



Coproduction Between Government and Civil Society to Establish Smart Cities in the State of Pará

Coprodução Sociedade Civil - Governo na Constituição de Cidades Inteligentes no Estado do Pará



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Resumo

O artigo discute as possibilidades de constituição da concepção de cidades inteligentes no estado do Pará a partir da coprodução de serviços públicos entre sociedade civil e governo. De forma particular, apresenta-se duas abordagens de coprodução contextualizadas em um cenário de telemedicina. Uma analítica, com foco rural, apresentada por via de um estudo de caso caracterizado pela parceria entre uma organização da sociedade civil e organizações públicas de diferentes esferas do governo para viabilizar atendimento médico especializado e; outra propositiva com foco urbano, apresentado em forma survey, onde se busca identificar a viabilidade de implantação de um serviço de compartilhamento de dados para coproduzir serviços públicos, inclusive serviços de telemedicina preventiva nos bairros da Região Metropolitana de Belém. Esta coprodução se dá a partir da cessão de uma porção da rede WiFi das famílias e indivíduos em áreas onde a infraestrutura de telecomunicações dos governos municipais não se faz presente. Tem-se como questão central a pergunta: Em que medida os cidadãos e as organizações não governamentais estão dispostos em coproduzir com o governo a partir do estabelecimento de parcerias?. Demonstra-se que tantos membros da sociedade civil quanto organizações não governamentais estão dispostos a coproduzir com o governo.

Palavras-chave: cidades inteligentes; coprodução; parceria; telemedicina.

Abstract

This article discusses the environment around the process of adopting the concept of smart cities in the State of Pará (Brazil), based on the coproduction of public services involving civil society and government. The study presents a case study of coproduction focusing on the rural area, characterized by the partnership between a civil society organization and public agencies from the state, and local governments to enable specialized medical care. The article also shows the results of a survey about coproduction, focused on the urban area, seeking to identify the feasibility to implement a data sharing service, using the Wi-Fi of individuals and households in areas where the local government has difficulties in offering public services. The use of this shared infrastructure would allow coproducing public services, including preventive telemedicine services in the neighborhoods around the Metropolitan Region of Belém. The survey was based on the following question: To what extent are citizens and civil society organizations willing to form partnerships to coproduce with the government?. The results of this article show that citizens and civil society organizations are willing to coproduce with governments and explore the conditions for these partnerships to happen. Also, the article shows that coproduction involving technological infrastructure and solutions may be a start to discussing and establishing smart cities in the state of Pará.

Keywords: smart cities; coproduction; partnership; telemedicine.

JEL Code: O18, H11, E23.

Introduction

The development of the Internet and its immersion in the individual's daily life brought numerous opportunities regarding the provision of public services. One of the great contributions of the Internet, particularly due to its high capillarity, is to the development of the so-called smart cities, which are cities that invest in social and human capital, urban mobility, modern communication infrastructure facilities, and technology (Genari, Costa, Savaris, & Macke, 2018), including the sensible management of natural resources, through participatory governance. This concept has a far greater scope than those found in older publications that did not emphasize issues such as sustainability and quality of life. Lemos (2013), for example, presents a concept of smart city as a city where everything is perceptible. According to Zubizarreta, Seravalli and Arrizabalaga (2015), there are several factors characterizing smart cities, such as citizens fully participating in public life; quality of life and participatory governance, emphasizing the transparency in the use of public resources.

Castelnovo (2016) considers that citizens are users of the city's intelligent infrastructures and services and, therefore, the citizens' willingness and ability to adopt innovation is the most obvious way to influence the success or failure of a smart city initiative. O'Brien (2016), considers that citizens are the city's **eyes and ears**, identifying and reporting the problems to the government.

In regions with high levels of poverty, there are several areas not covered by public technological infrastructure. This is the case in many areas in the state of Pará, where, according to the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística [IBGE], 2018), 45% of the population lives in poverty. The population's social conditions and the lack of infrastructure – evident both in rural and urban (particularly the surroundings of large cities) areas – are significant challenges in planning the possibilities of establishing the model of smart cities, especially when considering the low presence of the state.

In the more distant and understaffed parts of the state, many of the social problems could be tackled by using existing technologies. This measure, however, requires from governments an adequate telecommunication infrastructure. The lack of such infrastructure requires creative ways for governments to fulfill their roles as public service providers. One of the ways found to provide public services is through partnerships with private and civil society organizations, as well as engaging citizens directly (Andrade, 2018).

Authors such as Radnor, Osborne, Kinder and Mutton, (2014), and Vasconcellos, Vasconcellos, Heidtmann and Sousa (2015) demonstrate that partnerships are viable, feasible, scalable and fully adherent to smart cities solutions. There are multiple interpretations in the concept of partnerships (Vasconcellos, Vasconcellos, Heidtmann, & Sousa, 2015). A partnership can be a relationship of complementarity in the use of resources to meet common goals, as suggested by McQuaid (2000). According to Lewis (1998), it is related to sharing ideas and values for a long-term relationship. Also, it is a form of cohesion between different actors for a more noble purpose, such as the management of common resources (Ostrom, 1997), the fight against poverty (Chambers, 1997), or to address more immediate problems (Ferreira, 2003). The concept of partnership for this study involves the notions of cooperation and synergy between individuals and organizations, combining different resources to achieve common goals and solve social problems (Vasconcellos, 2009).

In this context, this article discusses the environment around the process of adopting the concept of smart cities in municipalities of the state of Pará, presenting elements of coproduction found in experiences involving civil society and government in the Brazilian Amazon region.

The article presents two initiatives involving coproduction. The first is a case study on coproduction between a civil society organization and the state and municipal governments to offer specialized medical care. The other initiative is a survey on the feasibility of implementing a data and information-sharing program to coproduce public services, where households and individuals in areas where the government does not have telecommunications infrastructure, offer their private WiFi network so the government can improve public services.

The case studied is a partnership between the Council of health secretaries of the municipalities of the state of Pará (Conselho das Secretarias Municipais de Saúde do Estado do Pará [COSEMS]) and the municipalities and state governments. The partnership was consolidated in 2018, coproducing specialized medical services through telemedicine, benefiting thousands of citizens living in distant regions of difficult access in the interior of the state.

The state of Pará created the program Navega Pará, which is an innovative program in the Brazilian Amazon. The initiative provides high-speed Internet network throughout the state, covering most of the municipalities and it is crucial for the telemedicine program. In order to expand this and other initiatives using an alternative to this infrastructure that was in line with the principles of coproduction, a survey was conducted to collect information from the affected population. The survey inquired 327 participants and aimed to identify the citizens' willingness to coproduce with the government, by granting a portion of their Wi-Fi network to transport monitoring data, thus enabling a series of actions relevant to promote the notion of smart cities in places where the telecommunications infrastructure of the government is insufficient.

The article presents four sections including this introduction. Section **Key-concepts** discusses the concepts of smart cities and coproduction of public services. Section **Coproduction Leading to Smart Cities** presents the case study and the survey conducted in municipalities of the state of Pará, analyzing critical elements and opportunities for coproduction, observing the possibilities regarding the development of smart cities in Pará. The final section, **Final Considerations**, presents the final considerations.

Key-concepts

Smart cities

The first references to the idea of smart cities were observed in Silicon Valley, California (USA), through the term smart community, used around 1993. This terminology referred to a “direct association towards optimal, positive, and sustainable development of a town, city, or region” (Lindskog, 2004, p. 2). Also, in the 1990s, the concept of digital cities was used, in a time where the general assumption was that many problems would be solved by simply distributing technology around the cities. Nowadays, there is the prevalence of the term smart cities, which emerged with the Kyoto protocol. According to Komninos (2006, p. 13) “a smart community is a community that has made a conscious effort to use information technology to transform life and work within its region in significant and fundamental, rather than incremental, ways.” The International Telecommunication Union defines smart cities as a city that harnesses ICT infrastructure to improve the quality of life and well-being of citizens, ensuring sustainable economic growth, optimizing municipal services, enhancing disaster prevention, and providing effective governance mechanisms. Nam and Pardo (2011) emphasize that truly smart solutions are those that put people at the center of smart cities, rather than technology.

Lemos (2013) emphasizes that smart cities are different because they involve computerized processes that are sensitive to the social context. The citizen, therefore, is not a spectator of the computerization process, but an effective participant of the city's life. Another concept that emerges from this participatory model is the **smart citizen**, in which people produce information and consequently coproduce public services. In the age of big data, Batty (2013) considers that most of the data is automatically and routinely produced by sensors and that the volume of this growth, notably realized in real time, can shift the emphasis of long-term strategic planning of cities.

According to Batty (2013), by appropriating the large amount of data produced when monitoring public spaces to improve services to the population, the manager can make better informed and more immediate decisions, improving strategic planning considering the scenarios revealed by the predictive analysis of the data collected. For example, Pan et al. (2013) present a case of monitoring the frequency of families in public squares and show that significant changes in this variable, in historical comparison, may be indicative of a possible performance of organized crime in the region. In these cases, a data prediction system can generate trend alerts to public managers in advance, helping them to plan preventive actions. The Internet infrastructure made this system possible, enabling

real-time transport of monitoring data associated with a wide range of purposes. With the evolution of the cryptography techniques, this process is quite safe and has already been adopted by several institutions. Remote device management, already consolidated in numerous solutions of residential automation, is a viable and promising alternative in the monitoring of smart cities. As for public services, it is increasingly common to see the establishment of the so-called Integrated Operations Centers (IOC), which, among other activities, monitor public spaces in cities through video images, transmitted via communication protocols from the Internet.

The perception of the citizen as an essential part of the coproduction of the cities' development has been explored only in recent decades. For a long time, the triple helix framework, by Leydesdorff and Etzkowitz (1995) (Figure 1), was adopted as a reference in the design of smart cities. This model advocates an integration based on three pillars: academia, industry, and government. The model is used as a framework to promote more dynamic innovations in the cities but does not consider the citizen on the same level of importance. Leydesdorff and Etzkowitz (1998) developed other variations of the model (triple helix II and III), in an attempt to adapt the framework. They also created the updated model of the quadruple helix (Figure 1) (Lindberg, Lindgren, & Packendorff, 2014), where civil society forms a fourth blade of the model. However, the relevance of the citizen was still not at the center of the debate. Perhaps the most appropriate representation would be to characterize the citizen as the axis of the helix model, since it constitutes the driving force capable of stimulating, through its needs and demands, the interaction between the other components. This alternative representation may incorporate more meaning to the proposition presented by the original model.

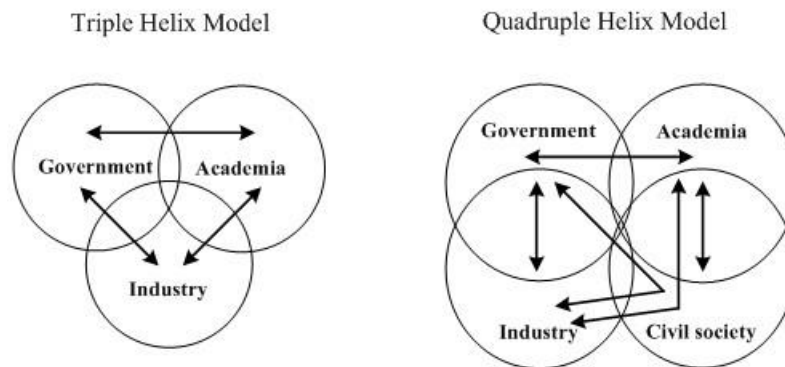


Figure 1. Evolution of the Triple Helix Model

Source: Adapted from Lindberg, M., Lindgren, M., & Packendorff, J. (2014). Quadruple helix as a way to bridge the gender gap in entrepreneurship: The case of an innovation system project in the baltic sea region. *Journal of the Knowledge Economy*, 5(1), 94–113. <https://doi.org/10.1007/s13132-012-0098-3>

The triple helix model is adequate to the European reality, but it is not suitable to the particularities of the state of Pará, where the industry is not well developed. According to the portal of industry large (Portal da Indústria, n.d.), industrial companies (250 or more employees) in Pará represent only 1.7% of the companies in the state large industrial companies.

For Castelnovo (2016) there cannot be a smart city without intelligent citizens. The vision of citizens as passive recipients of services delivered by smart cities is misleading since any initiative in this direction will fail if the citizen does not cooperate, even if only by assuming **smart behavior** or a **smart lifestyle**. The citizen contributes to the coproduction of the city. Inserting the citizen in the participatory context of a smart city requires the public's willingness and effort to manage the risks of this innovation (Nam & Pardo, 2011).

Concomitantly with this discussion, other propositions emerge to empower citizens in the context of the cities' development. One of these propositions is the coproduction of public services.

Coproduction of public services

Coproduction, regarding public services, may be defined as a strategy to deliver public services through shared responsibilities and power. The actors sharing responsibilities and power may be public and private agencies and citizens (Verschuere, Brandsen, & Pestoff, 2012).

For Osborne, Radnor, Vidal and Kinder (2014), although public management has wanted to adopt coproduction for decades, the first attempts that allowed understanding and implementing the approach in service management are recent. The main question is how to manage and work the coproduction and its implications toward the delivery of efficient public service, rather than add the characteristics of the approach to already existing models of public service. Because technology is not a public good, in its own right, but a secondary good used to support and enable the provision of public services, this article points to the importance of coproduction and how fruitful these partnerships can be in public management.

Osborne and Stokosch (2013) emphasize that it is necessary for the public manager to understand public services as the result of complex systems of service delivery. It is also crucial to recognize that digital technology plays a significant role, transforming the relationship between organizations and users of public services, as is already seen in service delivery in the market, for example.

Osborne and Stokosch (2013) present three types of coproduction: consumer coproduction, which improves the quality and impact of existing public services; participative coproduction, which improves the planning of existing public services and, in many cases, occurs through the involvement of citizens; and enhanced coproduction, which combines consumer experiences, participation, and planning to innovate creating new approaches for public services.

According to Marshall's (2004) point of view, coproduction only occurs when there is an opportunity and willingness of the citizen to participate actively in the process. Therefore, the engagement within coproduction in the context of smart cities relies on presenting the opportunities for participation to the citizen in an accessible and simplified format, especially since coproduction is a topic still unknown by a large part of society. It is essential to create strategies both for project dissemination and for persuasion, involving and encouraging citizens to cooperate in the public sphere. This call can occur in various ways and with low financial impact, including through social networks and sectoral public hearings.

Salm and Menegasso (2010), based on the investigation of different types of participation, present a proposal of organization on five models of coproduction of public goods, summarized in Table 1. The typologies are used to define the degree of citizen's participation. One of the most effective forms of participation aims at the citizen's direct involvement as a partner of the State. In this context, citizens may receive an incentive to carry out an activity and may offer resources for the activity or service to be carried out by the State. Among the models described in Table 1, most in line with the discussion in this article is the functional coproduction model, where participation can occur with mutual gains, expressed through both functional and material incentives (Bovaird, 2007). For Moretto, Souza and Salm (2014), functional coproduction involves the individual, group, or community in the provision of public services based on results and at a lower cost, i.e., more efficiently.

Table 1

Models of Coproduction

Model	Description
Nominal coproduction	It is a strategy to produce public services by sharing responsibility between the community, preferably volunteers, and the state apparatus, only to make these services more efficient.
Symbolic coproduction	It is a strategy to engage citizens in the production of public services in order to demonstrate the presence of the state.
Functional coproduction	It is a strategy used by the state to produce public services more effectively and efficiently, with the engagement of the individuals, groups, or community.
Representative coproduction with sustainability	It is the result of the synergy in public services with the participation of citizens, community organizations, and the state apparatus, all of them interacting for the common good.
Coproduction for community mobilization	It is a strategy to deliver public services with the participation of the entire community led by ethical principles and normative democracy, to keep the community permanently mobilized.

Note. Source: Salm, J. F., & Menegasso, M. E. (2010, setembro). Proposta de modelos para a coprodução do bem público a partir de tipologias de participação. *Anais do Encontro Nacional da Associação Nacional de Pós-Graduação e Pesquisa em Administração*, Rio de Janeiro, RJ, Brasil, 34. Recuperado de <http://www.anpad.org.br/admin/pdf/apb633.pdf>

For functional coproduction to become viable, synergy between society and government is essential (Evans, 1997). One of the ways to stimulate this process involves the creation of a collaborative environment between government and citizens (Lemos, 2013). For Przeybilovicz, Cunha and Meirelles (2018) cities with a focus on smart governance understand that truly smart involves incorporating collaboration. Pereira, Cunha, Lampoltshammer, Parycek and Testa (2017) discuss some principles of this collaboration, highlighting the theme of smart governance, which implies several stakeholders engaged in decision-making on public services (Lopes, 2017). In this process, in addition to the traditional formats, it is possible to make use of several emerging technologies, including social media and games that transmit educational or training content or training.

With regard to the most direct approximation between the local government and citizens to discuss the possibilities of coproduction in the public service, the strategy of municipal councils stand out. These councils are the most democratic ways of creating a collaborative environment since they are a space of dialogue. The municipal councils are public bodies that are not constituted as a legal organization, but as a space where citizens, civil servants, and public officials discuss mediating the interest of the population and the local government. The municipal councils are arenas to formulate public policies that meet local needs (Jesus & Cosenza, 2015).

Coproduction Leading to Smart Cities**Coproduction to provide specialized medical services – telemedicine in municipalities in the state of Pará**

The global scenario of great instability, marked by what has been treated in the business world as environment an environment of VUCA – volatility, uncertainty, complexity, and ambiguity (Bennett & Lemoine, 2014), public managers reinvent themselves. They are constantly searching for smart solutions based on partnerships able to address social problems in a more agile way. According to Vasconcellos (2009), the participatory form desired by public managers is based on cooperation and synergy between individuals and organizations that combine different resources to solve social problems. This study explores an initiative in the

state of Pará where coproduction between the government and a civil society organization has benefited thousands of citizens delivering healthcare.

The Council of health secretaries of the municipalities of the state of Pará (COSEMS) is characterized as a nonprofit membership organization with no economic goal, formally registered, and technically, administratively, and financially autonomous (COSEMS, 2018). Its members are 144 municipal health secretariats in the state of Pará. The organization discusses with its members and with the state government, the issues related to the Brazilian Unified Health System (SUS), considering that the healthcare in Brazil is funded solidarily by federal, state, and local governments.

The coproduction in this case study occurs in the provision of specialized medical services and is characterized by the delivery of medical care via the internet, called **telemedicine**. The initiative was designed based on the guidelines of the Conselho Federal de Medicina (CFM - Resolução CFM nº 1.643, 2002 - Brazilian council that represents doctors and regulates their activities). The telemedicine project emerged as an alternative for the care of people with specific diseases who live in the rural areas of the state and who do not have access to specialized medical services.

The federal government already had a **telehealth** program. It was a tool with documental resources, in the form of questions and answers, where health professionals interacted with one another in mutual consultation. However, the service did not meet the needs of the state of Pará. Data collected from COSEMS registered around 500 consulting sections using this tool per year. This number was far below the expectations of the council and the community as a whole since the population of the state is about eight million inhabitants.

Studies carried out by COSEMS showed that in 2016, the state of Pará allocated around R\$ 50 million with out-of-home treatment (OHT). Sick patients often had to travel for up to twelve hours, by boat, just for the first consultation, where the doctor conducted the anamnesis (interview with the patient) and requested the exams for later return. COSEMS realized that the enormous amount of resources used for patient displacement could be saved if there were telemedicine service centers distributed within the state. In addition, when the service is available in the municipality where the patient lives (or in a neighboring region), it is easier for the local government to provide end-to-end and accessible infrastructure, as discussed by Alperstedt Neto, Rolt and Alperstedt (2018).

After observed the need for improvement in the procedures to deliver medical care in remote areas, the state of Pará elaborated the project of telemedicine service, which was designed based on guidelines of the CFM (Resolução CFM nº 1.643/2002). The project observed both the security aspects (regarding the management and preservation of the patient's privacy), as well as the protocol of operation of the service.

Currently, the initiative has service centers in seven municipalities in the state of Pará: Cametá (136,390 inhabitants); Breves (101,891 inhabitants); Bragança (126,436 inhabitants); Abaetetuba (156,292 inhabitants); Redenção (83,997 inhabitants); Castanhal (198,294 inhabitants); and Paragominas (111,764 inhabitants), (IBGE, 2018), covering together a population of 915,064 people. Each of these municipalities serves the population of neighboring cities. For example, the services in the municipality of Cametá serves the populations of the municipalities of Limoeiro do Ajuru, Baião, Mocajuba (these three cities, together, have a population that corresponds to 77.52% of Cametá's total population).

The services offered by the telemedicine project were managed by a committee, the Comissão de Intergestores Bipartite (CIB) (committee of managers), formed by seven members of COSEMS and representatives of the state government. The resources received by COSEMS to pay for the activities come from the municipalities, according to an agreement among the partners, previously agreed upon by the members.

The Brazilian legislation, supported by the Tel Aviv resolution, does not allow online medical assistance between doctor and patient (The World Medical Association, Inc., 1999). The solution for this barrier, based on the legislation, was to provide the patient's visit with the general practitioner at the service center, and the participation of the specialized doctor who stays in Pará's capital, Belém, via the Internet. Therefore, the patients are with a doctor, and the visit is characterized as a regular full visit for the patient and a tele-consultancy between

the two doctors. There are currently four specialties available: neurology, neuro-pediatrics, cardiology, and endocrinology. Other specialties such as dermatology and infectology are to be offered in the future. In each service center, there is a doctor, a nurse, and an official of the administration to deal with technical problems.

The major challenge for COSEMS to make the service available was to find an Internet provider that was available in the regions in the interior of the state and meet the minimum technical requirements necessary for the transmission of the video stream (10 Mbps). The solution came from the partnership with the data processing company of the state of Pará, PRODEPA, through the use of the Navega Pará program (<http://www.navegapara.pa.gov.br/>, retrieved December 02, 2018). The program is an initiative from the state government that uses the communication infrastructure available in the electric power transmission towers maintained by the Electricity Company Eletronorte. This Navega Pará is similar to the federal program (Internet for all) put forward by the federal government (http://internetparatodos.mctic.gov.br/portal_ip/opencms, retrieved November 28, 2018). The difference is that the state program in Pará uses various telecommunication technologies, such as radio and fiber optics, enabling the access and availability of digital public services. The average cost of installing a spot for the videoconferencing system in the health units – as long as they are close to the optical fiber passage of the Navega Pará program – is around R\$ 10,000, which is easily paid-off using a small part of the budget designated for the OHT. In the city of Abaetetuba, for example, according to data provided by the municipal health department, the resources designated for the OHT service in 2018 were R\$ 47,817.60.

Between March and November 2018, 2,200 patient visits were conducted. When counting the return visit, this number goes to 2,343, and when comparing these data with the number of visits conducted via OHT in one year, proportionally, the telemedicine increased the service fourfold.

There are several obstacles preventing more initiatives such as this one, many of them are not related to technology. Some mayors, for example, even though aware of the effectiveness of the service, prefer to keep local medical care restricted in accredited clinics, even without the aforementioned specialists, because they already have contracts in place.

The great value added of the project is the coverage that benefits the impoverished population, offering quality service (particularly because there is an evaluation system that monitors the quality).

The impact of the telemedicine service may be observed by the results obtained in one of the cities, considering the perspective of the municipality's secretary of health. Abaetetuba is the seventh most populated city of the state, located in Northeastern Pará, about 150 kilometers from the state's capital, Belém. It is a municipality considered the center of a micro-region formed with the municipalities of Moju, Igarapé-Miri, and Barcarena, counting a population of more than 350,000 inhabitants. The city has an area occupied by riverine communities that counts 72 islands (Região das Ilhas), where the access is possible mainly through boats called **rabetas**, which is the river **taxi** in the municipality's hydrographic network (<https://www.abaetetuba.pa.gov.br>, retrieved January 27, 2019). The municipality health secretary has been a member of COSEMS in the telemedicine program since June 2018. The program is considered relevant and is evaluated positively, increasing the options for specialized treatment for the population, as well the program continuously monitors the patient, which is a differential regarding the public service's quality. The program proved to be more cost effective, improving the application of the resources designated for OHT. The resources saved started to be invested in activities for prevention and health promotion.

Figure 2 shows the number of visits to Abaetetuba, referring to the consultations carried out with specialists within the telemedicine program in the municipality. The fall in consultations in some situations was due to the mandatory annual leave of general practitioners who accompany the patients in the service centers.

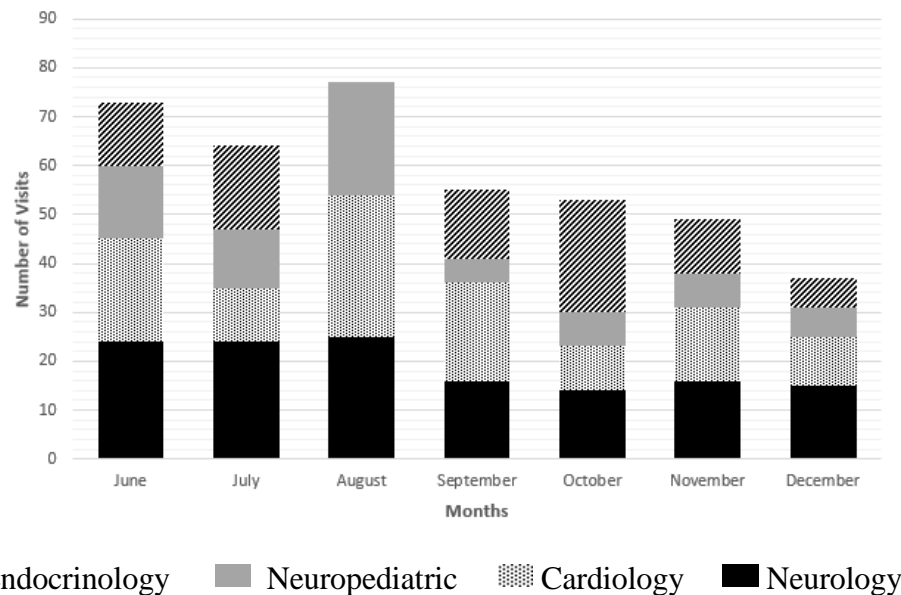


Figure 2. Visits Via Telemedicine in Abaetetuba (PA)

Source: Elaborated by the author.

COSEMS offered training for the municipality's healthcare personnel, motivating the professionals with the possibilities brought by the innovation. The patients showed great acceptance toward the telemedicine project. The main concern on the part of the municipal health secretary was about the dissemination and clarification of the service through various media, including television, radio, and social networks. In this process, a rather didactic approach was used to clarify potential doubts.

This modality of service showed to benefit the most impoverished population of the Amazon, removing cultural, socio-economic and geographical barriers, and approaching the concept of smart cities as communities that consciously use ICT to change lives in the territory in fundamental ways (Komninos, 2006).

It is worth noting that the coordination of the project by COSEMS, an independent civil society organization, is a positive feature of the program since COSEMS is not attached to bureaucratic barriers posed to public agencies. Another promising aspect is the expansion of other health specialties, which is a demand already being studied and about to be arranged.

This case study shows that this type of initiative, if adopted on a large scale, may represent a revolution toward public health in large regions such as the state of Pará. Other specific actions related to what has been treated as smart health could also be adopted in remote areas of large Amazonian cities, providing services such as periodic monitoring of population's health indicators (Solanas et al., 2014). Services such as the one presented in this case study could be offered in partnerships with residents' associations, who, supported by health agents, would periodically transmit the data using infrastructure as presented in the next section, implying in a high level of commitment between public management and the local community.

The telemedicine project developed in coproduction by COSEMS, municipal health secretaries, and the government of the state of Pará showed excellent results, becoming a reference regarding the idea of developing smart cities in the Amazon region. The project results corroborate the findings of Lindskog (2004) on smart community initiatives since there is a direct association of the project with optimization and sustainable and positive development of the cities and regions involved. The case study stresses the benefits and reflects the need for greater approximation between governments and private entities, strengthening expertise, and improving services to the citizens.

The general perception is that the partnership described in this case study is a successful example of coproduction. The next part of this article will describe and reflect on another initiative exploring the concept of

coproduction in the state of Pará. Different from the case study, the initiative below was conducted in the urban context and referred to coproduction between government and citizens directly, to address chronic problems in the areas of health and safety.

Citizen's willingness to coproduce with the local government

The initiative described here is a survey conducted in the Brazilian Amazon region, and explores the possibility of direct and active participation of citizens in the process of coproduction of public services. The information obtained from the survey was complemented by data collected in direct observation and in-depth interviews in specific areas of the state of Pará, inquiring about an initiative on Wi-Fi sharing, as described below. The assumption around the type of participation examined in the survey is that several services associated with smart cities (such as flood warnings because of heavy seasonal rains) are possible through citizen-government partnership. One of the major obstacles in providing environmental disaster warning services to citizens is the government's lack of telecommunication infrastructure – and hiring telecommunication services for ubiquitous coverage in cities involves excessive costs, which most municipalities do not have. A better interaction, with voluntary and effective citizen participation in this kind of service, certainly would foster the services. The data collection sought to understand citizen participation, exploring the possibility of a partnership where individuals and households provide part of their Internet bandwidth (limited and adjusted by the citizen using a specific software) for the local government. Thus, the citizens' Wi-Fi network could be used in the public interest to transmit data from monitoring sensors located close to their residence, to an Integrated Operations Centers (IOC). Since the coverage area of these networks often exceeds the physical boundaries of homes, it would be possible to receive and route the demands of nearby monitoring devices. The idea was to build a partnership for functional coproduction (Moretto, Souza, & Salm, 2014) involving individuals and/or households to contribute to the provision of less costly and more efficient public services.

The first step to implement this idea, complementing the data collected through the survey, was to investigate whether the peripheral areas of cities in the state of Pará were covered with signals from Wi-Fi networks from private connections. These examinations were conducted using Wi-Fi signal strength measurements in the neighborhoods of the metropolitan region of Belém. The city of Belém has an estimated population of 1,485,732 inhabitants (IBGE, 2018).

In order to enrich the reflections on coproduction inspired by the survey, the measurement of Wi-Fi coverage in a specific area of Pará is demonstrated in Figure 3. The figure was designed based on results obtained in the measurement in Bairro da Guanabara, located in the peripheral region of Pará's capital, Belém. The data was collected through the WiFi Tracker application (2018) in 34 streets of this neighborhood. The dashed line of Figure 3 (with enlarged cutout) delimits the mapped area. In this process, more than 2,000 Wi-Fi spots were detected, which showed a dense coverage of the neighborhood, providing a real alternative infrastructure for access to coproduction services and initiatives that are characteristic of the smart cities.

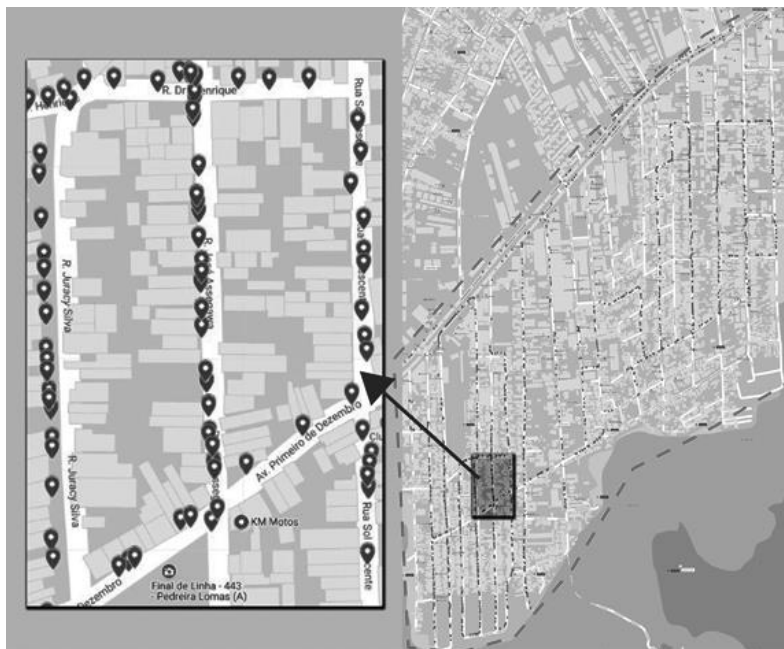


Figure 3. Wi-Fi Tracking in Bairro do Guanabara, Belém-Pará

Source: Adapted from Google Maps (<https://maps.google.com/>, Recuperado em 15 de novembro, 2018), based on data collected via Wifi Tracker. (2018). (Version 1.2.122) [Software]. Retrieved from <https://play.google.com/store/apps/details?id=org.prowl.wifiscanner&hl=en>

A more specific study was then carried out in one of the squares of the Bairro da Guanabara (Figure 4). It shows the average signal level captured at five different points. All the results, expressed in dBm power unit and presented in Table 2, come from Wi-Fi networks of the residents of the square and refer to the technical feasibility of an eventual need for data transmission.

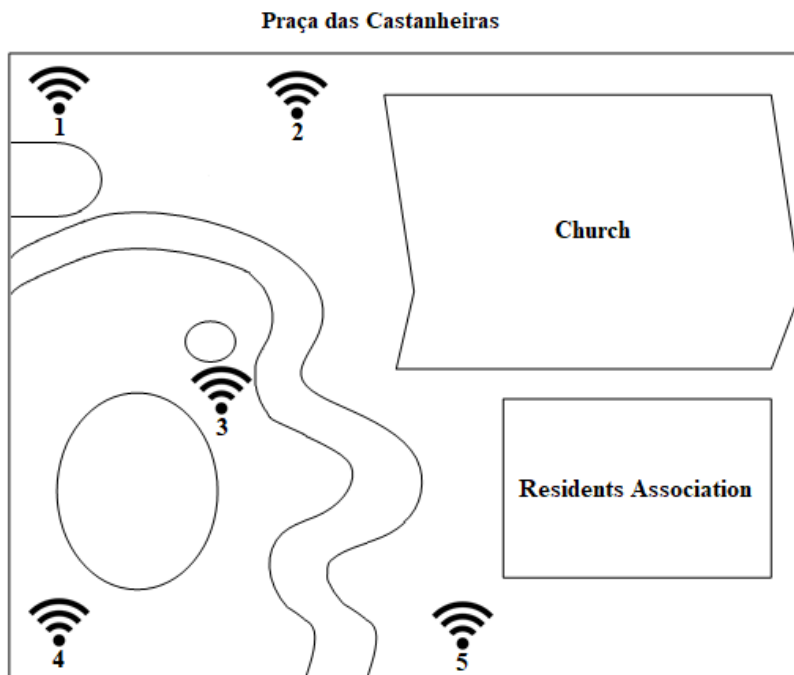


Figure 4. Spots of Signal Mediation in Praça das Catanheiras

Source: Elaborated by the author.

In order to illustrate the results of the survey and using the data collected by mapping the Wi-Fi networks, residents of Praça das Castanheiras were inquired about their willingness to coproduce in a project of Wi-Fi sharing. Among the residents, 75% said they would coproduce with the municipality without any compensation, including by sharing their Wi-fi network. One of the residents said that their possible coproduction would depend on the public service involved in the partnership. In the case of sharing the Wi-Fi, this specific citizen would not offer to share, saying that the connection was not strong enough. The average age of the group of residents inquired was 34.5 years old; 50% completed high school and 50% superior education. The high percentage of people willing to participate in the coproduction of the public service (functional coproduction) (Moretto et al., 2014) indicates that even in peripheral and poor areas, the construction of partnerships between civil society and government to gather different resources (Vasconcellos, 2009) and offer solutions for social problems is feasible.

Table 2

Data From Mediation of the Signal Level of Praça Castanheiras

Mediation spot	Number of Wi-Fi networks detected	Average value of the signal, in dBm
Spot 1	3	-82
Spot 2	6	-78.7
Spot 3	4	-71.5
Spot 4	4	-63
Spot 5	4	-70.5

Note. Source: Elaborated by the authors.

As for the survey, 327 respondents provided their inputs on coproduction of public services. Among them, 242 (74%) declared to be willing to coproduce with the government.

It is noteworthy that 53% of the respondents that are willing to coproduce would do so only in exchange of a direct benefit as compensation from the government, such as the reduction of local taxes (tax on property, called IPTU). Electricity distribution companies already use this arrangement, where citizens who install solar panels offer the company the surplus of the panels' production in exchange for discounts when they need to use the company's electricity. Such a simple idea with mutual gains, adapted to the case of information technology, would be fundamental to transform lives in communities (Komninos, 2006). However, there are several managerial and legal obstacles preventing this kind of innovation in public administration.

Table 3

Willingness to Coproduce

Willingness	Frequency	Proportion	Percentage
No, not interested (NI)	12	0.0367	3.67
Other	16	0.0489	4.89
No, do not trust the government (NTG)	26	0.0795	7.95
No information (NI)	31	0.0948	9.48
Yes, unconditionally (YI)	67	0.2049	20.49
Yes, with compensation (YC)	175	0.5352	53.52
Total	327	1.00	100

Note. Source: Elaborated by the authors.

It is noteworthy that 84% of all respondents in the age group 30 – 51 years old and willing to coproduce, have relevant participation in family income. The fact that this population is probably more financially stable may explain this willingness.

Both in the case study discussed in section **Coproductio to provide specialized medical services – telemedicine in municipalities in the state of Pará** (coproduction between public and private institutions) and the direct coproduction between government and citizens discussed in this section indicate possibilities of establishing smart solutions for the municipalities in Pará. Smart solutions address social issues based on creative and participatory management. These solutions suggest a type of coproduction designated by Salm and Menegasso (2010) as a coproduction of public services in sharing responsibilities between people in the community and government, which seeks better efficiency and effectiveness for the common good.

Final Considerations

The emerging needs of citizens in modern societies and the increasing migration to large urban centers are crucial challenges for public managers in the municipalities in the Brazilian state of Pará. Against this backdrop, governments have the potential to base their strategies for public service provision in collaborative alternatives, promoting coproduction as a smart managerial solution for municipalities, and leading them, starting by few social segments, in the direction of establishing smart cities.

The positive results of the coproduction partnership for telemedicine services presented in the case study are evidenced by the results presented in the municipality of Abaetetuba (where, in seven months, 408 visits with specialist doctors, were carried out). In addition, the mobilization to expand the services observed in the Council of Health Secretaries of the Municipalities of Pará (COSEMS) show that health secretaries believe that the project is an opportunity to improve the services for the population in their municipalities. In the survey presented in this -article, it is important to emphasize that the citizens are willing to participate in the solutions for the communities. However, a large part of the respondents pointed out the need for compensations from the government as an incentive to participate and to encourage others to engage. The coproduction increases the access to public services, enabling new partnerships, and helping to reverse the dystopian view of government-centered solutions that is current in Brazilian public administration.

Collaborations by sharing difficulties and competencies seem to be a smart alternative to overcome the enormous managerial challenges faced in Brazil, in the Amazon region, and particularly in the state of Pará. The smart and active search for partnerships, mapping citizen's and institution's expertise, is certainly a great encouragement to innovative public managers and a first step towards the establishment of smart cities.

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