# Crowdsourcing, design management and smart cities: literature review on emphases and gaps

*Crowdsourcing, gestão de design e cidades inteligentes: ênfases e lacunas na literatura*

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## ABSTRACT

This article discusses the themes crowdsourcing, design management and smart cities, based on unsystematic and systematic bibliographic review. The growing use of locative media related to the urban space and its use demands from designers a new role in designing products and services for cities. Studies in progress focus on companies, with the use of crowdsourcing data associated with product improvements. Few studies highlight the importance of understanding population data by urban agencies and planners, without data that evidence the use of design management associated with crowdsourcing.

## KEYWORDS
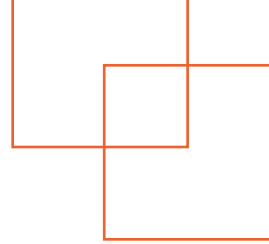
Design Management. Crowdsourcing. Smart Cities.

## RESUMO

Este artigo discute os temas crowdsourcing, gestão de design e cidades inteligentes, a partir de revisão bibliográfica assistemática e sistemática. O crescente uso de mídias locativas relacionadas ao espaço urbano e sua utilização vêm demandando aos designers nova atuação no projeto de produtos e serviços para as cidades. Estudos em andamento possuem como foco empresas que utilizam dados do crowdsourcing associados a melhorias em produtos. Poucos trabalhos ressaltam a importância do entendimento dos dados da população por parte de órgãos e planejadores urbanos, sem dados que evidenciam o uso da gestão de design associada ao crowdsourcing.

## PALAVRAS-CHAVE

Gestão de Design. Crowdsourcing. Cidades Inteligentes.

# 1 INTRODUCTION

The themes of design management to the use of crowdsourcing in projects related to smart cities[1] planning are articulated in this article, whose context is presented below.

First of all, it is essential to emphasize that the term smart city is an abstract term that can be interpreted in several ways, adding different knowledge and city management areas. It appeared in the '90s and has been developing as the primary differentiating element in relation to the traditional conception of the city, supported by the use of Information and Communication Technologies - ICTs, Living Labs, Internet of Things - IoT and Internet of the future, which provides an innovative ecosystem to meet new demands of today's society (Rizzon, Bertelli, & Matte, 2017).
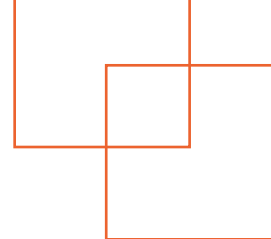
One of the criticisms regarding smart cities' concept comes from the fact that innovation derived from ICTs by the repressive role or control that its use can exert on citizens. In this sense, issues such as ethics in the use of data, privacy and how these data are implemented in city planning are seen as negative points in the concept of smart city (ibid).

In this study, however, the subject interest is related to what is considered a positive point: a smart city can offer its citizens welfare that has been lost in recent decades, by the possibility of including city inhabitants in its planning. This loss occurs due to the deviation of the focus from the human scale, as a product of planning ideologies, to market forces and market trends, which orient the architecture on a large individual scale (Gehl, 2013).

As an example, the use of ICTs offers the perspective that its citizens can analyze and transform the environment in which they are inserted, providing, among others, a feeling of security and well being (Pereira, Procopiuck, Fonseca, & Oliveira, 2019). To this end, by uniting with the interests of private actors for the elaboration of public policies, public governance can produce results that are more in line with the interests of the population (Buta & Teixeira, 2020).

For this reason, this work is based on the concept of a smart city as is considered the one that, despite appropriating data from its citizens, offers in return a collaborative action contributing to the improvement of life, which can be triggered through crowdsourcing.

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1   The term smart city, in this study, is based on the city that uses information technology to design spaces and understand the needs of the population, reverting to improvements in quality of life.

Crowdsourcing is a developing ICT that aims to obtain data from users of various products and services. Formed by two words, crowd + outsourcing, this term was coined in 2006 by Jeff Howe. It consists of obtaining information that is transferred to a database (Reis & Serres, 2018).

There are several types of crowdsourcing. Generally speaking, data is collected and monitored through the applications used in all kinds of digital devices. It can be carried out from companies and organizations' invitations to consumers or users, giving feedback to products from various segments, serving as a source of data. In addition to this data provided on-demand, collaborative production can also be done specifically for a company or contractors can purchase previously planned products and information and modify them (Fumayama, 2019).

This new reality brings a possibility of product and service design to cities and their association with urban planning. Besides, more and more works related to design policies focused on cities have been pointing out the need to include design from a strategic perspective. With this, design management can have a mediating and managing role within the stages of projects and within companies of any branch, including those with public companies, acting at the strategic level (Daros & Kistmann, 2018). Design management also considers the participative approach in its management, including collaborative processes and the use at the operational status of design thinking. However, still consisting of a little-explored and little-studied technology, it is necessary to deepen on these themes, to trace a theoretical basis for future research.

Therefore, this study aims to raise the arts' state regarding design management associated with crowdsourcing in constructing intelligent cities from the research conducted. It is essential to point out that this study is part of more extensive research in design management focused on cities. The focus on crowdsourcing demands the identification of fields already explored and areas still without theoretical advance, essential for the forwarding of future research. Besides, trying to approach the Brazilian reality considers Curitiba - PR, in the search because the city is one of the eight smart cities in Latin America (Smart Cities Council, 2019). The city has several initiatives in this segment and has already been considered the best city to live in Brazil (Mackea & Casagrande, 2019).

Considering this context, the method used is based on the bibliographic review, with systematic and assistematic bibliographic research techniques, to understand state of the art, defining its gaps and emphases, based on Comfort Amaral & Silva (2011).
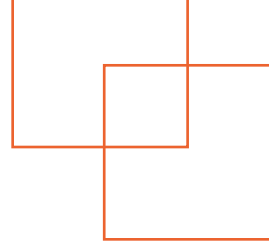
## 2 Preliminary concepts on smart cities, crowdsourcing and design management

As a starting point of this study, an assistematic review of the literature on the themes was carried out to explore the theme to base a systematic review later, reported below.

First of all, the term smart city, in some cases, comes as a potential conciliator between the impacts of mankind on the environment and the growth of cities. Smart cities would allow rethinking how to design cities looking at sustainable issues in various dimensions of society (Yigitcanlar, Kamruzzaman, Iopollo, Sabarini-Marques, Costa & Yun, 2018). But on the other hand, it is observed that the term also has an ideological bias, which hides specific problems associated with the use of information technology, assuming that automatically all the needs of urban planning can be fixed and met (Hollands, 2014).
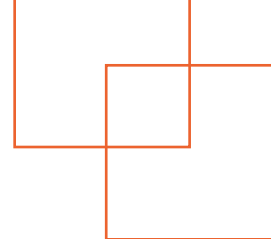
Risks of social exclusion and gentrification that this new style of planning can cause are also mentioned since the analysis of data generated by applications, monitoring of busy places and demand for public policies can develop biased results aimed at small portions of the population (ibid).

But advances can also be obtained by considering technology, population diversity and political and governmental institutions as required development fields in smart cities' construction (Lara, Da Costa, Furlani & Yigitcanlar, 2016).

As can be seen, intelligent cities have specific objectives of including technology in urban planning and management of essential services to citizens, focusing on conscious and sustainable growth. As seen above, these tools can reflect positively or negatively, depending on how they are applied. But these new means of understanding and planning the city have raised issues of privacy and property since constant monitoring, and the large volume of data generated are essential factors that require analysis and application methodologies and new norms and rules.

Today, there are several products and services offered that already use ICTs and crowdsourcing and interfere in the urban planning of cities. One example is the CyberParks project, a platform that analyzes data with urban space planning (Costa & Menezes, 2016).

Designers develop these products and services, but without the action of design with public policies include design as a core competence at the levels of management and planning, as advocated by Mozota and Kim (2009). They could act in the construction of products and services based

on crowdsourcing, contributing to the construction of smart cities from an innovative process, integrating sectors to improve the final quality of the product or service for users (Palmier & Figueiredo, 2018). Therefore, it can be an essential tool in constructing smart cities, focusing on the citizen.

Thus, design management has the role of addressing these dimensions of smart cities' development and implementing its integrated communication process between levels. So, public policies and other projects are planned correctly, reverting the use of data to improve the quality of life of the population and cost-benefit to the project developers.

However, in this first part of the study, was not considered the relations between design management and crowdsourcing for smart cities'. Therefore, to deepen the study, it was sought, with the systematic bibliography, to verify the existing emphases and gaps, which could point to new investigations.

## 3 Methodological Procedures

The issue of smart cities construction is controversial. Some authors consider that citizens can play an active role. Other authors who criticize them assume that crowdsourcing, one of the tools used in building smart cities can have a controlling effect or only benefit companies interested in the data. Therefore, by its nature and in an inductive manner, was based on qualitative and exploratory research.

For this, considering what was proposed by Conforto et al. (2011), the study first researched the themes in articles obtained through an assistematic bibliographic review on the subject, presented in the previous topic. Using a systematic bibliographic review, it sought to identify how the field that articulates smart cities' themes, crowdsourcing and design management is built, which will be presented in the next topic.

According to the previous literature review, the search strings were selected, and the filters included: applied social sciences, peer-reviewed articles, as of 2012, in English, Portuguese and Spanish. The review also followed defined stages, divided into its three phases, considering primary sources in the periodicals of Capes, Scopus, and Science Direct.

After the collection, the articles were analyzed and related to the research. As follows, they were classified in an evaluation between high, medium and low links with the present research.
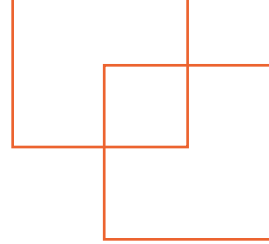
# 4 Results

The systematic bibliographic review was carried out following the procedures proposed by Conforto et al. (2011), complemented by adopting the approach by Fialkowski and Kistmann (2018). Therefore, besides identifying the articles in the journals, the analysis was also completed using two new criteria: theme and content.

The strings used in the journals, CAPES, Science Direct and Scopus were: "Smart City" AND "Curitiba", "Crowdsourcing" AND "Smart City", "Crowdsourcing" AND "Design Management", "Crowdsourcing" AND "Design Management" AND "Urban Mobility", "Design management" AND "Urban Mobility", "Crowdsourcing" AND "Urban mobility", "Curitiba" AND "crowdsourcing".

From the primary search sources, 951 articles were found, related to the themes. These articles' titles were then read, eliminating those not directly linked to this study, those related to software development, computer engineering and case reviews with various themes, and non-scientific journals. The result of this selection was 148 articles.
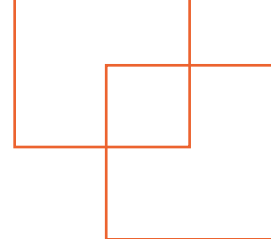
It was possible to observe with greater depth and understanding the most relevant research for this research by reading the keywords. This resulted in 73 selected articles.

In a third stage, a new filter, "F2" was applied. Reading the abstracts of these articles resulted in 27 articles.

These 27 articles were then read in their entirety and ordered from the defined objective, topics covered, reference source, and publication place. A subjective evaluation was added regarding the degree of relevance to this study's subject (Fialkowski & Kistmann , 2019). Chart 1, presented below, was thus constructed.

Table 1. The relevance of the articles concerning the intended study.

| AUTHOR | Main Objective | Keywords | Country | Evaluation |
|---|---|---|---|---|
| 1 MACKE (2018) RBS | Conceptualize Curitiba and its practices as a model of Smart City and innovations for the well-being of the population. | Citizens' perception; Curitiba; Quality of life; Smart city | USA | Medium |
| 2 NETO (2018) RBS | Develop application together with data collection for the effective and conscious planning of a Smart City. | Accessibility; smart cities; crowdsoucing; mobility; technology. Abstract | BRAZIL | High |
| 3 CLEDOU (2017) RBS | Analysis of the taxonomy and state of the art of urban mobility within the selected Smart Cities. | City transport; Digital services; Public value; Smart cities; Smart mobility; Taxonomy | PORTUGAL | High |
| 4 PRANDI (2014) RBS | Presents the role of crowdsourcing in planning a specific case study of public transportation. | Crowdsourcing; geospatial mapping systems; open data; sensing; smart city; urban accessibility | FRANCE | Hign |
| 5 BLASCHKE (2011) RBS | Integration of urban systems and their data in geospatial vision. | Collective sensing; Future trends; Human-environment interactions; In situ sensing; Sensor web; Smart city; Urban remote sensing | AUSTRIA | Medium |
| 6 PETERSEN(2013) RBS | Talks about the potential and limitations of crowdsourcing in the design process. | crowds; crowdsourcing; design research; new social media; six; six step co-creation cycle; social networks; | KOREA | High |
| 7 LEMOS (2018) RBS | Presents a study on sense citizen in the city of Salvador in Bahia | Mobile Applications. Smart City. Smart Citizen | BRAZIL | High |
| 8 MUELLER et al(2018) RBS | Describes the need not only to design but also to understand the users' needs through those generated. | Citizen design science; Citizen participation; Crowd creativity; Crowdsourcing; Participatory planning; qua-kit | EUROPE | High |
| 9 SEMANJSKI (2016) RBS | It talks about the development of strategies from the monitoring data. | Attitude based segmentation techniques; Crowdsourcing mobility behaviour; Data-driven mobility management; Smart city mobility | BELGIUM | Low |

| 10 FLORES (2017) RBS | Talks about media data and digital city mapping. | Social network services, Urban áreas, Collective intelligence, Local government, Collaboration, Crowdsourcing | USA | Low |
|---|---|---|---|---|
| 11 MERGEL (2015) RBS | It describes that crowdsourcing can help with government planning and as a consequence the delivery of better projects and olanos to the population. | Crowdsourcing; open innovation; peer production; public sector | USA | Medium |
| 12 DI SANTO (2015) RBS | It describes the current scenario of the Smart Grid in relation to sources and power generation. | Demand-side response; Energy; Grid automation; Self-healing; Smart grid | BRAZIL | Medium |
| 13 STELZLE (2017) RBS | Talks about the importance of participation for urban planning | Decision making; Design Science; Urban design; Urban development; Workflow | FRANCE | High |
| 14 CAPDEVILA E ZARLENGA (2015) RBS | It talks about the role of the citizen within the construction of Smart Citeis and has as a case study the city of Barcelona in Spain. | Bottom-up; Open collaborative spaces; Open data; Smart citizens; Smart city; Smart districts; Top-down | SPAIN | High |
| 15 RIZZON,BERTELLI(2017) RBA | It presents the concept of Smart Cities and its history over time. | Smart Cities; Information and Communication Technology; Citizen; Systematic Literature Review. | BRAZIL | High |
| 16 CROOKS (2015) RBS | It presents typologies of analysis and data collection related to urban space. | GIS; crowdsourcing; form and function; social media; urban morphology | USA | High |
| 17 COSTA ET AL. (2015) RBS | Crowdsourcing application in transportation management and planning: Waze concepts, potentials and partnerships | Urban planning; Urban mobility; Collaborative maps, Neocartography. | BRAZIL | High |
| 18 MARZANO ET AL (2018) RBS | Crowdsourcing solutions for urban mobility. | Keywords: Urban crowdsourcing; Citizensourcing; Urban mobility; Urban crowdsensing | FRANCE | High |

Source: authors, 2019.

As can be seen, the authors are not related to each other. As the use of this technology is recent, it can be assumed that this is due to the subject's novelty.

Next, reading the bibliographical references presented, it analyzed the relation between the studied themes and how the research brought the
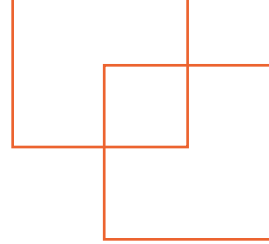
discussion of intelligent cities together with crowdsourcing. The design management theme was identified as a general gap because it does not have related articles in the same way as the other themes.

From these data, one can verify the evolution of the research over time. With them was elaborated the following chart 1.

Chart 1 - Incidence of articles per year
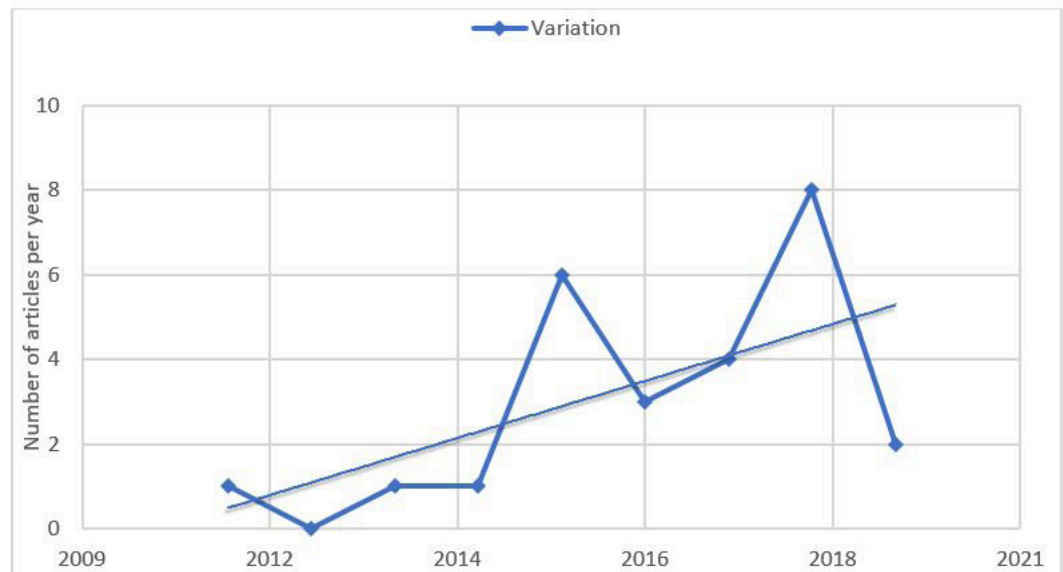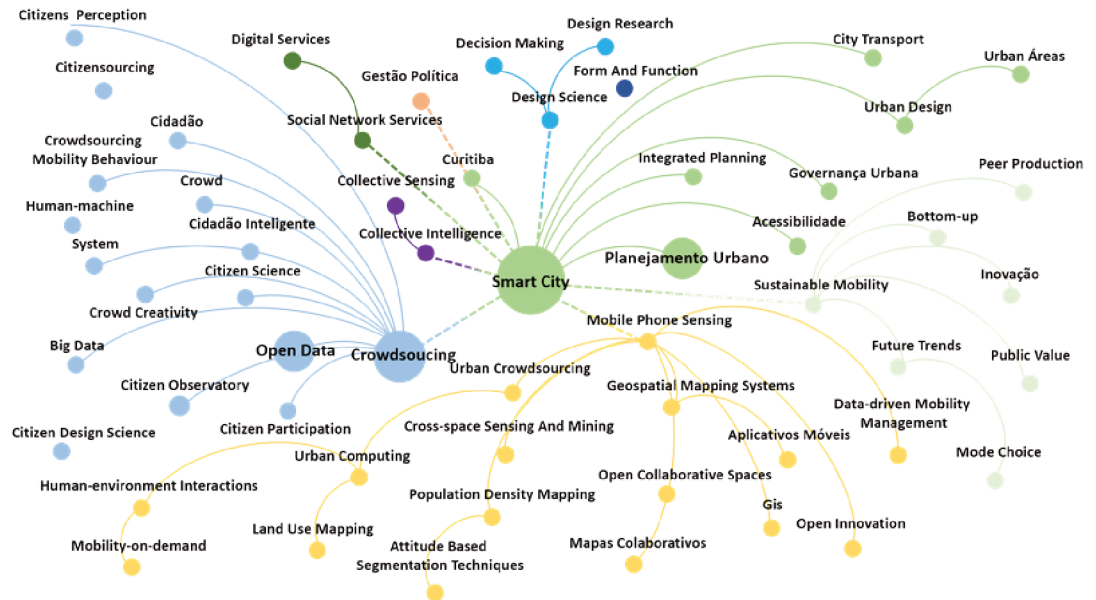


Source: Authors, 2020

In can be seen that the theme has been showing a very sharp general growth, proving to be a trend, with a rising production line.

Also, it is clear that in 2015, Google launched its autonomous car, the Waymo. With this, new issues began to appear in society, both in the field of information technology, urban planning and privacy issues (Maclvor, 2016)

Moreover, in 2018, the augmented reality was one of the most critical subjects in the field of technology, being used to predict social phenomena, study future scenarios and stimulate the use of games in smartphones, generating more and more data from users within the urban space (Carvalho & Canto, 2019). Therefore, the growth demonstrated regarding these themes can be explained, since it refers to a field of study that develops with technology advancement.

Another chart was also made to relate the themes approached according to the articles' keywords and their incidence. The result is shown in figure 1, below.

Figure 1: Influence between the themes in relation to the incidence in the periodicals.
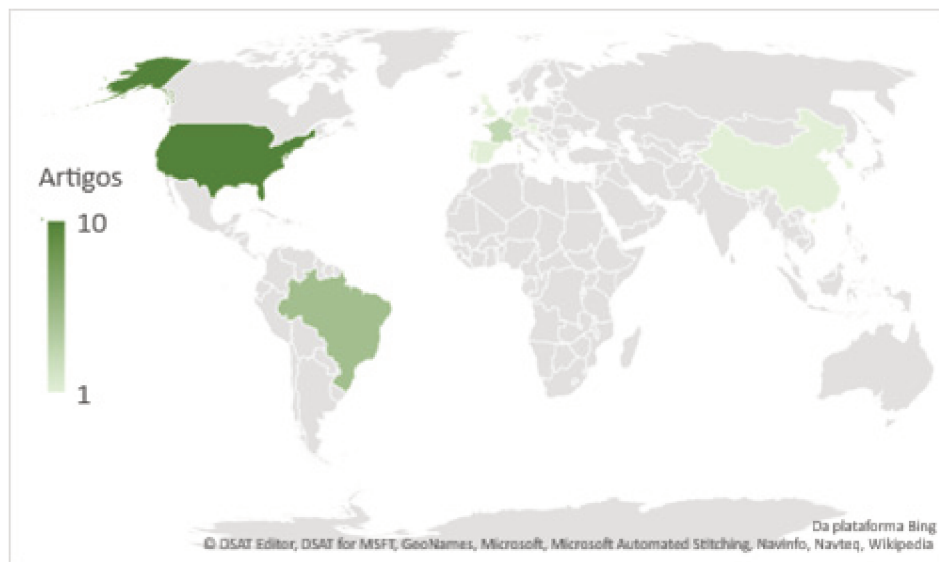


Source: Authors, 2020

The keyword that had the highest incidence in the articles was the smart city, with a total of seven times, followed by crowdsourcing, five times, and urban planning and open data with a total of two times. The other keywords were identified only once in the review. It is also noticeable that the articles related to design are still poorly articulated, demonstrating the importance of further studying the subject.

Another analysis was carried out, considering the places of publication. The number of published articles was computed regarding the origin of the work. They are presented, as shown in figure 2 below.

Figure 2 - Incidence of articles by country.



Source: Authors, 2020, based on Bing, 2020.

Figure 2 shows a significant concentration of the works in the United States of America, followed by the Brazilian results and French ones. This can be explained first because large information technology companies such as Microsoft, Oracle, Apple, Google, and SAP are mostly located in Silicon Valley, USA.

Besides these companies in Brazil, which have branches in the national territory, there are also telephony companies that perform data monitoring and hold the information. This stands out because cell phones in Brazil are relatively high, concerning its population.

Figure 2 also demonstrates that researchers from European countries deal with the theme, as much as from Asia, with information technology and communication companies located in China and Japan. Therefore, the subject has been treated with particular emphasis in these locations.

After these analyses, with the texts[2] full reading as a complementary step, the data were again systematized in Table 2, below. The central focus of the studies was highlighted, according to Fialkowski & Kistmann (2018).

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2    LEMOS(2018); 2 - RIZZON,BERTELLI(2017); 3- CAPDEVILA E ZARLENGA (2015); 4 - MACKE(2018); 5 - NETO (2018); 6 - CLEDOU(2017); 7 - PRANDI(2014); 8 - Blaschke(2011); 9 - STELZLE(2017); 10 - CROOKS(2015); 11 - MUELLER et al(2018); 12 -  PETERSEN(2013); 13 - SEMANJSKI(2016); 14 - FLORES(2017); 15 - MERGEL(2015); 16 - DI SANTO(2015); 17 -  COSTA(2015)RBS; 18 - MARZANO ET AL (2018) RBS; 19 - PASCHOAL (2017) RBS; 20 - GUO ET AL. (2015) RBS; 21 - KESERU (2018) RBS; 22 - STEPHENNE ET AL. (2016) RBS; 23 - MASSOBRIO (2018) RBS; 24 - LAU ET AL (2019) RBS; 25 - ARTS ET AL. (2016) RBS; 26 - LIU ET AL (2018) RBS; 27 - PAPAGEORGIOU ET AL ( 2019).
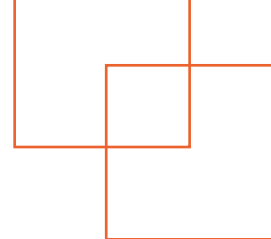
Table 2 - Classification of articles by focus

| Tópicos Foco | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a) Smart Cities Development | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 30 |
| b) Role of generated data | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 29 |
| c) Crowdsourcing process in the city | 1 | 0 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 25 |
| d) Citizen as sensor | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 24 |
| e) Analyze for data use | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 28 |
| Subtotal | 6 | 5 | 9 | 6 | 9 | 6 | 10 | 9 | 10 | 10 | 10 | 9 | 7 | 7 | 9 | 7 | 8 | 9 | 7 | 9 | 6 | 9 | 7 | 10 | 8 | 9 | 7 | 137 |

Source: Authors, 2019.

The interest of this research determined the definition of the focus in this table. Thus, the differences and similarities between the surveys were observed, divided between the most important and least important. The articles were then analyzed according to the following topics: Development of intelligent cities; Role of data generated; Crowdsourcing process in the city; Sensor citizen; and Analysis for data use.

The result of this table 2 points out that the focus on generated data and sensor citizen's role were identified as the main ones when reading the articles.

Another analysis was performed: according to the support themes found (Fialkowski & Kistmann, 2019). According to this research's interest, the type of approach used for its realization was considered to support. They were then scored with a score from 0 to 2, for each of the five topics listed, as in table 3.
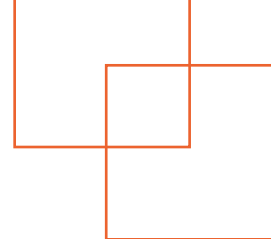
Table 3: Classification of articles by support.

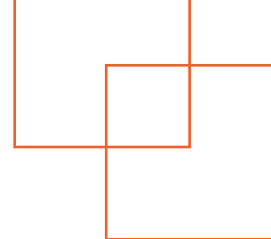| Tópicos Apoio | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| f) Development of mobility applications | 1 | 1 | 1 | 0 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 0 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 19 |
| g) Usability of spaces | 0 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 20 |
| h) Involvement of public authorities | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 25 |
| i) History and Chronology | 0 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 17 |
| j) Concept | 0 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 2S |
| Subtotal | 3 | 8 | 7 | 6 | 7 | 9 | 7 | 6 | 8 | 6 | 7 | 7 | 5 | 5 | 6 | 6 | 8 | 7 | 5 | 8 | 5 | 7 | 6 | 7 | 7 | 6 | 6 | 111 |

Source: Authors, 2020.

In the group support, the most identified issues were: development of mobility applications; usability of spaces, public power; history and chronology; and concept. The articles with the highest score were Lemos and Araújo (2018), Blaschke, Hay, Weng and Resch (2011) and Guo, Wang, Yu, Wan, Yen, Huang and Zhou (2015).

# 5 Discussion: design management, crowdsourcing and smart citizens

Based on the survey conducted with systematic and assistematic revision, followed by reading the texts listed in Table 1, the data were compiled and organized as follows.

Discussing the use of the term smart city, Capdevila and Zarlenga (2015) claim that it has been popularized in political speeches that consider citizens, even if translated into institutions such as users, tasters or clients instead of considering them producers of sources of creativity and innovation. The authors continue that "smart" urban policies refer to initiatives that use technologies to increase inhabitants' quality of life while contributing to sustainable development (Capdevila & Zarlenga, 2015).

Smart cities presuppose 'smart citizens' (Kresin, 2013). Sometimes he acts as a political activist, producing data to question the status quo, sometimes he is just an information provider. One can think of this intelligent citizen as a 'citizen-sensor' capturing and producing information

as he moves through urban space, either in the form of primary data, as in some examples of the use of Smart-Kits4 using government websites or applications to send (Lemos, 2018).

In this sense, the citizen's role in cities is developing as a tool for understanding the user space and their needs. With this, the exchange of information and technological communication offered artifices to plan and exercise their citizenship. From this point of view, the idea of the "intelligent citizen, as a provider of information for government interaction and users of urban spaces, makes applications a mediator between the two (Lemos, 2018).

But what Lemos (2018) advocates as a sensor citizen goes beyond applications using questionnaires and qualitative evaluation. Besides these, the site's usability and how the user used the environment is indirect-acting as non-explicit monitoring. With the growing use of applications for locomotion, users are continually producing qualitative and quantitative data.

Regarding the use of data by cities, Blaschke (2011) refers to the city as a complex system of numerous components interacting and involving multiple spatial and temporal scales. In the article, the author reports that it becomes impossible to capture and analyse this generated data as a result of the countless activities within this system. The work shows the perspective of some tools that, if used correctly, can come close to the objective of understanding most of the data. This is related to the aforementioned article, in which the censor citizen is mentioned (Lemos, 2018). Both identify the human being beyond the user, but rather a tool for discovering their needs within space.

With the identification of domains and properties through crowdsourcing, data have become a market value. For this reason, some scholars on the subject have created the term surveillance capitalism, which means the use of behavioural data as products disputed by large companies to direct their marketing to the target audience (Zuboff, 2019). On the other hand, it can be seen that the use of information and communication technologies help cities to create competitive advantages, making use of collective and technological human capital. In this way, it is observed that the data collected feeds public policies, to improve their projects from the planning phase to the monitoring of environments and measures in use by the population (Trindade, Hinning, Costa, Marques, Bastos, & Yigitcanlar, 2017).

Large companies use crowdsourcing to develop their products. From the technology of today's smartphones, which can support a wide range
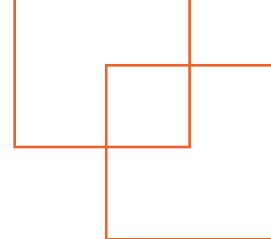
of mobility applications, data can be collected by the accelerometer of a smartphone and used to detect if a person is crossing a street and also if there are pedestrian traffic lights. Besides, cell phone towers can be used to detect and collect people's movement paths, and geographic fence applications can be implemented to request users' information when they enter, leave or remain in some geographic regions (Marzano & Wagtenigen, 2019). Concerning the crowdsensing segment, the tool with the character of urban information of location and user perception by the city space stands out (Guo, et al., 2015).

The data generated can be classified into 4 types, according to Crooks, Jenkins, Croitoru (2015): the form and function of urban data generated by users of space, explicit and implicit, which have the traditional and crowdsourced way. According to the author, mapping, records, and recordings are explicit typologies. The implicit typologies of the form can be geonarrative and tour guides. As a function, they are travel guides.  In the crowdsourced typology, the assumed form is given by geolocation and open-source.
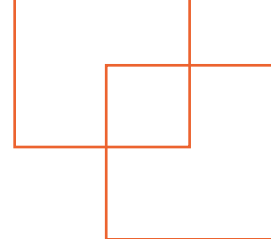
As an example of crowdsourcing, Prandi (2016) presents an analysis of the mapping of the use of public transportation from the users' tickets, to improve the service offered. With mobile applications, much more data can be generated by users, contributing to urban planning and development of more useful and intelligent products for the population. This scenario transforms the user into a data generator, allowing the monitoring of environments and interacting with smart systems (Rizzon & Bertelli, 2017).

The activity of creating applications for citizen data extraction can be based "either on their most banal daily actions, such as taking a bus or on a more active participation in public life, such as participating with opinions in the definition of the municipal budget or sending opinions on urban infrastructure problems" (Lemos, 2018, p.2).

Macke et al. (2018) analyze the case study in the city of Curitiba relating its development as a smart city related to its residents' quality of life. He mentions that the city is considered among the 10 smart cities in the world, being green and friendly. One of the city's implementations cited by the article is the example of the connection between public transportation and 3G broadband.

In the researches, it is clear the necessity of innovation in the management of the cities. Capdevila and Zarlenga (2015) describe that in cities, as complex ecosystems, companies with different interests collaborate to develop more sustainably.

In this sense, the amount of accessible, big data generating

technologies available adds to the development of intelligent cities and emphasizes that communication technology is the backbone of new tools (Lau, Marakkalage, Zhou, Hassan, Yuen, Zhang, &Tan, 2019).

With the growing demand for answers and solutions to the problems that arise and technological development, Alperstedt and Rolt (2018) surveyed to gather information and data within the cities to create an application that would assist in planning.

Cledou, Estevez and Barbosa (2018) have already paid attention to the need for greater rigour when it comes to analyzing data and putting them into practice in projects. There is a need to specify and contextualize the public policies to be implemented and their results in the population's life. The study made presents the taxonomic dimension of the terms used in the research and how the correct understanding facilitates the projects' success.

In the same way that the user can collaborate with the data, companies and the government must provide tools to make this possible. Stelzle, Jannack and Noennig (2017) refer to the act of collaboration as co-design and co-decision. The help of the user becomes the very process of design of the environment. The authors continue to describe other methods and tools and how the process within them can help or hinder research.

The concept of building through the data generated and ceded is considered both in the technological field of platforms, as described by Petersen and Hussain (2012) in their research on crowdsourcing in design, or as Mueller, Chirkin, Klein & Schimitt (2018). They talk about the role of the citizen and their feedback from the space and their contributions. The authors say that the growing focus of technology has taken the direction away from users' power at the time of planning.

Semanjski and Gautama (2016) demonstrate in their research a more significant concern with this data related to urban mobility, specifically operability, observing the use of applications to acquire information and translate into improvements in road infrastructure. And Mergel (2014) and Di Santo, Kanashiro, Di Santo and Saidel (2015) describe the importance of the government being involved in data development. However, Mergel (2015) warns that public and private initiative software can contribute to a more accurate reading of urban space through the information collected.

Along with the articles, it was possible to observe similarities and differences of current cities and identify what is necessary for a city to be considered a smart city.
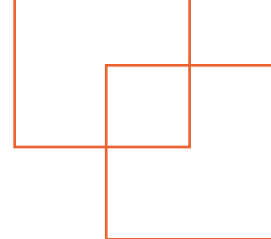
# Final considerations

Considering the objective of this research to analyze state of the art through a systematic bibliographic review, related to crowdsourcing, design management, and smart cities, thinking about the situation of Curitiba, the study shows, through the growth of the themes and the possibility of improving the lives of citizens, its relevance in the academic environment. It also shows that design is an essential element in constructing a smart city focused on its citizens, highlighting the need to deepen its management role.

It is noticeable that the time clipping shows a growth in the number of works in recent years: in 2013 and 2014 we found only 1 article for each year, while in 2018 there were 4. The principal authors, by the survey, were Stelzle et al. (2017) and Prandi (2014), although Lemos (2018) has brought interesting contributions regarding the inclusion of the citizen in the design process.

The articles bring two main themes: the use of technology and the role of the user. In the latter case, the work highlighting how citizen participation can improve development and projects focused on urban space stands out. The study sought to identify gaps and emphases regarding the tripod design management, smart cities, and crowdsourcing for Curitiba.

One of the articles dealt with design management's theme concerning the city, emphasizing that Curitiba is seen as a smart city by the initiatives of public power and welfare of the population.  No article has brought the theme of design management, and none has associated with it the crowdsourcing. Future studies can be carried out to understand why the pieces are not yet related since they benefit society.  Research has shown that there is no research pertaining to crowdsourcing, design management, and urban planning concerning the gaps. Topics are treated in pairs, such as crowdsourcing and urban planning and smart cities with design management.

No articles were found focusing on crowdsourcing as a methodology and aid in the design management process, specifically related to smart cities. This analysis shows that the professionals who plan the cities, companies and academia still do not focus on the study of available data. This factor is considered necessary because smart cities have communication and information exchange as a differential. When investigated from the perspective of the relationship with smart cities, the term crowdsourcing is found in works that demonstrate that this relationship begins to be studied in further research with applications directed to urbanism. This content
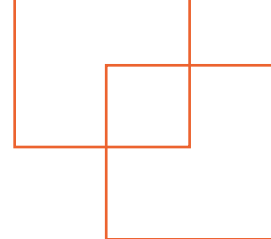
is given through the typologies of analysis and data collection in urban space, digital innovations for the improvement of cities, identification of the citizen as a data producer and other factors cited throughout the articles analyzed. Perhaps this aspect can be considered a new emphasis since the selected works are still small.

The search for an innovative ecosystem, based on crowdsourcing of participatory use is still little explored in the literature studied. However, this possibility is considered an essential point for innovation and citizens' quality of life. Management and planning are crucial factors mentioned for developing public policies to be implemented with results in the population's life. On the other hand, design management is not addressed in any of them, nor is the operational level found. Likewise, topics such as ethics in the use of data, privacies and even how these data are implemented in city planning were not identified in the analyzed articles.

With this research, it was possible to identify the potential that the current field of technology, urban planning and design management can improve society.
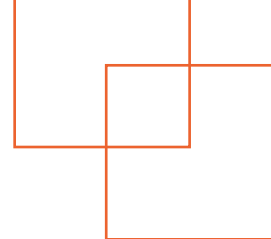
## References

ALPERSTEDT, A. et al.  Acessibilidade e Tecnologia na Construção da Cidade Inteligente. **Revista de Administração Contemporânea,** Rio de Janeiro, v. 22, n. 2, p. 291-310, 2018.

BLASCHKE, T.; HAY, G. J.; WENG, Q.; RESCH, B. Collective sensing: Integrating geospatial technologies to understand urban systems-An overview. **Remote Sensing**, Austria, V. 3, p. 1743-1776, 2011. Disponível em:  http://qihaoweng.net/refereed%20journal/Blaschke%20et%20 al.%202011%20Remote%20Sens..pdf Acesso em: 20 out. 2019

CAPDEVILA, J., & ZARLENGA, M. I. Smart city or smart citizens? The Barcelona case. **Journal of Strategy and Management**, Inglaterra,  v. 8, n. 3, p. 266-282, 2015. Disponível em: https://www.researchgate.net/ publication/277180909_Smart_City_or_smart_citizens_The_Barcelona_ case . Acesso em: 20 jin. 2019.

CETAX. **Big Data.** Disponível em: <https://www.cetax.com.br/blog/ big-data/> Acesso em: 13 dez. 2019

CLEDOU, G.; ESTEVEZ, E.; SOARES BARBOSA, L.  A taxonomy for planning and designing smart mobility services. **Government Information Quarterly,** Holanda, v. 35 p. 61–76, 2018. Disponível em: https://collections.unu.edu/view/UNU:7433 . Acesso em: 23 jun. 2019

CONFORTO, E. C.; AMARAL, D. C.; SILVA, S. Roteiro para a revisão bibliográfica sistemática: aplicação no desenvolvimento de produtos e gerenciamento de projetos. Trabalho apresentado no 8° Congresso Brasileiro de Gestão de Desenvolvimento de Produto. **Anais...**, Porto Alegre: IGDP, 2011.

CROOKS, A. Crowdsourcing urban form and function. **International Journal of Geographical Information Science,** Reino Unido, v. 25, p. 1-22, 2017. Disponível em: https://www.researchgate.net/publication/273099707_Crowdsourcing_urban_form_and_function. Acesso em: 20 fev. 2020

DAROS, C. **Gestão de Design & Cidades Criativas Gestão de Design & Cidades Criativas.** 2018, f. 270 Tese (Doutorado em design) – Programa de Pós Graduação em Design, Universidade Federal do Paraná, Curitiba , 2018.

FUMAYAMA, A. **Crowdsourcing: como utilizar a inteligência coletiva em prol do seu negócio.** Disponível em: <https://digitalents.com.br/crowdsourcing-como-utilizar-a-inteligencia-coletiva-em-prol-do-su-negocio/>. Acesso em: 15 ago. 2019.

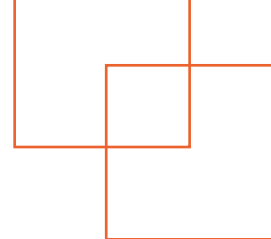GEHL, J. **Cidades Para Pessoas.** SãoPaulo: Perspectiva, 2015.

GORB, Peter. The business of design management. Design Studies, Inglaterra, v.7, n.2, p. 106-110, 1986. Disponível em: https://www.sciencedirect.com/science/article/abs/pii/0142694X . Acesso em: 25 nov. 2010

GUO, B. Mobile Crowd Sensing and Computing: The Review of an Emerging Human-Powered Sensing Paradigm. **ACM Computing Surveys.** China, v. 48, n. 1, p. 01-30, 2015. Disponível em: https://www.researchgate.net/publication/282161106_Mobile_Crowd_Sensing_and_Computing_The_Review_of_an_Emerging_Human-Powered_Sensing_Paradigm. Acesso em: 12 fev. 2020

HOLLANDS, R. Critical interventions into the corporate smart city. **Cambridge Journal of Regions Economy and Society.** Inglaterra, 2014. Disponível em: https://www.researchgate.net/publication/273499619_Critical_interventions_into_the_corporate_smart_city. Acesso em: 11 maio 2020

KRESIN, F. Design Rules for Smarter Cities. **Smart Citizens.** Inglaterra, 2012 Disponível em: https://www.researchgate.net/publication/320172156_Design_Rules_for_Smarter_Cities. Acesso em: 20 Maio 2020

LARA, A. et al. Smartness that matters: towards a comprehensive and human-centred characterisation of smart cities. **Journal of Open**

**Innovation: Technology, Market, and Complexity.** Disponível em: https://www.researchgate.net/publication/305775049_Smartness_that_matters_towards_a_comprehensive_and_human-centred_characterisation_of_smart_cities. Acesso em: 10 13 maio 2020. DOI: 10.1186/s40852-016-0034-z

LAU, P.; MARAKKALAGE, H. A Survey of Data Fusion in Smart City Applications. Information Fusiuon, Estados Unidos, v.2 p. 357–374. 2019 Disponível em: https://www.researchgate.net/publication/333444718_A_Survey_of_Data_Fusion_in_Smart_City_Applications. Acesso em: 25 fev. 2020.

LEMOS, A; ARAÚJO, N. Cidadão Sensor e Cidade Inteligente: Análise dos Aplicativos Móveis da Bahia. **Revista Famecos,** Porto Alegre, v.25, n. 3 , p. 1-19, 2018. Disponível em: http://revistaseletronicas.pucrs.br/ojs/index.php/revistafamecos/article/view/28708> Acesso em: 12 mai. 2019.

MACKE, J; CASAGRANDE, R. M., SILVA, K. A. Smart city and quality of life: Citizens' perception in a Brazilian case study. **Journal Of Cleaner Production,** Porto Alegre, v. 25, p. 717-726, p. 648-665, 2019. Disponível em: http://revistaseletronicas.pucrs.br/ojs/index.php/revistafamecos/article/download/28708/17204> . Acesso em: 13 mai. 2019

MARZANO, G.; LIZUT, J.; SIGUENCIA, L. O. Crowdsourcing solutions for supporting urban mobility. **Procedia Computer Science,** França, v. 149, p. 543 - 547 Disponível em: https://www.researchgate.net/publication/331692568_Crowdsourcing_solutions_for_supporting_urban_mobility. Acesso em: 10 dez. 2019

MERGEL, I. Opening Government: Designing Open Innovation Processes to Collaborate With External Problem Solvers. **Social Science Computer Review.** Estados Unidos, v. 1, p. 599–612, 2015. Dsiponível em: https://pdfs.semanticscholar.org/1092/1e5c7020d10478c3c22105c7d924e8dff269.pdf> . Acesso em: 12 mai. 2019

MOZOTA, B; KIM, B.Y. Managing Design as a Core Competency: Lessons from Korea. Design **Management Review,** Estados Unidos, v. 20, p. 67-76, 2009. Disponível em: http://www.cdcm.dk/wp-content/uploads/2012/11/Managing-design-as-a-core-competency-Lessons-from-Korea-Mozota-Kim-2009.pdf. Acesso em: 18 dez. 2019

MOZOTA, B. B.; KLÖPSCH, C.; COSTA, F. C. X da. **Gestão do design: usando o design para construir valor de marca e inovação corporativa.** Porto Alegre: Bookman Editora, 2011

MUELLER, J., LU, H., CHIRKIN, A., KLEIN, B., SCHMITT, G. Citizen Design Science: A strategy for crowd-creative urban design. **Cities,** Inglaterra, v. 72, p. 181–188, 2018. Disponível em: https://www.sciencedirect.com/
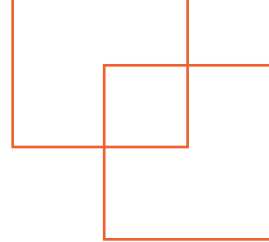
science/article/pii/S0264275117304365> . Acesso em: 16 dez. 2019

NETO, C. Acessibilidade e Tecnologia na Construção da Cidade Inteligente. **Revista de Administração Contemporânea**, Rio de Janeiro, v. 22, n. 2, p. 291-310, 2018.

PALMIERI, A.; FIGUEIREDO, L., F. Função própria e pertinente da gestão de design. **Revista DAPesquisa,** Florianópolis. v. 7, p. 498-509, 2012. Disponível em: http://www.revistas.udesc.br/index.php/dapesquisa/article/view/13978. Acesso em: 10 dez. 2019

PEREIRA, A. P; PROCOPIUCK, M; FONSECA, M.; OLIVEIRA, R. Espaço Público: Reconfigurações Físicas E Percepções De Usuários Em Perspectivas De Longo Prazo. **Revista Arquiteturas**, Porto Alegre,  v. 15, p. 117-137, 2018. DOI: 10.4013/arq.2019.151.07 Disponível em: http://revistas.unisinos.br/index.php/arquitetura/article/viewFile/arq.2019.151.07/60746947>. Acesso em: 10 dez 2019.

PETERSEN, S. I. Crowdsourcing in Design Research - Potentials & Limitations. **International Conference on Engineering Design,** Estados Unidos, v.3, p. 1–9, 2013. Disponível em: https://www.researchgate.net/publication/301202682_Crowdsourcing_in_Design_Research_-_Potentials_Limitations>. Acesso em: 05 out. 2019

PRANDI, C. **Participatory Sensing and Crowdsourcing in Urban Environment.** F. 143, Tese ( Doutorado em Informática)- Informática, Universidade de Bolgna. 2016. Disponível em: http://amsdottorato.unibo.it/7490/1/prandi.pdf>. Acesso em: 10 mai. 2019
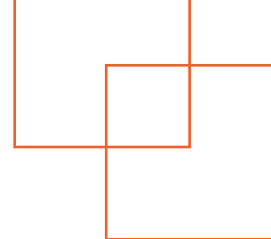
REIS, M., SERRES, J. Fenômenos culturais no amálgama social.  **CIPCS,** Brasil,  v.1, p. 849-851, 2018.

RIZZON, F. et al. Smart City: um conceito em construção. **Revista Metropolitana de Sustentabilidade**, São Paulo, v. 7, p. 124-142, 2017. Disponível em: http://www.revistaseletronicas.fmu.br/index.php/rms/article/view/1378. Acesso em: 10 mar. 2019

SEMANJSKI, I., & GAUTAMA, S. (2016). Crowdsourcing mobility insights – Reflection of attitude based segments on high resolution mobility behaviour data. **Transportation Research Part C: Emerging Technologies,** 71, 434–446. https://doi.org/10.1016/j.trc.2016.08.016

SMART CITIES COUNCIL. **Smart Cities Readiness Program .**Disponível em: https://smartcitiescouncil.com/. Acesso em: 22 de Maio 2020

STELZLE, B. et al. Co-Design and Co-Decision: Decision Making on Collaborative Design Platforms. **Procedia Computer Science.** Holanda, V. 112, p. 2435-2444, 2017. Disponível em:https://www.researchgate.net/publication/319446826_Co-Design_and_Co-Decision_Decision_Making_on_Collaborative_Design_Platforms

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TRINDADE, P. et al. Sustainable development of smart cities: a systematic review of the literature. **Journal of Open Innovation: Technology,** Market, and Complexity, México, P. 2-14, 2017. Disponível em: https://jopeninnovation.springeropen.com/articles/10.1186/s40852-017-0063-2. Doi: 10.1186/s40852-017-0063-2

YIGITCANLAR, T. et al, Understanding 'smart cities': Intertwining development drivers with desired outcomes in a multidimensional framework, **Cities,** 2018. Disponível em: https://www.researchgate.net/publication/324747061_Understanding_'smart_cities'_Intertwining_development_drivers_with_desired_outcomes_in_a_multidimensional_framework. Acesso em: 10 abri. 2020. DOI: 10.1016/j.cities.2018.04.003

ZUBOFF, S. **Um capitalismo de vigilância.** Le mondeDiplomatique. 2019. Disponível em: https://diplomatique.org.br/um-capitalismo-de-vigilancia/. Acesso em: 10 maio 2020

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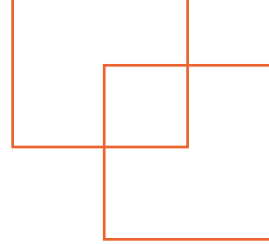
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