nam and Pardo (2011)	It aims to improve the quality of public services to citizens and the establishment of integrated systems, based on ICTs, in which services and information are shared	Services to townspeople
Cretu (2012)	It underpins governance and economics with new paradigms of thinking, encompassing sensor networks, smart devices, real-time data, and ICT integration	Management, economics, innovation and integration
Lazaroiu and Roscia (2012)	It refers to medium-sized technology locality, interconnected and sustainable, comfortable, attractive, and safe	Integration, sustainability and safety
Lombardi et al. (2012)	Applies ICTs with their effects on human capital/education, social and relational capital, and environmental issues	Education, social and environment
Marsal-Llacuna et al. (2015)	Improves urban performance by using data and information technology (IT) to deliver more efficient infrastructure and services to citizens, combining diverse economic actors and innovative businesses in the public and private sectors	Services to citizens, infrastructure, integration and economy

Source: elaborated from Weiss, Bernardes and Consoni (2015) and Albino, Berardi and Dangelico (2015).

As can be seen in Chart 1, the definitions, in their great totality, make reference the use of technological innovations for the management of cities, with the purpose of social development, offering better services and improving the quality of life of citizens. In addition, there is the conceptual resumption of the use of IT and emphasis on people, with the addition of the economic aspect in the definition of the concept of smart city.

The corresponding challenges to efficiency in the management of smart cities require collaborative approaches between government, business, and academia, through technological innovations (Weiss, 2019). In a complementary way, the application of technological innovations for the creation of smart cities is of various types, and these innovations may already be available in the market and be adapted to the needs and characteristics of each locality (Weiss, Bernardes and Consoni, 2015).

There are different models that establish what technological components and infrastructure a smart city needs (Gaur, 2015). A general framework model for smart cities is difficult to design, since there is a diverse range of devices and technologies (Jalali, El-Khatib and Mcgregor, 2015). Synthetically, most smart city architectures contain at least three basic layers, which are: sensor, network or processing and actuator (Laufs, Borrion and Bradford, 2020).

The classification of these different layers assists in understanding and identifying smart cities as a complex structure composed of several components, ranging from single sensors to software and cloud servers, which encompass them and ensure communication between them (Zhang et al., 2017). To enable intelligent services and provide better quality of life to citizens, the use of techniques such as internet of things, big data analysis, cyber-physical systems and real-time control assist in the detection and application of physical changes in the smart city (Zanella, 2014).

Actions involving smart cities require appropriate planning and strategies. For this, one must analyze what exists in the city and what can be improved in its infrastructure, emphasizing the collaboration of stakeholders – population, government, companies etc. – on information of resources and needs of the city (Angelidou, 2014). For a smart city planning based on technological innovations it is necessary to have the usability of urban data (Stratigea, Papadopoulou and Panagiotopoulou, 2015).

Cities around the world collect large amounts of data related to urban life through their infrastructures, and the use of this data is able to generate useful content for stakeholders (Lim, Kim and Maglio, 2018). However, the process of transforming data into information for smart cities has some challenges, listed in Figure 1.

The six challenges listed in Figure 1 imply that the use of big data in smart cities requires specialization in citizen knowledge, data management, data analysis, legislation, and municipal administration (ibid.). Big data refers to a large and complex set of data that represents digital human activities, classified in terms of scale, volume, and methods of analysis (Chen, Chiang and Storey, 2012).

Figure 1 – Challenges of using data in a smart city

Data quality	• Data inaccuracy • Lack of standardization
Integration of the data	• Diferent data structures
Privacy	• Ethical issues
Understanding of needs	• Data usability
Geographic deliveries	• Unavailability of geographic information systems
Smart city services	• Value generation
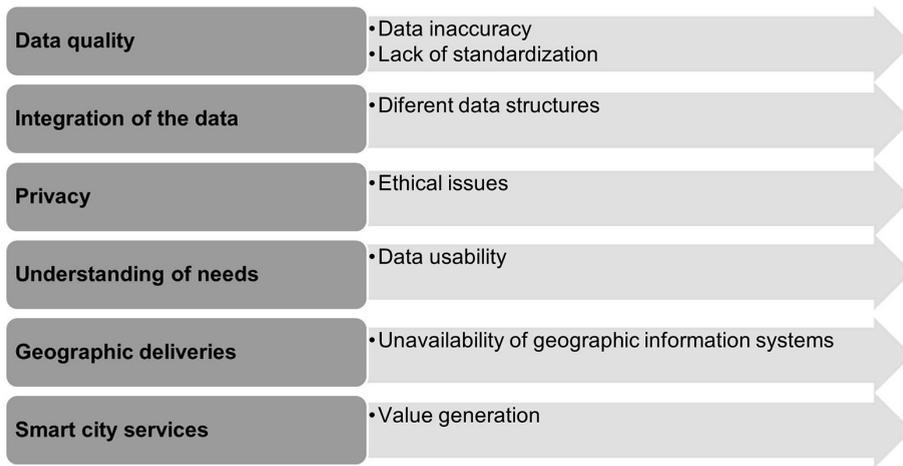
Source: elaborated from Lim, Kim and Maglio (2018).

Data analysis helps form new concepts, make descriptive, casual inferences, and generate predictions (Brady, 2019). For better functioning of the management of smart cities, access to information is indispensable. This is mainly due to the widespread adoption of computers, communication networks, and sensors that store large amounts of data processed in real time (Li, Batty and Goodchild, 2020).

The smart city provides society with network connections and opportunities for the government to detect problems in real time and generate information that acts as solutions to the difficulties encountered by the citizen, which includes public safety (Hamada and Nassif, 2018). Technologies for identifying threats and preventing crime through data collection and use have been around for a long time, but their combination with the police service or any human intervention is nevertheless new (Laufs, Borrion and Bradford, 2020).

In the area of public security, the use of technologies with cameras and sensors helps in preserving the physical integrity of the public agent and improves the execution of police work (Bouskela et al., 2016). In a traditional city, security is assigned to officers on the streets who patrol regularly; Already, in the smart city, the presence of security cameras prevents and helps in the identification of suspicious actions and individuals, reducing the response time and the number of police officers on the streets (ibid.).

It is noteworthy that safety and security are intrinsic factors of human well--being and of any smart city project (Reddy et al., 2018). Geotechnology contributes to urban management, monitoring socio--environmental phenomena (through cartographic representation capable of surveying infrastructural problems of the city), environmental risks and improving public safety (Seixas and Bordignon, 2020).

Geotechnology is an effective tool for mapping crime in urban areas (Pinto et al., 2021). The geographical analysis of crimes allows the identification of weekdays, neighborhoods, and areas with a higher concentration of crimes, providing improvement in police action (Silva et al., 2018). Geocoded criminal data is correlated with social and economic data, identifying causes of criminal phenomena (Bordin et al., 2013).

The use of sophisticated technologies for the purpose of surveillance, prevention, and control of crime in the urban space is part of the construction of the so-called smart city (Batista, Fariniuk and Mello, 2016). Given this, a surveillance scheme can become intelligent, being called smart surveillance (Hampapur et al., 2003). It is possible, through intelligence, to monitor the actions of people, locate violent acts and individuals involved; in addition, intelligent surveillance models can emit alarms if an adverse situation is identified (Talari et al., 2017). In an intelligent surveillance model, the most used system structure is the closed-circuit television camera (CCTC) (Melgaço, 2012).

The use of surveillance cameras and other technological monitoring devices in smart cities decreases the opportunity for crime and provides greater security to the population, improving the experience in the city, since it is part of the premise of smart city (Hamada and Nassif, 2018). The data from the video surveillance process should provide reports for consultations and gap analysis in order to improve the management of cities, with better quality of life, safety, among others (Batista, Fariniuk and Mello, 2016).

However, without failing to observe a critical prism, one cannot forget the limitations and negative aspects linked to the use of video surveillance devices. Just as an example, it is worth noting: (1) the belief that the simple installation of cameras has the power to remedy (or drastically decrease) public security problems in the urban space, with multiple causes and contexts; (2) the loss of privacy on the part of individuals; and (3) the lack of individual control over the destination of the data generated (Reis et al., 2021; Torres Neto and Patrício, 2022).

Despite the demand for smart cities to be constantly monitored, it must be remembered that evaluating information and criminal acts is something eminently challenging (Talari et al., 2017). Due to these challenges, Rathore et al. (2016) proposed new scenarios to strengthen the security of smart cities, such as the implementation of emergency buttons at various points in the city, which can be triggered by citizens if they witness any infraction or claim, issuing a message for public security agencies to act more quickly.

Video surveillance cameras (or video surveillance), in addition to providing more security to the population, bring more conviction and effectiveness in the decision-making of public security agents (Lima et al., 2018). The video surveillance actions carried out by public security agencies, in conjunction with municipal governments, provide opportunities for socioeconomic gains, giving the citizen a sense of security and increasing the confidence of local entrepreneurs (Magron, 2020).

The purpose of monitoring urban spaces is diverse, ranging from the protection of goods and traffic regulation to the control of people in large city events (Pedro, Bonamigo and Melgaço, 2017). But for public safety, specifically for police use, video surveillance cameras have the function of capturing images about the incidence of crimes, which, a posteriori, will serve as evidence and assist the police in attending to the occurrence, acting in advance (Lima et al., 2018).

The functioning of video surveillance occurs through human and non-human actors (Latour, 2006). Thus, the surveillance cameras will perform the function of capturing the images at the moment of the event, at the same time that the operators will judge the images and choose whether or not to trigger the police through other communication devices (Pedro, Bonamigo and Melgaço, 2017). It is noteworthy that some people management practices contribute to better performance of video monitoring, such as: action planning, team training, equipment necessary for the execution of tasks, and personal recognition (Aleixo et al., 2021).

Surveillance camera operators perform other functions besides monitoring, such as the process of archiving images in databases and transforming actions into crime and violence statistics (Pedro, Bonamigo and Melgaço, 2017). These statistics help in decision-making for public safety, such as on the increase in the number of cameras and/or face-to-face policing (ibid.).

The interpretation of the reproduced images stays with the operators who are endowed with subjectivities and can analyze the images according to their personal perspective (Heebels and Aalst, 2020; Oliva, 2015). And the work done by the camera operators is considered monotonous and exhausting, since the analysis of the images occurs inside closed rooms, without striking attributes, with a lack of incentives and demand for positive results (Oliva, 2015; Smith, 2004). An element that increases the charge of operators is the presence of cameras in the workplace, watching them (Oliva, 2015).

But workers in the younger age group are more tolerant of installing cameras inside the workroom than the older age group (Doberstein et al., 2022). To mitigate the fatigue resulting from the monotonous work in monitoring the safety images, the operators have strategies to pass the time that help to increase the productivity and effectiveness of the work instead of hindering the functioning of the surveillance, such as short breaks that avoid too much monotony – to drink coffee, smoke a cigarette or other possibilities – or even the use of the cameras for observations not directed directly to public safety issues (Heebels and Aalst, 2020; Oliva, 2015).

The public safety service performed by video surveillance in cities raises issues related to citizens' right to privacy and data protection (Laufs, Borrion and Bradford, 2020). In order for the private life of the citizen to be preserved and not affected by the eyes of the State, rules

must be established for the provision and dissemination of stored images, guaranteeing the right to privacy of the population (Mozetic and Barbiero, 2022).

To address innovation in public safety, it is necessary to know its basic concepts, adjusting it to the public sector. The conception of Schumpeter (1961, 1997) is considered fundamental when it comes to innovation (Menelau, Vieira and Fernandes, 2016). Innovation is exercised between economic, social, organizational, and political elements; it is multidisciplinary and there is no linearity between its creation and implementation (Santos and Sano, 2016).

This definition progresses gradually in order to adapt to various sectors and areas of knowledge. Gallouj (2002) highlights that innovation is not a final and definitive result, but rather a problem-solving process, in which multiple interactions between organizational agents play a fundamental role in the diffusion and continuity of innovation. In a complementary way, it is understood that innovation is a multilevel process, arising from creative energy and individual efforts capable of generating innovative results at the individual, group, organizational and social levels (Sears and Baba, 2011).

The Oslo Manual, prepared by the Organization for Economic Cooperation and Development (OECD), established a broader scope of the concept of innovation, which currently corresponds to "the implementation of a new or significantly improved product (good or service), or a process, or a marketing method, or a new organizational method in business practices in the workplace organization or in external relations" (OECD, 2005, p. 55). It is resumed that the typology

of Schumpeter (1997) brings the proposition of a fifth type of innovation, the acquisition of new sources of inputs or semi-finished goods, regardless of their existence or creation.

Except for this fifth, the other types of innovation elaborated by the OECD (ibid.) are similar to those developed by Schumpeter (1997), although there are some modifications and adaptations in the conceptualization. That is, although the OECD has in its most recent manual added innovation of the organizational and marketing type to its proposition of typology of innovation, Schumpeter (1997) had already defined between the lines approaches that can be attributed to these types of innovations.

According to the criterion of the temporality of its occurrence, innovation is classified into two general types: radical and incremental (Schumpeter, 1961). Incremental innovation refers to the introduction of small, significantly new improvements to something already existing, modifying its routine practices without changing the benchmarks (Carvalho, Reis and Cavalcante, 2011; Moreira and Queiroz, 2007; Tigre, 2006).

Radical innovation, on the other hand, corresponds to the introduction of a set of new characteristics capable of causing a structural rupture in organizations, products, processes, or society, with changes in reference standards, that is, there is an abandonment of usual practices (Carvalho, Reis and Cavalcante, 2011; Djellal, Gallouj and Miles, 2013; Moreira and Queiroz, 2007).

Carvalho, Reis and Cavalcante (2011) state that when innovation involves some technological aspect, it is characterized as technological in product and process. It is noteworthy that in the process of

technological innovation there is no complete abandonment of the previous practice for the emergence of a new one, and its diffusion goes through phases (introduction-growth-maturation-decline), in which incremental innovations are added (Reis, 2008; Tigre, 2006). Therefore, there is accumulation of knowledge and techniques, prevailing the understanding of practices that should be abandoned or maintained (Tigre, 2006).

Carvalho et al. (2019) and Tõnurist, Kattel and Lember (2017) reinforce that within the public sector innovations are complex and tend to be incremental; In this way they must be in accordance with the constitutional conformities and especially with the common welfare. Innovation in the public sector takes on different meanings, however, it concerns new ideas that foster the creation of public value in this sector (Djellal, Gallouj and Miles, 2013; Isidro Filho, 2017; Mulgan, 2007).

Promoting innovation in the public sector requires strategic formulations that result in an increase in quality through the implementation of new products, services and delivery methods that facilitate the fulfillment of sector objectives (Demircioglu and Audretsch, 2017). Innovation in public agencies must be related to changes and internal improvements (Demircioglu and Audretsch, 2017; Mulgan and Albury, 2003), and the success of applying an innovation can vary from one institution to another, with organic organizations being more favorable to adoption and success (Randol, 2014).

It is verified that bureaucratic complexities and budgetary limitations make emerge the need to innovate in the public sector, deconstructing the premise that only the private sector innovates (Dias, 2014). In this sense, there is evidence that the public sector innovates, and that the government encourages, takes risks, and creates conditions for the emergence of these innovations through investments in development agencies (Larsen, 2015; Mazzucato, 2014). What is observed is that public organizations have sought, through innovative practices, to respond to economic changes, policies, and society's yearnings for quality public services (Cavalcante and Cunha, 2017).

It is added that public sector organizations typically focus their innovations on internal administrative processes (Tõnurist, Kattel and Lember, 2017). It is argued that the public sector tends to copy and apply innovations originating from the private sector, employing it as a model, which is not well regarded (Mazzucato, 2014; Potts and Kastelle, 2010). When innovating in the public sector, one should check which techniques work or not within the sector, due to its environmental context, avoiding loss of time and investments in practices that do not meet the demand and do not create innovative opportunities in this sector (Potts and Kastelle, 2010).

It is recommended that, when studying innovation in the public sector, one has a distancing and does not adopt the typology used to the analysis of innovations from the private sector (Halvorsen, 2005). But innovations from both the public and private sectors must encompass significant changes to the organization (Bloch and Bugge, 2013). For better adaptation and usefulness to the analysis of innovation in the public sector, the types proposed by Schumpeter (1997) are adapted to a typology (Chart 2).

Chart 2 – Types of innovation in the public sector

Types of innovation	Definition
Service	It consists of the introduction of a new or improved service and the improvement of its delivery
In process	It is the change in the procedure of providing service or product and interaction with users
Organizational	It deals with the introduction of new organizational conceptions for the delivery and production of services, using new political instruments with results of political changes
Conceptual	It is a change of perspective of innovation formulators, referring to a change in the overall strategy or social objectives of the organization
Systemic	It constitutes a new system or fundamental change of the existing system, establishing a new organization or a new form of cooperation and interaction with other companies and knowledge bases
With radical change of rationality	It encompasses a modification in the overview or mental matrix of government agency employees and involves new policy concepts, arising from: changes in policies, new programs, or major reforms

Source: based on Bloch and Bugge (2013) and Halvorsen (2005).

In this typology of Chart 2, the conceptions of conceptual innovations and radical change differ from the types proposed for the private sector, as they have a broader and less technical character (Bloch and Bugge, 2013). It complements itself, noting that innovation in the public sector emphasizes the creation of the new (whether a service, process, or method), but this element must be composed of organizational improvements (Santos and Sano, 2016). Therefore, the public sector acts as a creator of sources of innovation and technologies should be introduced at the service of public management (Mazzucato, 2014; Osborne and Brown, 2013; Vries, Bekkers and Tummers, 2016).

Study methodology

The study method used was deductive, because it started from a theory for the observations and the construction of the categories of analysis, with the intention of advancing in the knowledge about a phenomenon (Richardson, 2011). The study was of qualitative approach, because it sought to know the reality, according to the perspective of the participating subjects (Flick, 2013; Zanella, 2011). Regarding the temporality of the research, it was a cross-sectional proposal, since the reality of the phenomenon was analyzed in a single moment (Creswell, 2010).

Regarding the purposes, the research is descriptive (the characteristics of the phenomenon relevant to the study were discussed through the interpretation of observations) and exploratory (since information was collected on the theme addressed and more familiarity with the theme was acquired) (ibid.; Trivinos, 1987). Considering the technical procedures, we used the following research strategies: (1) bibliographical, regarding the themes for the completion of the study; (2) documentary, on official websites, whether or not the

documents have received analytical treatment; and (3) field, with individuals in their place of work or coexistence (Zanella, 2011).

The *locus* of the study is the CIODS that offers the video surveillance service and has the responsibility to keep it running in operational and infrastructure terms. The choice of the research participants occurred in a non-random way, that is, the interviewees were intentionally selected by virtue of being part of the locus and for assisting in the understanding of the investigated phenomenon, in terms of depth of knowledge (Creswell, 2010). Thus, for this research, the people who collaborate with the operation of video surveillance and who aim to improve the provision of public security services in Recife were chosen.

The 10 interviewees – who to preserve anonymity are referred to from E1 to E10 – are managers belonging to the Ciods headquarters and agents (operators and superiors) who perform video surveillance in the military police battalions (MPBs) of PMPE (Chart 3).

The instrument used for the collection of primary research data was a semi-structured interview script, with a body of 19 questions, elaborated according to the theoretical framework, applied flexibly by the researchers.

The interview script was composed of two parts, according to Richardson (2011) and Trivinos (1987): (1) introduction, which gave the interviewees explanations about the research and asked them for authorization to collect the information following the ethical precepts adopted; and (2) body of questions that covered the theoretical framework and helped in understanding the objectives of the research.

The process of conducting the interviews took place through the opening of a protocol in the electronic information system (EIS) of the government of PE, and they were conducted in person in September 2022. In addition, a document observation protocol was used as a secondary data collection instrument, which adopted, in the registry, the following steps: (1) identification of the central theme; (2) testing of the themes with the interviews; (3) alignment of the themes to the research objectives; and (4) elaboration of the result of the analysis (Roesch, 1999).

The choice of documents to compose the corpus followed the rules defined by Bardin (2011), which are homogeneity and relevance; there are eight corporate documents of the SDS-PE that, in the analysis, are named from T1

Chart 3 – Positions and sectors of the research subjects

Position	Locality	Number of respondents
Manager	Ciods	3
Superior	Battalionss	5
Operator	Battalionss	2

Source: authors, in 2022.

Figure 2 – Ordering of content analysis
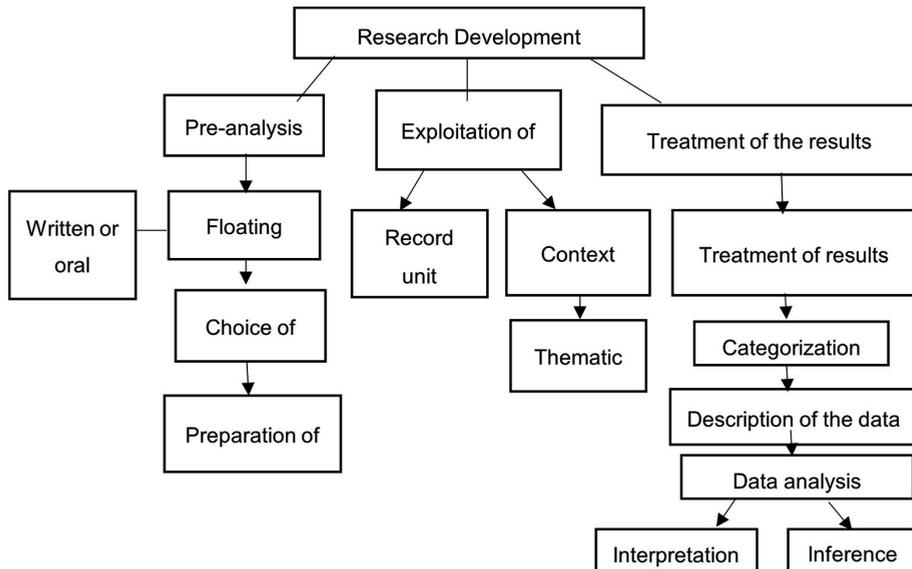
to T8. The analysis chosen was that of content, defined as a set of methodological instruments used to diverse discourses (Flick, 2013; Richardson, 2011). The data were organized, transcribed, and analyzed according to the predelimited categories and, subsequently, discussed according to Bardin (2011). The step--by-step ordering of content analysis is seen in Figure 2.

Analysis and discussion

The analysis and the discussion of the results were guided by two thematic axes: innovation in the public sector and smart cities, which were grouped based on the pre-established analytical categories. We sought to characterize the SDS-PE video surveillance system as an innovation in the public sector, specifically in the public security service. The management of Ciods is assigned to PMPE police officers since it holds greater responsibility in the provision of the video surveillance service of the state of PE.

New literature on innovation in the public sector indicates the need to introduce technologies to the service of public management (Osborne and Brown, 2013; Vries, Bekkers and Tummers, 2016). Innovation is a problem-solving process, in which the various multiple interactions between organizational agents contribute to the diffusion and continuity of innovation (Gallouj, 2002). The Ciods works to integrate the service of its four operatives – military, civil, scientific and fire brigade –; The interaction between them is one of the fundamentals that helps in the diffusion of the technological innovation of video monitoring.

The incorporation of the video surveillance system to the work of the police did not present difficulties, its implementation occurred quickly, highlighting the individual role for the diffusion of innovation in police organizations (Meijer, 2014). However, age proved to be a differential for adaptation to the system, since older police officers are more resistant to innovative changes, as pointed out by Mastrofski and Rosenbaum (2011). Another point that hinders the diffusion of innovation in the security sector refers to the resistance to the abandonment of traditionalist practices and the strong organizational culture of police institutions (Menelau, Vieira and Fernandes, 2016; Rolim, 2007).

It should be considered that the public sector is capable of innovating, especially when there is government incentive (Larsen, 2015; Mazzucato, 2014). In the case of the video surveillance system provided by Ciods, the support of the government of the state of Pernambuco is evaluated, by the interviewees, as insufficient for innovation in the organization. Fact evidenced in the statements of E2 and E8: "*The policy gets in the way of acquiring high-value equipment*" (E2), "*It hurts just because of that, right? That sometimes, if you don't have an incentive, an investment of politics in the corporation, it's not going to grow*" (E8). Thus, the institutional environment hinders more than it favors the occurrence of innovation and the provision of police service.

It is resumed that innovation can be classified through two types (radical and incremental), according to Schumpeter (1961). It was highlighted that video surveillance is an incremental innovation for the public security sector because it brings improvements to the service and does not cause exacerbated change in the way PMPE operates. The following excerpt illustrates this point of view: "*I think it's something that already existed and was improved right?*" (E8). Video surveillance was also considered a technological innovation, and its diffusion process goes through four phases, they are: introduction, growth, maturation, and decline (Reis, 2008; Tigre, 2006).

E7 elucidated the importance of maintaining and expanding the video surveillance service for all MPBs in the state of PE, through the addition of incremental innovations in the maturation phase of the innovation. Another type of innovation found in video surveillance was the procedural innovation with the application of new delivery methods and new ways of acting of the public security service, this fact is reported by E2: "*Previously, the video surveillance system was carried out by police officers and currently there is the figure of outsourced operators to fulfill this function, the process was subdivided, and the police began to act as manager*".

To respond to economic changes, public organizations have been looking for innovative practices that guarantee quality public services (Cavalcante and Cunha, 2017). It was observed by E7 that the Ciods video surveillance is a service evaluated as of quality, because its response time is short and fast, with regard to the attendance of occurrences, and brings cost reduction and economy to the State.

Public security agencies that have the most effective internal communication will have police officers more prone to organizational innovations (Mastrofski and Rossenbaum, 2011). As for video monitoring, it has been proven that communication helps

in the diffusion of innovation, especially when it comes to informal communication fostering decision making (Weiss, 1997).

To analyze how SDS video surveillance contributes to making Recife a smart city, the actions returned by this system with regard to public safety were identified. Therefore, we sought to understand the concept of smart cities according to the point of view of the interviewees and its applicability to the sixth pillar of the concept (Giffinger and Gudrun, 2010).

To ensure greater administrative agility, smart cities should include, in their management, technological innovations, in order to integrate public agencies and services of the city (Freitas, 2014). Thus, as reported by E2 at Ciods, "*The action in the face of integration is much faster*". T5 contributes to this understanding through state decree no. 37,089 of September 8, 2011. It was verified, then, that the integration of different agencies favors the expansion and applicability of the concept of smart cities for Recife, especially when making use of technological innovations, such as video monitoring.

It should be noted that, to improve the management of smart cities, having access to data and information is imperative (Li, Batty and Goodchild, 2020). With regard to the usability of data, there are some challenges that prevent its full use. The interviewees, in their entirety, affirmed the absence of challenges and that the data are of good quality, standardized and accurate, with identical structures in the MPBs responsible for video monitoring, see E4 "*So there's going to be a standardization and everybody's going to be aware... It has no difficulty not with regard to the system no*".

With regard to issues of privacy and data protection of citizens, the Ciods video surveillance system acts in a way that respects the right of image of citizens. According to the E2 report, the Center operates through the General Data Protection Law (GDPL) of Brazil; this Act provides that images captured by security cameras may not be released (e.g. to the press), but may be used as part of a legal process.

About smart city architectures (Laufs, Borrion and Bradford, 2020), through reports of E4 and E5, it was found that the sensor layer – data collection units – is made by video surveillance cameras scattered at specific points in the city of Recife, and this data (images) is transported through the network layer with transmission technologies and software for actuator layer that operates, providing the necessary service through the police, sending a vehicle to the occurrence. The interviewee E3 highlighted that the images of daily life are stored for 30 days, while the images of public repercussion and of investigative interest are stored in drives for more than five years.

In order to identify which are the technologies that make up the video monitoring system, it was found that the cameras used in the video monitoring of the SDSPE do not have technologies of motion sensors, easy recognition, license plate readers, among others. The confirmation of this deficit is described when E2 informs about the publication of a new Term of Reference for the acquisition of the video surveillance service with more than 2,000 cameras accompanied by artificial intelligence analytics. In the course of the interviews, it was observed that geotechnology is included

in the SDSPE video surveillance system through the geographic tracking of vehicles (Seixas and Bordignon, 2020)

The video surveillance provided by SDSPE, on Ciods management, has more functions, in addition to fighting crime, acting as a social agent, saving lives and aiming at the well-being of the population, as stated by Pedro, Bonamigo and Melgaço (2017). As reported by E1 and E2, CIODS video surveillance cameras can capture: drowning victims and shark attacks on beaches; avoid suicide attempts; control the flow of people at large events; do the monitoring of barriers etc.

The greatest benefit that video surveillance brings to public safety, to the work of police officers and to citizens is evidenced by interviewees E4 and E6, who consider the validity in the attendance of occurrences by the PMPE, with more accurate information, offering society a greater sense of security. Situation also found in T3 that says, "*monitoring with cameras brings a sense of security to the population, inhibiting the actions of bandits*".

In order to verify the effectiveness of video surveillance in Recife in the fight against violence and crime, we sought to investigate how the interviewees evaluate the performance of video monitoring. The research subjects identified the effectiveness of the cameras through the preventive work they perform; observe that after a certain time the cameras stop capturing occurrences, because the equipment becomes known by the offenders at specific points, avoiding the crime (E8).

It was evidenced that the training and availability of adequate and updated equipment are considered essential for the best performance of video surveillance, as it says from E7 "*What we have here is this, every once in a while it's... Every six months or four months, it's the effective here goes through a qualification there at the Central*."

In order to investigate how the process of interpretation of the images reproduced by the video surveillance cameras and the creation of the occurrence occurs, it was attested that the initial reading of the images is made by the outsourced operators, who perform the final monitoring activity. According to the point of view of E2, E6, E7 and E10 to avoid errors and subjectivities in the analysis of the images, the operators always make sure with the military police present in the room if there is any violation of the law on the screens.

The strategies used to improve the performance of video surveillance workers are strategies linked to bonuses such as personal motivation and the relaxed work environment, corroborating what was pointed out by Heebels and Aalst (2020). However, inside the video monitoring rooms, the research subjects reported some difficulties that impair their performance at work (Olivia, 2015). Situation portrayed by E9, which reported on issues related to the lack of resources indispensable to the execution of the task and the entry and exit of people in the room, making the environment noisy and diverting attention.

Conclusion

Nam and Pardo (2011) indicate that a smart city aims to improve the quality of public services for citizens with integrated systems based on ICTs. In public security, surveillance technologies are key pieces for initiatives that seek applications of smart cities – although they are not exclusive – because they are able to prevent and detect crimes, as well as offer, to the population, a greater sense of security (Van Heek, Aming and Ziefle, 2016). Thus, it was necessary to understand the concept of smart cities and the relevance of the use of video surveillance technology in the management of public security in Recife.

In order to identify the actions related to video surveillance with regard to public safety, it was noted that Ciods provides more services than video surveillance of public roads. It was found that the video surveillance service has a dynamic cycle and changes as needed. Therefore, its core activity is not only focused on preventing and preventing the occurrence of crimes in the city. The technological deficit of video surveillance hinders the enabling of intelligent services that provide better quality of life to the citizens of the GRA, an element pointed out by Zanella et al. (2014).

It was attested also that monitoring cameras play their role in combating violence and crime. The way in which this statement becomes irrefutable is when the research subjects report that, after the installation of the cameras at strategic points, the incidence of crimes decreased, since the surroundings are also benefited by video surveillance.

Considering what was exposed, the present research considered video surveillance as a technological innovation in the public security service and had as general objective to analyze the influence of government support in the implementation of video surveillance and its effect on the performance of Recife as a smart city. As reported in the interviews, the support of the government of the state of Pernambuco is insufficient to the needs of diffusion and continuity of the video monitoring system.

The integration between the various organs of the public security system involved favors the expansion and applicability of the concept of smart cities to Recife. As in Reddy et al. (2018), the greatest benefit that video surveillance brings to Recife society is the delivery of the most agile and best quality security service. An important finding that this research brings is that the video monitoring of Ciods is considered a technological, incremental and technological innovation.

Thus, it is argued that the general objective of the research was achieved, given that the influence of government support is essential for better functioning of the video surveillance of the SDSPE. It is also observed that the institutional environment was considered the main agency of federal subsidies for the introduction of improvements and innovations in video surveillance (Morabito, 2008).

It is worth mentioning, here, that the construction of this work was fruitful, however, like all research, there were difficulties to its realization. The main limitations found are related to the lack of consistent literature in the area of technological innovation in public safety. The delay in authorizing the research by the SDSPE and the non-authorization of the use of statistical data by the Criminal and Statistical Analysis Management (with regard to the

indication of more violent public places and neighborhoods in the city of Recife) can also be mentioned as obstacles to the study.

Finally, as suggestions for future studies, it is indicated that research be carried out that covers the perspective of the citizen regarding the effectiveness of video surveillance of cities in the fight against crime and the prevention of violence. Another suggestion that is made is to study the video surveillance service of the prefectures in conjunction with that of the police, to attest how the combination of these bodies favors the application of the concept of smart cities.

[I] https://orcid.org/0000-0002-0038-3692
Universidade Federal de Pernambuco, Departamento de Ciências Administrativas, Programa de Pós--Graduação em Administração, Recife, PE/Brasil.
danniellyleandro@gmail.com

[II] https://orcid.org/0000-0002-5479-7292
Universidade Federal de Pernambuco, Núcleo de Gestão, Programa de Pós-Graduação em Gestão, Inovação e Consumo, Caruaru, PE/Brasil.
suelimenelau@gmail.com

[III] https://orcid.org/0000-0002-5785-3026
Universidade de Brasília, Instituto de Psicologia, Programa de Pós-Graduação em Ciências do Comportamento, Brasília, DF/Brasil.
guilhermelima03@gmail.com

Acknowledgment

Note

(1) "Everyone has the right to life, liberty and security of person." (ONU, 1948)

Referências

ABDI – Agência Brasileira de Desenvolvimento Industrial (2018). *Cidades inteligentes: oportunidades e desafios para o estímulo ao setor no Brasil: relatório técnico*. Brasília. Disponível em: http://inteligencia.abdi.com.br/wp-content/uploads/2017/08/2018-09-11_ABDI_relatorio_5_cidades-inteligentes-oportunidades-e-desafios-para-o-estimulo-ao-setor-no-brasil_WEB.pdf. Acesso em: 24 ago 2021.

AGUIAR, M. P.; SANTANA, E. F. (2018). A Polícia Militar na segurança pública do estado democrático de direito brasileiro. *Revista de Criminologias e Políticas Criminais*. Florianópolis, v. 4, n. 1, pp. 82-97.

ALBINO, V.; BERARDI, U.; DANGELICO, R. M. (2015). Smart cities: definitions, dimensions, performance, and initiatives. *Journal of Urban Technology*. Londres, v. 22, n. 1, pp. 3-21.

ALEIXO, A. D.; MATOS, A. R.; SILVA, S. A.; OLIVEIRA, N. D. A.; JUNKES, M. B. (2021). As influências da tecnologia na gestão de pessoas: um estudo a partir da implantação do sistema de videomonitoramento de vias públicas no município de Cacoal/RO. In: CONGRESSO INTERNACIONAL DE ADMINISTRAÇÃO, 34, pp. 1-15. *Anais*. Ponta Grossa, UEPG.

ALLEN, D.; KARANASIOS, S. (2011). Critical factors and patterns in the innovation process. *Policing: A Journal of Policy and Practice*. Oxford, v. 5, n. 1, pp. 87-97.

ALVES, D. A.; SABARÁ, M. T. R. (2015). Disciplinamento e controle: análise de uma rede de monitoramento visual. *Revista Tecnologia e Sociedade*, v. 11, n. 21, pp. 98-113.

ALVES, F. M. S.; SANTOS, J. E. L. (2018). Análise crítica sobre a segurança pública: reflexões à luz dos direitos humanos e fundamentais. In: SIMPÓSIO INTERNACIONAL DE ANÁLISE CRÍTICA DO DIREITO, 8, pp. 41-54. *Anais*. Jacarezinho, UENP.

ALVES, M. A.; DIAS, R. C.; SEIXAS, P. C. (2019). Smart Cities no Brasil e em Portugal: o estado da arte. *Revista Brasileira de Gestão Urbana*. Curitiba, v. 11, pp. 1-15.

ANGELIDOU, M. (2014). Smart city policies: a spatial approach. *Cities*. Londres, v. 41, pp. S3-S11.

_____ (2015). Smart cities: a conjuncture of four forces. *Cities*, Londres, v. 47, pp. 95-106.

BARDIN, L. (2011). *Análise de conteúdo*. Lisboa, Edições 70.

BATISTA, M. M.; FARINIUK, T. M. D.; MELLO, S. C. B. (2016). Smart surveillance em aplicações recentes no Brasil: um estudo de caso nas cidades de Recife e Curitiba. *Revista de Gestão e Secretariado*. Aracaju, v. 7, n. 2, pp. 104-137.

BLOCH, C.; BUGGE, M. M. (2013). Public sector innovation: from theory to measurement. *Structural Change and Economic Dynamics*. Amsterdam, v. 27, pp. 133-145.

BORDIN, M.; SILVA, J. P.; MANSKE, K. V.; COSTA, A. C.; CANEPARO, S. C. (2013). O uso do geoprocessamento na segurança pública do estado do Paraná. In: SIMPÓSIO BRASILEIRO DE SENSORIAMENTO REMOTO, 16, pp. 4776-4783. *Anais*. Foz do Iguaçu, Inpe.

BOTTON, G. Z.; PINHEIRO, L. K. S.; OLIVEIRA, M. C. J.; VASCONCELOS, A. M.; LOPES, J. C. J. (2021). As construções das abordagens conceituais de cidades sustentáveis e inteligentes para superar os desafios dos objetivos do desenvolvimento sustentável. *Desafio Online*. Campo Grande, v. 9, n. 3, pp. 619-642.

BOUSKELA, M.; CASSEB, M.; BASSI, S.; DE LUCA C.; FACCHINA, M. (2016). *Caminho para as smart cities: da gestão tradicional para a cidade inteligente*. Washington, BID.

BRADY, H. E. (2019). The challenge of big data and data science. *Annual Review of Political Science*. San Mateo, v. 22, pp. 297-323.

BRASIL (1988). Constituição da República Federativa do Brasil, de 5 de outubro de 1988.

CARDOSO, B. V. (2012). The paradox of caught-in-the-act surveillance scenes: dilemmas of police video surveillance in Rio de Janeiro. *Surveillance & Society*. Chapel Hill, v. 10, n. 1, pp. 51-64.

CARVALHO, H. G.; REIS, D. R.; CAVALCANTE, M. B. (2011). *Gestão da inovação*. Curitiba, Aymará.

CARVALHO, J. F. S.; ALVES, R. S.; SANTOS, W. C.; DAVID, H. R.; SOUZA, F. S. (2019). Inovações no setor público: relato de experiências. *Revista CESUMAR*. Maringá, v. 24, n. 1, pp. 197-219.

CAVALCANTE, P.; CUNHA, B. (2017). "É preciso inovar no governo, mas por quê?". In: CAVALCANTE, P.; CAMÕES, M.; CUNHA, B.; SEVERO, W. (orgs.). *Inovação no setor público: teoria, tendências e casos no Brasil*. Brasília, Enap-Ipea.

CHEN, H.; CHIANG, R. H. L.; STOREY, V. C. (2012). Business intelligence and analytics: from big data to big impact. *MIS Quarterly*. Minneapolis, pp. 1165-1188.

CNN BRASIL (2021). Mortes violentas crescem 4% em 2020 e vitimam mais de 50 mil brasileiros. São Paulo, 15 de julho. Disponível em: https://www.cnnbrasil.com.br/nacional/mortes-violentas-crescem-4-em-2020-e-vitimam-mais-de-50-mil-brasileiros/. Acesso em: 24 ago 2021.

COSTA, A. T. M. (2017). "A SENASP e as políticas estaduais de segurança". In: FORUM BRASILEIRO DE SEGURANÇA PÚBLICA. Atlas da violência 2017. Brasília, Ipea.

COSTA, A. T.; LIMA, R. S. (2014). "Segurança pública". In: LIMA, R. S.; RATTON, J. L.; AZEVEDO, R. G. (orgs.). *Crime, polícia e justiça no Brasil*. São Paulo, Contexto.

CRESWELL, J. W. (2010). *Projeto de pesquisa: métodos qualitativo, quantitativo e misto*. Porto Alegre, Artmed/Bookman.

CUNHA, M. A.; PRZEYBILOVICZ, E.; MACAYA, J.; BURGOS, F. (2016). *Smart cities: transformação digital de cidades.* São Paulo, PGPC.

DEMIRCIOGLU, M. A.; AUDRETSCH, D. B. (2017). Conditions for innovation in public sector organizations. *Research Policy*. Amsterdam, v. 46, n. 9, pp. 1681-1691.

DIAS, I. M. (2014). "Práticas de inovação em gestão pública". In: AGUNE, R. et al. (org.). *Gestão do conhecimento e inovação no setor público: dá para fazer.* São Paulo, Secretaria de Planejamento e Desenvolvimento Regional.

DIAS, Y. O. R.; SOUZA, G. B. C. (2019). *Uso da tecnologia na atividade policial*. Biblioteca Digital de Segurança Pública, pp. 1-16. Disponível em: https://www.hindawi.com/journals/scn/2021/9999398/. Acesso em: 13 jun 2023.

DJELLAL, F.; GALLOUJ, F.; MILES, I. (2013). Two decades of research on innovation in services: which place for public services? *Structural Change and Economic Dynamics*. Amsterdam, v. 27, pp. 98-117.

DOBERSTEIN, C.; CHARBONNEAU, É.; MORIN, G.; DESPATIE, S. (2022). Measuring the acceptability of facial recognition-enabled work surveillance cameras in the public and private sector. *Public Performance & Management Review*. Boston, v. 45, n. 1, pp. 198-227.

FENN, L.; MARKS, J.; CHRISTOFORIDES, K.; COUPAR, F. (2020). Applying research beyond the ivory tower: reflections from police now. *Policing: a journal of policy and practice*. Oxford, v. 14, n. 1, pp. 135-145.

FERREIRA, D. L. S.; MENELAU, S.; MACEDO, F. G. L. (2019). Programa Educacional de Resistência as Drogas da Polícia Militar do estado de Pernambuco como uma contribuição para o serviço de policiamento comunitário. *Revista Brasileira de Estudos de Segurança Pública*. Goiânia, v. 12, n. 1, pp. 112-122.

FLICK, U. (2013). *Introdução à metodologia de pesquisa: um guia para iniciantes*. Porto Alegre, Penso Editora.

FOLHA PE (2020). Projeto quer usar câmeras para reconhecer criminosos e veículos roubados em Pernambuco. FOLHA PE, 18 de setembro. Disponível em: https://www.folhape.com.br/noticias/projeto-quer-usar-cameras-para-reconhecer-criminosos-e-veiculos/155267/. Acesso em: 24 ago 2021.

_____ (2021). Recife registra em 2020 o menor número de roubos da série histórica, diz SDS. FOLHA PE, 14 de jan. de 2021. Disponível em: https://www.folhape.com.br/noticias/recife-registra-em-2020-o-menor-numero-de-roubos-da-serie-historica/168896/. Acesso em: 24 ago 2021.

FBSP – Fórum Brasileiro de Segurança Pública (2021). *Anuário Brasileiro de Segurança Pública 2021*. São Paulo, FBSP.

FRANZE, J. J.; MALOA, J. M.; MALOA, T. M. (2022). Como fortalecer a segurança pública em Moçambique com o uso de câmera de vigilância. *Revista Brasileira de Segurança Pública*. São Paulo, v. 16, n. 2, pp. 32-47.

FREITAS, J. A. (2014). *Cidade inteligente Búzios: entre paradigmas e percepções*. Tese de doutorado. Rio de Janeiro, Fundação Getulio Vargas.

G1 PE (2021). Mesmo com a pandemia, Pernambuco fecha 2020 com aumento de 8,4% nos assassinatos. G1 PE, 15 de janeiro. Disponível em: https://g1.globo.com/pe/pernambuco/noticia/2021/01/15/mesmo-com-a-pandemia-pernambuco-fecha-2020-com-aumento-de-84percent-nos-assassinatos.ghtml. Acesso em: 24 ago 2021.

GALLOUJ, F. (2002). *Innovation in the service economy*. Great Britain, Edward Elgar Publishing.

GAUR, A.; SCOTNEY, B.; PARR, G.; MCCLEAN, S. (2015). Smart city architecture and its applications based on IoT. *Procedia Computer Science*. Amsterdam, v. 52, pp. 1089-1094.

GIFFINGER, R.; GUDRUN, H. (2010). Smart cities ranking: an effective instrument for the positioning of the cities? *ACE: Architecture, City and Environment.* Barcelona, v. 4, n. 12, pp. 7-26.

HALVORSEN, T. (2005). "On innovation in the public sector". In: HALVORSEN, T.; HAUKNES, J.; MILES, I. RØSTE, R. (orgs.). *On the differences between public and private sector innovation*. Oslo, Nifu Step.

HAMADA, H. H.; NASSIF, L. N. (2018). Perspectivas da segurança pública no contexto de smart cities: desafios e oportunidades para as organizações policiais. *Perspectivas em Políticas Públicas*, v. 11, n. 22, pp. 189-213.

HAMPAPUR, A.; BROWN, L.; CONNELL, J.; PANKANTI, S.; SENIOR, A.; TIAN, Y. (2003). Smart surveillance: applications, technologies and implications. In: INTERNATIONAL CONFERENCE ON INFORMATION, COMMUNICATION & SIGNAL PROCESSING, 4. Proceeds. Singapore, ICICS.

HARRISON, C.; DONNELLY, I. A. (2011). A theory of smart cities. In: *Annual Meeting of the ISSS, 55*. Hull. Proceedings. Hull, International Society for the Systems Sciences. pp. 1-15.

HEEBELS, B.; AALST, I. V. (2020). Surveillance in practice: operators' collective interpretation of CCTV images. *Surveillance & Society.* Chapel Hill, v. 18, n. 3, pp. 312-327.

ISIDRO-FILHO, A. (2017). "Inovação no setor público: evidências da gestão pública federal brasileira no período 1999-2014". In: CAVALCANTE, P.; CAMÕES, M.; CUNHA, B.; SEVERO, W. (orgs.). *Inovação no setor público: teoria, tendências e casos no Brasil*. Brasília, Enap-Ipea.

JALALI, R.; EL-KHATIB, K.; MCGREGOR, C. (2015). Smart city architecture for community level services through the internet of things. In: INTERNATIONAL CONFERENCE ON INTELLIGENCE IN NEXT GENERATION NETWORKS, 18. Proceeds. Paris, IEEE, pp. 108-113.

KANTER, R. M.; LITOW, S. S. (2009). Informed and interconnected a manifesto for smarter cities. *Harvard Business School General Management*. Boston, v. 9, n. 141, pp. 1-27.

LARSEN, T. S. (2015). The ambivalent relations between bureaucracy and public innovation: the case of the successful failure of dial police. *International Journal of Public Administration*. Nova York, v. 38, n. 2, pp. 92-103.

LATOUR, B. (2006). *Changer de société: refaire de la sociologie*. Paris, La Découverte.

LAUFS, J.; BORRION, H.; BRADFORD, B. (2020). Security and the smart city: a systematic review. *Sustainable Cities and Society.* Amsterdam, v. 55.

LAZAROIU, G. C.; ROSCIA, M. (2012). Definition methodology for the smart cities model. *Energy*, v. 47, n. 1, pp. 326-332.

LI, W.; BATTY, M.; GOODCHILD, M. F. (2020). Real-time GIS for smart cities. *International Journal of Geographical Information Science*. Abingdon, v. 34, n. 2, pp. 311-324.

LIM, C.; KIM, K.-J.; MAGLIO, P. P. (2018). Smart cities with big data: reference models, challenges, and considerations. *Cities.* Londres, v. 82, pp. 86-99.

LIMA, F. D. S.; MARTINS, J. S.; RODRIGUES, W. S.; ALMEIDA, J. L. (2018). Tecnologia das câmeras de videomonitoramento na segurança pública. *Homens do Mato-Revista Científica de Pesquisa em Segurança Pública.* Cuiabá, v. 18, n. 1, pp. 43-60.

LIMA, R. S.; BUENO, S.; MINGARDI, G. (2016). Estado, polícias e segurança pública no Brasil. *Revista Direito GV*. São Paulo, v. 12, pp. 49-85.

LOMBARDI, P.; GIORDANO, S.; FAROUH, H.; YOUSEF, W. (2012). Modelling the smart city performance, innovation. *The European Journal of Social Science Research*, v. 25, n. 2 pp. 137-149.

MAGRON, A. H. (2020). Sistema de videomonitoramento de segurança urbana: Uma solução para os municípios de pequeno e médio portes. *Revista Competitividade e Sustentabilidade*. Cascavel, v. 7, n. 2, pp. 387-398.

MARSAL-LLACUNA, M.-L.; COLOMER-LLINÀS, J.; MELÉNDEZ-FRIGOLA, J. (2015). Lessons in urban monitoring taken from sustainable and livable cities to better address the smart cities initiative. *Technological Forecasting and Social Change*. Nova York, v. 90, pp. 611-622.

MASTROFSKI, S. D.; ROSENBAUM, D. (2011). *Receptivity to police innovation: a tale of two cities*. Disponível em: https://www.ojp.gov/ncjrs/virtual-library/abstracts/receptivity-police-innovation-tale-two-cities. Acesso em: 4 jun 2021.

MATHIAS, J. C. S. (2010). A Polícia Militar e as políticas públicas municipais na prevenção criminal. *Revista LEVS*. Marília, v. 5, n. 5, pp. 24-36.

MAZZUCATO, M. (2014). *O Estado empreendedor: desmascarando o mito do setor público vs. setor privado*. São Paulo, Portfolio Penguin.

MEIJER, A. J. (2014). From hero-innovators to distributed heroism: an in-depth analysis of the role of individuals in public sector innovation. *Public Management Review*. Londres, v. 16, n. 2, pp. 199-216.

MELGAÇO, L. (2012). Estudantes sob controle: a racionalização do espaço escolar através do uso de câmeras de vigilância. *O Social em Questão.* Rio de Janeiro, v. 15, n. 27, pp. 193-212.

MENDES, R. M.; MISKULIN, R. G. S. (2017). A análise de conteúdo como uma metodologia. *Cadernos de Pesquisa*. São Paulo, v. 47, n. 165, pp. 1044-1066.

MENELAU, S.; VIEIRA, A. F. B. R.; FERNANDES, A. S. A. (2016). Inovação em serviço de segurança pública no Brasil: facilitadores e barreiras à inovação nos Postos Comunitários de Segurança do Distrito Federal. *Revista Brasileira de Políticas Públicas e Internacionais*. João Pessoa, v. 1, n. 1, pp. 24-48.

MORA, L.; BOLICI, R.; DEAKIN, M. (2017). The first two decades of smart-city research: a bibliometric analysis. *Journal of Urban Technology*. Abingdon, v. 24, n. 1, pp. 3-27.

MORABITO, M. S. (2008). The adoption of police innovation: the role of the political environment. *Policing: an International Journal of Police Strategies & Management.* Bradford, v. 31, n. 3, pp. 466-484.

MOREIRA, D. A.; QUEIROZ, A. C. S. (2007). *Inovação organizacional e tecnológica*. São Paulo, Thomson.

MOZETIC, V. A.; BARBIERO, D. R. (2022). Surveillance e a teoria da ponderação: o conflito entre direito a privacidade e segurança pública no Brasil. *Revista Argumentum-Argumentum Journal of Law.* Marília, v. 23, n. 1, pp. 223-243.

MULGAN, G. (2007). *Ready or not? Taking innovation in the public sector seriously*. Londres, Nesta.

MULGAN, G.; ALBURY, D. (2003). *Innovation in the public sector*. Londres, Prime Minister's Strategy Unit.

NAM, T.; PARDO, T. A. (2011). Smart city as urban innovation: Focusing on management, policy, and context. In: INTERNATIONAL CONFERENCE ON THEORY AND PRACTICE OF ELECTRONIC GOVERNANCE, 5. Proceedings. Tallinn, Icegov, pp. 185-194.

NASCIMENTO, D. E.; TEIXEIRA, M. A. N. (2016). Segurança pública e desenvolvimento local: experiências do Brasil, Colômbia e Japão. *Revista Brasileira de Planejamento e Desenvolvimento*. Curitiba, v. 5, n. 3, pp. 365-385.

NEIROTTI, P.; DE MARCO, A.; CAGLIANO, A. C.; MANGANO, G.; SCORRANO, F. (2014). Current trends in smart city initiatives: some stylised facts. *Cities*. London, v. 38, pp. 25-36.

OCDE – Organização para Cooperação e Desenvolvimento Econômico (2005). Manual de Oslo. Diretrizes para coleta e interpretação de dados sobre inovação. Finep. Disponível em: http://www.finep.gov.br/images/a-finep/biblioteca/manual_de_oslo.pdf. Acesso em: 15 ago 2021.

OLIVA, D. C. (2015). Olhares humanos: o exercício do olhar nos sistemas de videomonitoramento urbano. *Áskesis.* São Carlos, v. 4, n. 1, pp. 191-205.

ONU – Organização das Nações Unidas (1948). *Declaração universal dos Direitos Humanos.* Disponível em: https://www.unicef.org/brazil/declaracao-universal-dos-direitos-humanos. Aceso em: 30 ago 2021.

_____ (2015). Sobre o nosso trabalho para alcançar os Objetivos de Desenvolvimento Sustentável no Brasil (ODS). Disponível em: https://brasil.un.org/pt-br/sdgs. Aceso em: 30 ago 2021.

OSBORNE, S. P.; BROWN, L. (2013). *Handbook of innovation in public services*. Cheltenham, Elgar.

PEDRO, R. M. L. R.; BONAMIGO, I. S.; MELGAÇO, L. (2017). Videomonitoramento e seus efeitos na cidade: cartografia de redes sociotécnicas em diferentes espaços urbanos. *Revista Eco-Pós*. Rio de Janeiro, v. 21, n. 3, pp. 93-110.

PINTO, W. H. A.; FRANÇA JÚNIOR, A. A.; SOUZA, K. O.; SOUZA, L. H. A.; OLIVEIRA FILHO, R. C.; MORAES, V. A. V. (2021). O uso das geotecnologias como ferramenta para análise da violência no entorno de uma escola pública no bairro do Japiim, Manaus–AM. *Revista de Educação Ciência e Tecnologia do IFAM.* Manaus, v. 15, n. 1, pp. 13-25.

POTTS, J.; KASTELLE, T. (2010). Public sector innovation research: what's next? *Innovation: Management, Policy & Practice.* Cambridge, v. 12, n. 2, pp. 122-137.

PRISLAN, K.; LOBNIKAR, B. (2019). Modern trends in policing: public perceptions of the preferred policing model in Slovenia. *Revija Za Kriminalistiko In Kriminologijo/Ljubljana*. Ljubljana, v. 70, n. 5, pp. 483-500.

RANDOL, B. M. (2014). Modelling the influence of organisational structure on crime analysis technology innovations in municipal police departments. *International Journal of Police Science & Management*. Londres, v. 16, n. 1, pp. 52-64.

RATHORE, M. M.; AHMAD, A.; PAUL, A.; RHO, S. (2016). Urban planning and building smart cities based on the internet of things using big data analytics. *Computer Networks*. Amsterdam, v. 101, pp. 63-80.

REDDY, A. G.; SURESH, D.; PHANEENDRA, K.; SHIN, J. S.; ODELU, V. (2018). Provably secure pseudo-identity based device authentication for smart cities environment. *Sustainable Cities and Society*. Amsterdam, 41, pp. 878-885.

REIS, D. R. (2008). *Gestão da inovação tecnológica*. Barueri, Manole.

REIS, C.; ALMEIDA, E.; DA SILVA, F.; DOURADO, F. (2021). *Relatório sobre o uso de tecnologias de reconhecimento facial e câmeras de vigilância pela administração pública no Brasil*. Brasília, Laboratórios de Políticas Públicas e Internet.

REN, S.; LI, J.; TU, T. I.; PENG, Y.; JIANG, J. (2021). Towards efficient video detection object super-resolution with deep fusion network for public safety. *Security and Communication Networks.* Londres, v. 2021, pp. 1-14.

RICHARDSON, R. J. (2011). *Pesquisa social: métodos e técnicas*. São Paulo, Atlas.

ROESCH, S. M. A. (1999). *Projetos de estágio e de pesquisa em Administração: guia para estágios, trabalhos de conclusão, dissertações e estudo de caso*. São Paulo, Atlas.

ROLIM, M. (2007). Caminhos para a inovação em segurança pública no Brasil. *Revista Brasileira de Segurança Pública*. São Paulo, v. 1, n. 1, pp. 32-47.

SANTOS FILHO, J. V.; COÊLHO, A. V. S. (2018). Cidades inteligentes: desafios e tecnologias. *Revista de Tecnologia da Informação e Comunicação.* Funchal, v. 8, n. 2, pp. 69-76.

SANTOS, F. J. S.; SANO, H. (2016). Inovação no setor público: um olhar sobre os estudos brasileiros. *Revista Interface*. Botucatu, v. 13, n. 2, pp. 33-48.

SCHUMPETER, J. A. (1961). *Capitalismo, socialismo e democracia*. Rio de Janeiro, Fundo de Cultura.

_____ (1997). *Teoria do desenvolvimento econômico: uma investigação sobre lucros, capital, crédito, juro e o ciclo econômico.* São Paulo, Nova Cultural.

SEARS, G. J.; BABA, V. V. (2011). Toward a multistage, multilevel theory of innovation. *Canadian Journal of Administrative Sciences*. Montreal, v. 28, n. 4, pp. 357-372.

SEIXAS, L. P.; BORDIGNON, I. M. (2020). Campinas, cidade inteligente: do fetichismo à pós-política do espaço urbano. *Boletim Campineiro de Geografia*. Campinas, v. 10. n. 2, pp. 447-460.

SILVA, E. P.; LAUDARES, S.; LIBÓRIO, M. P.; EKEL, M. P. (2018). Criminality spatial dynamic in Manaus city, AM. *HOLOS*. Natal, v. 34, n. 1, pp. 259-270.

SMITH, G. J. D. (2004). Behind the screens: examining constructions of deviance and informal practices among CCTV control room operators in the UK. *Surveillance & Society*. Chapel Hill, v. 2, n. 2/3, pp. 376-395.

STRATIGEA, A.; PAPADOPOULOU, C.-A.; PANAGIOTOPOULOU, M. (2015). Tools and technologies for planning the development of smart cities. *Journal of Urban Technology*. Abingdon, v. 22, n. 2, pp. 43-62.

TALARI, S.; SHAFIE-KHAH, M.; SIANO, P.; LOIA, V.; TOMMASETTI, A.; CATALÃO, J.P.S. (2017). A review of smart cities based on the internet of things concept. *Energies.* Basileia, v. 10, n. 4, pp. 1-23.

TIGRE, P. B. (2006). *Gestão da inovação: a economia tecnológica do Brasil.* Rio de Janeiro, Elsevier.

TÕNURIST, P.; KATTEL, R.; LEMBER, V. (2017). "Discovering innovation labs in the public sector". In: CAVALCANTE, P.; CAMÕES, M.; CUNHA, B.; SEVERO, W. (orgs.). *Inovação no setor público: teoria, tendências e casos no Brasil.* Brasília, Enap-Ipea.

TOPPETA, D. (2010). The smart city vision: how innovation and ICT can build smart, "livable", sustainable cities. *The Innovation Knowledge Foundation*, v. 5, pp. 1-9.

TORRES NETO, A. P.; PATRÍCIO, E. (2022). Imagem-síntese e legitimação das câmeras de vigilância inteligentes como política governamental no território cearense. *Fronteiras – estudos midiáticos,* v. 24, n. 3, pp. 85-97.

TRIVINOS, A. N. S. (1987). *Introdução à pesquisa em ciências sociais: a pesquisa qualitativa em educação.* São Paulo, Atlas.

UNODC – United Nations Office in Drugs and Crime (2021). UNODC integra comissão em visita ao Centro Integrado de Operações de Defesa Social (CIODS) de Pernambuco, 26 de julho. Disponível em: https://www.unodc.org/lpo-brazil/pt/frontpage/2021/07/prevencao-com-base-em-evidencias_-unodc-e-spvd-visitam-ciods-de-pernambuco.html. Acesso em: 18 abr 2023.

VAN HEEK, J.; AMING, K.; ZIEFLE, M. (2016). "How fear of crime affects needs for privacy & safety": Acceptance of surveillance technologies in smart cities. In: INTERNATIONAL CONFERENCE ON SMART CITIES AND GREEN ICT SYSTEMS (SMARTGREENS), 5. Roma, Ieee, pp. 1-12.

VRIES, H.; BEKKERS, V.; TUMMERS, L. (2016). Innovation in the public sector: a systematic review and future research agenda. *Public Administration*, Londres, v. 94, n. 1, pp. 146-166.

WASHBURN, D. et al. (2009). Helping CIOs understand "smart city" initiatives. *Growth*, v. 17, n. 2, pp. 1-17.

WEISS, A. (1997). The communication of innovation in American policing. *Policing: An International Journal of Police Strategies & Management.* Bradford, v. 20, n. 2, pp. 292-310.

WEISS, M. C. (2019). Cidades inteligentes: uma visão sobre a agenda de pesquisas em tecnologia da informação. *Revista Brasileira de Gestão e Inovação*. Caxias do Sul, v. 6, n. 3, pp. 162-187.

WEISS, M. C.; BERNARDES, R. C.; CONSONI, F. L. (2015). Cidades inteligentes como nova prática para o gerenciamento dos serviços e infraestruturas urbanos: a experiência da cidade de Porto Alegre. *Urbe*. Curitiba, v. 7, n. 3, pp. 310-324.

WEISS, M. C.; BERNARDES, R. C.; CONSONI, F. L. (2017). Cidades inteligentes: casos e perspectivas para as cidades brasileiras. *Revista Tecnológica da Fatec Americana*. Americana, v. 5, n. 1, pp. 1-13.

WEST, D. M.; BERNSTEIN, D. (2017). *Benefits and best practices of safe city innovation*. Washington, Center for Technology Innovation at Brookings.

ZANELLA, A.; BUI, N.; CASTELLANI, A.; VANGELISTA, L.; ZORZI, M. (2014). Internet of things for smart cities. *IEEE Internet of Things Journal.* Piscataway, v. 1, n. 1, pp. 22-32.

ZANELLA, L. C. H. (2011). *Metodologia da pesquisa*. Florianópolis, Universidade Federal de Santa Catarina.

ZHANG, K.; NI, J.; YANG, K.; LIANG, X.; REN, J.; SHEN, X. S. (2017). Security and privacy in smart city applications: challenges and solutions. *IEEE Communications Magazine*. Piscataway, v. 55, n. 1, pp. 122-129.