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On Smart Cities and Sustainable Development Goals

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Abstract
The theme smart cities (SCs) appeared on the literature since the 1990s, and gained more visibility a decade later, when publications started to skyrocket. The United Nations launched the program sustainable development goals (SDGs), composed of 17 objectives, which purpose, in general terms, is the well being of life on the Planet. Both themes, SCs and SDGs, were born to be "soulmate' themes, once they have the same purpose of study: the wellness of human being. The purpose of this paper is to find the connections between these two themes. To achieve this purpose, a systematic literature search was done, and the content analysis was performed on the titles and abstracts of the works found. The results show that, by analyzing the concepts and definitions of SCs, there is not a direct mention of the SDGs on the works. However, an indirect connection between SCs and SDGs can be inferred by analyzing the whole works on SCs, which is a suggestion for future works.

1   Introduction

Humans are gregarious beings, and have lived in communities ever since the beginning of human History. Together, man hunted, build houses, procreated. With the event of the First Industrial Revolution, villages and towns had an explosion in growing, and big cities started popping, especially close to rivers, where industries settled down to use the hydropower force.

Cities play in important role on economic and social aspects on the sustainable development (Mori & Christodoulou, 2012). This is explained once cities are systems with a complex

metabolism, which has inputs of goods, products, raw material, energy and so on; consumes all these and other resources, and transform them into outputs, which might be products, goods, energy, and a lot of waste also.

In an overall way, we can classify the resources present in the inputs, in the black box, and in the outputs as: human (as resources and clients), energy, raw material, industrialized products, ICT, environmental elements, among others that one can add.

The challenges a city might have are many. One of them is that, along with the other outputs, there is a large amount of waste, which many cities, especially in developing countries, do not have a final adequate destination for it yet.

Having these and other challenges on the agenda, the studies on SCs started on the literature around 1991. The theme had its faster growing only a decade later. When the theme emerged on literature, in the 1990s, it was mostly used to define a city using a complex system of ICT and modern technologies (Alawadhi et al., 2012). The concepts evolved, and many definitions are provided in the literature. Table 1 presents the different definitions and concepts of smart city (SC), in an evolutionary approach, starting from the year 2000. For each definition, we provided the core terms present on each definition, in a way to synthesize the conceptions of the authors.

Table 1 Evolution of SCs concept

Core terms	Definition and concepts	Authors / year
Infrastructures	Monitors and integrates conditions of all of its critical infrastructures, including roads, bridges, tunnels, rails, subways, airports, seaports, communications, water, power, even major buildings, can better optimize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens.	Hall (2000)
Human, economy, environment and governance.	Well performing […] in economy, people, governance, mobility, environment, and living, built on the smart combination of endowments and activities of self-decisive, independent and aware citizens. SC generally refers to the search and identification of intelligent solutions which allow modern cities to enhance the quality of the services provided to citizens.	Giffinger, Fertner, Kramar, Kalasek, Pichler-Milanovic, and Meijers (2007)
Technology, social, and business.	Smart community which makes a conscious decision to aggressively deploy technology as a catalyst to solving its social and business needs – will undoubtedly focus on building its high-speed broadband infrastructures, but the real opportunity is in rebuilding and renewing a sense of place, and in the process a sense of civic pride.	Eger (2009)
Infrastructure, IT, social and business.	A city connecting the physical infrastructure, the IT infrastructure, the social infrastructure, and the business infrastructure to leverage the collective intelligence of the city.	Harrison, Eckman, Hamilton, Hartswick, Kalagnanam, Paraszczak, and Williams (2010)
Smart computing technologies, city management (education, real state, transportation, and healthcare)	The use of Smart Computing technologies to make the critical infrastructure components and services of a city—which include city administration, education, healthcare, public safety, real estate, transportation, and utilities—more intelligent, interconnected, and efficient.	Washburn, Sindhu, Balaouras, Dines, Hayes, and Nelson (2010)
Infrastructures for daily quality of life.	SCs will take advantage of communications and sensor capabilities sewn into the cities' infrastructures to optimize electrical, transportation, and other logistical operations supporting daily life,	Chen (2010)

	thereby improving the quality of life for everyone.	
Sustainable development (TBL approach), modern infrastructure.	SCs of the future will need sustainable urban development policies where all residents, including the poor, can live well and the attraction of the towns and cities is preserved. [...] SCs are cities that have a high quality of life; those that pursue sustainable economic development through investments in human and social capital, and traditional and modern communications infrastructure (transport and information communication technology); and manage natural resources [...] sustainable, converging economic, social, and environmental goals.	Thuzar (2011)
Human, social, economic, infrastructure, governance.	A city is smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance.	Caragliu, Del Bo, and Nijkamp (2011)
Economy, quality of life, knowledge workers and talent attraction.	Creative or SC experiments [...] aimed at nurturing a creative economy through investment in quality of life which in turn attracts knowledge workers to live and work in SCs. The nexus of competitive advantage has [...] shifted to those regions that can generate, retain, and attract the best talent.	Thite (2011)
Information management, infrastructure, quality of life, energy conserving.	Infuses information into its physical infrastructure to improve conveniences, facilitate mobility, add efficiencies, conserve energy, improve the quality of air and water, identify problems and fix them quickly, recover rapidly from disasters, collect data to make better decisions, deploy resources effectively, and share data to enable collaboration across entities and domains.	Nam and Pardo (2011)
Connectivity, information, new Technologies, sustainable, competitive and innovative, life quality.	SC as a high-tech intensive and advanced city that connects people, information and city elements using new technologies in order to create a sustainable, greener city, competitive and innovative commerce, and an increased life quality.	Bakıcı, Almirall, and Wareham (2012)
Technologies, integration, sustainable.	Being a SC means using all available technology and resources in an intelligent and coordinated manner to develop urban centers that are at once integrated, habitable, and sustainable.	Barrionuevo, Berrone, and Ricart (2012)
Knowledge management, infrastructure performance, communication, and entrepreneurial.	Result of knowledge-intensive and creative strategies aiming at enhancing the socio-economic, ecological, logistic and competitive performance of cities. Such SCs are based on a promising mix of human capital (e.g. skilled labor force), infrastructural capital (e.g. high-tech communication facilities), social capital (e.g. intense and open network linkages) and entrepreneurial capital (e.g. creative and risk-taking business activities).	Kourtit and Nijkamp (2012)
Productivity, human capital, planned output, creative, sustainable.	SCs have high productivity as they have a relatively high share of highly educated people, knowledge-intensive jobs, output-oriented planning systems, creative activities and sustainability-oriented initiatives.	Kourtit, Nijkamp, and Arribas (2012)
Technology, connectivity, security, sustainable.	A community of average technology size, interconnected and sustainable, comfortable, attractive and secure.	Lazaroiu and Roscia (2012)
ICT, human capital, environment.	The application of ICT with their effects on human capital/education, social and relational capital, and environmental issues is often indicated by the notion of SC.	Lombardi, Giordano, Farouh, and Yousef (2012)

Intellectual ability, "green", infrastructure, connectivity, economy, information, human capital.	A SC is understood as a certain intellectual ability that addresses several innovative socio-technical and socio-economic aspects of growth. These aspects lead to SC conceptions as "green" […] urban infrastructure for environment protection and reduction of CO2 emission, "interconnected" […] revolution of broadband economy, "intelligent" […] to produce added value information from the processing of city's real-time data from sensors and activators […] "innovating", "knowledge" cities […] refer to the city's ability to raise innovation based on knowledgeable and creative human capital.	Zygiaris (2013)
Data, IT, efficient services, collaboration, business innovative.	SCs initiatives try to improve urban performance by using data, and information technologies (IT) to provide more efficient services to citizens, to monitor and optimize existing infrastructure, to increase collaboration among different economic actors, and to encourage innovative business models in both the private and public sectors.	Marsal-Llacuna, Colomer-Llinas, and Melendez-Frigola (2014)
Economy, mobility, environment, people, governance, ICT.	SCs can be identified and ranked along six main axes or dimensions: a smart economy; smart mobility; a smart environment; smart people; smart living; and, finally, smart governance. These six axes connect the traditional theories of urban growth and development, with the modern aspect of sustainable development of a city. […] can be defined as "smart" when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic development and a high quality of life, with a wise management of natural resources, through participatory governance.	Greco and Cresta (2015) Caragliu and Njkamp (2009)
ICT, service efficiency, cost reduction, collaboration.	The concept considers the use of ICT to improve the efficiency of city services, to reduce costs and resource consumption, to address societal challenges and improve collaboration between citizens and government	Hudson, Kortuem, Wolff, and Law, (2016)
Resources, infrastructure, quality of life, ICT, TBL approach.	The concept envisions enhancing resource utilization and infrastructure available at a city in a sustainable fashion while improving the quality of life of its population. A city can be viewed as smart when investments on human and societal capital as well as on modern ICTs harmoniously contribute to sustainable economic development and improvements in citizens' quality of life through participative, engaged actions.	Cavalcante, Cacho, Lopes, and Batista (2017)
Data management, automation, collaborative spaces, inclusive, equal benefits for all.	A number of key characteristics are required in a SC: the city will be instrumented to allow the collection of increasing amounts of data about city life; the data from different sources and city systems will be available to be easily aggregated together to gain far greater insight into what is going on in the city […].	Basiri, Azim, and Farrokhi (2017)
Smart technologies for development.	A SC is conceptualized as the institutionalized and integrated application of smart technologies with a digital age mindset to the tasks and challenges of urban management. This definition includes institutional aspects and integration in order to emphasize the long-term commitment needed by governments to embrace technology for development.	Vu and Hartley (2018)
ICT, people, economy, governance, mobility, living and environment.	SCs are conceived as means of integrating the ICTs with the urban space and provide the city with solutions that enhance city's six dimensions: people, economy, governance, mobility, living and environment.	Anthopoulos, Fitsilis, and Ziozias (2019)

Source: The Author.

Also, it is not possible to define a SC with a single group of elements without considering all the other elements involved in a human grouping living together. Therefore, we here define a SC as one that is a human agglomeration living together in a geographical area, which is provided with natural and technological resources, that are managed in way to provide the satisfaction of human needs in an efficient and sustainable way, as such to provide quality of life for all the people there living, with gradual reducing the impacts of negative outputs in the environment, on the land or water.

In 2000, the United Nations (2015) launched the program Millennium Development Goals (MDGs). The program was concluded in 2015, when The Sustainable Development Goals (SDGSs) were then launched by UN. A brief of the SDGS are on Table 2.

Table 2 Sustainable Development Goals

Goal Number	Sustainable Development Goals	Description
1.	No poverty	Economic growth must be inclusive to provide sustainable jobs and promote equality.
2.	Zero hunger	The food and agriculture sector offers key solutions for development, and is central for hunger and poverty eradication.
3.	Good health and well-being	Ensuring healthy lives and promoting the well-being for all at all ages is essential to sustainable development.
4.	Quality education	Obtaining a quality education is the foundation to improving people's lives and sustainable development.
5.	Gender equality	Gender equality is not only a fundamental human right, but a necessary foundation for a peaceful, prosperous and sustainable world.
6.	Clean water and sanitation	Clean, accessible water for all is an essential part of the world we want to live in.
7.	Affordable and clean energy	Energy is central to nearly every major challenge and opportunity.
8.	Decent work and economic growth	Sustainable economic growth will require societies to create the conditions that allow people to have quality jobs.
9.	Industry, innovation and infrastructure	Investments in infrastructure are crucial to achieving sustainable development.
10.	Reduced inequalities	To reduce inequalities, policies should be universal in principle, paying attention to the needs of disadvantaged and marginalized populations.
11.	Sustainable cities and communities	There needs to be a future in which cities provide opportunities for all, with access to basic services, energy, housing, transportation and more.
12.	Responsible production and consumption	Responsible Production and Consumption.
13.	Climate action	Climate change is a global challenge that affects everyone, everywhere.
14.	Life below water	Careful management of this essential global resource is a key feature of a sustainable future.
15.	Life on land	Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss
16.	Peace, justice and strong institutions	Access to justice for all, and building effective, accountable institutions at all levels.
17.	Partnerships for the goals	Revitalize the global partnership for sustainable development

Source: UN (2015).

The SDGSs are a "call for action by all countries […] to promote prosperity while protecting the planet." (UN, 2015). The 17 goals that compose the SDGS an aims at implementing strategies on education, health, social protection, and job opportunities, while tackling climate change and environmental protection. The UN states the SDGSs are the blueprint to achieve a better and more sustainable future for all (2015).

By analyzing the concepts and definitions of SCs, we cannot infer other idea unless that both concepts, SCs and SDGS, are intrinsically and inexorably connected to each other.

Therefore, what does the literature tell us about this bond? The purpose of this paper is to find the connecting bonds between the themes SCs and SDGS. To achieve this objective, a systematic literature search aiming at mapping out the state of the art on SCs and SDGS was done. The results show that there is still more connections to be made.

This paper is composed of six sections. This present one, where we contextualized the themes under research, offered the concepts and definitions on SCs, and presented the objectives of this paper. The next section brings in detail the methodology used to achieve the objectives. In the sequence, Section 3 brings the results of the bibliometry. Analysis and discussion are presented on Section 4. Section 5 concludes the findings, and we finish the paper with the references used.

2   Methodology

Literature presents several protocols for systematic review. Amongst these protocols we mention the Handbook for identification and review of the scientific literature (NHMRC, 2000; Moher et al, 2009) the Cochrane Collaboration Model (Rosswurm & Larrabee, 1999; Higgins & Green, 2008) works of Tranfield et al. (2003), Kitchenham (2004), and Kitchenham et al. (2009); the Guide of SLR (Okoli and Schabram, 2010), Ralston et al. (2017), and, described by Higgins and Green (2001). The protocol PRISMA (2009) has its roots on the Cochrane Collaboration Model.

In essence, all of these works follow the same guidelines, firstly proposed by The Cochrane Collaboration Model, which was conceived for the health field, and which proposes the reading of all the works possible in the theme selected. Following the idea of Cochrane, Pagani, Kovaleski and Resende (2017; 2018) proposed the protocol named Methodi Ordinatio. Differently from Cochrane, Methodi Ordinatio is designed for those considered independent researchers, who cannot count on thousands of reviewers to perform his/her research. The reality of most of independent researchers is that they can only count on themselves for the research tasks. Therefore, a criteriously selection and exclusion of not relevant works must be done, as so his/her work can be completed.

Methodi Ordinatio, as applied in Campos, Pagani, Resende, and Pontes (2018); Stadler, Arantes, Halicki, and Safraiter (2017); Vaz, Macedo, Soares Junior and Bittencourt (2018); Barros, Salvador, Piekarski and De Francisco (2018); Salvador, Barros, Rosário, Piekarski and Francisco (2019), Silva, Kovaleski, and Pagani (2019), among others, is composed of nine steps. The systematic reading is the last step to be performed when the researcher already knows which are the most relevant works for his/her research.

In order to develop this present paper, Methodi Ordinatio was employed. However, since the objective is to map out the state of the art on SCs, only the first steps of the methodology were used. The steps used are described in the sequence.

Step 1: establishing the keywords for the search: the intention of this research was to map out the state of the art on the theme smart cities. Since we also wanted to study the correlation of smart cities and sustainable development goals, the combination of these terms were searched.

Step 2: Preliminary search: consists in testing the keywords in data bibliographic data bases in order to make an overall assessment of the findings concerning the data bases, time delimitation, and checking for terms and their combinations, as well as the best Boolean operators to be used for refining the search. The refining prevents works not related to theme to come along.

Step 3: Definition of keywords combinations, databases, and time delimitation: the combination of keywords and Boolean operators defined were "Smart Cities" OR "Smart City". These two combinations allowed reaching a broader number of works possible, and the search was delimited to find only works whose title contained the terms combined. The words "sustainable development goals" OR "SDGS" combined with "Smart Cities" OR "Smart City" returned no results in the title search. The bibliographic database used was Web of Science Clarivate Analyctics. The reason for selecting this database is because it offers an analytical tool to analyze the results, providing numbers concerning the publications aspects, such as number of papers per country/region, areas of research and so on. We did not delimit a period of time for the search, so that we could better evaluate the year when the theme started being studied.

Step 4: Final search on database: using the elements defined on Step 3, we proceeded with the final search. Still on the database website, we applied the tools to find the numbers regarding the aspects of the publication, which are presented in the results. To collect the data, we used the reference manager Mendeley. This previous search found 2.956 works whose titles contained the combination of keywords "Smart Cities" OR "Smart City". However, as mentioned before, no results were found matching the themes smart cities and sustainable development goals.

Step 5. Filtering procedures: in the reference manager Mendeley, we checked for duplicates, and there were none.

The Methodi Ordinatio steps used were until number 5, enough for us to continue the work as wanted.

The results are presented in two subsections, the first using the data obtained from Methodi Ordinatio, and the second from VOSviewer. VOSviewer is a free software, that uses the data collected by a reference manager to draw maps of words, authors, and keywords.

3   Results

Results will be presented into two subsections. The first subsection presents the results obtained from the bibliometry on SCs and SDGs, done on the Web of Knowledge data base.
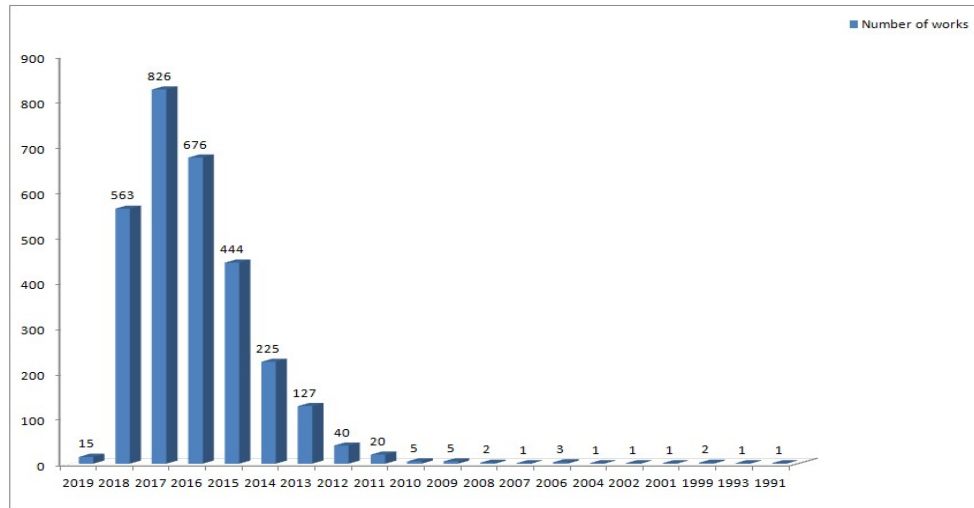
3.1   Bibliometry: mapping the scientific production on SCs related to SDGS

The search returned results only for the combination "Smart Cities" OR "Smart City", with 2.956 works. Regarding the combination of "smart cities" AND "SDG" OR "Sustainable Development Goals" no papers were found.

The first point to present is the number of papers published by year. The theme first appeared in 1991, with a single publication (Fig.1). Numbers started increasing timidly from 2011, reaching a tremendous amount in 2017, with 826 works published. In 2018 this number diminished considerably. The reason for that might be several: changing in the name of the theme or

migration for other more specific subjects related to SCs, but the reasons should still be investigated, which is not the purpose of this paper.

Figure 1 Number of papers per year

Most of the works, 58%, were presented in events, like conferences, congress and the like (Fig. 2). The analysis showed 25 names of the events where there were more than 7 works presented. Besides the 25, other 925 names for events, with one works presented at each one, were found. Therefore, it is possible to infer that such events draw the interest of a diverse public, considering the large number of them. Articles in journals are the second choice for publication, with 36%. Editorial material represents only 5%.

Figure 2 Type of document
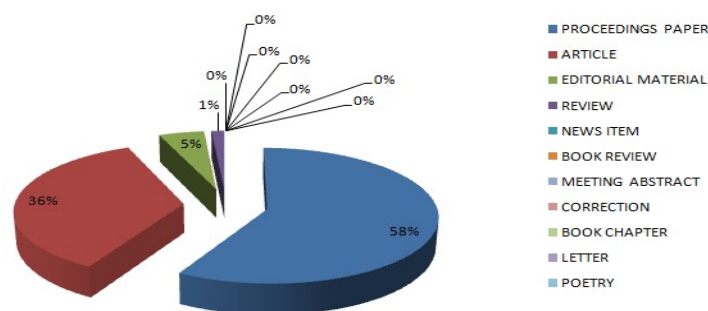
According to the information on Figure 3, the countries that presented a higher number of publications by its researcher's nationality were respectively Italy, with 391 works; China, with 374; USA, with 327; Spain, with 277; India, with 200; and England, with 199. From Latin American countries, Brazil is the only country representing the region, with 86 works.

Figure 3 Publications by country / regions
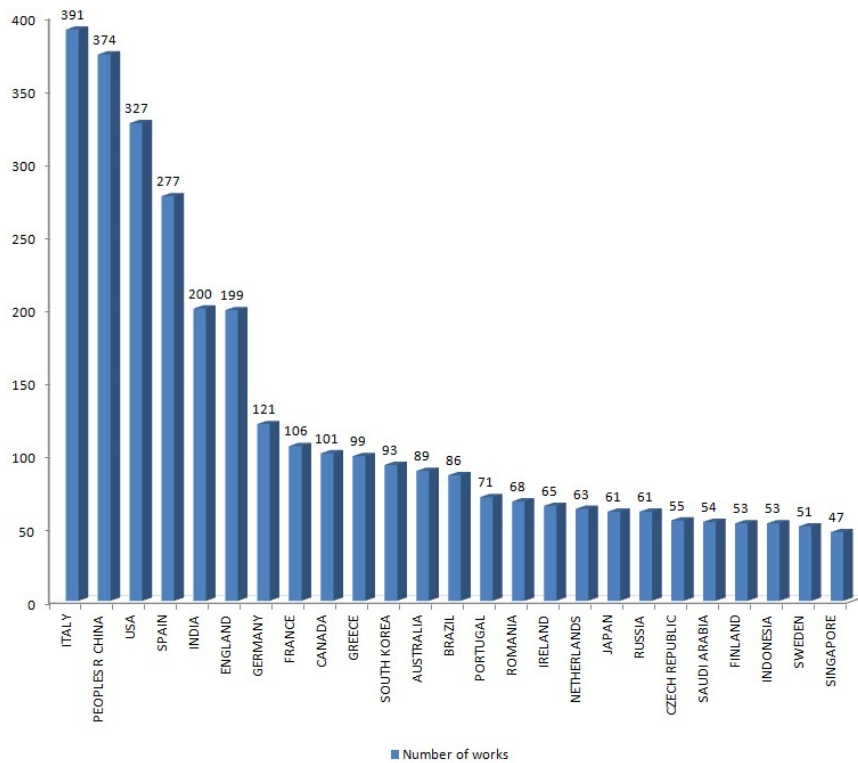
Source: The Author.

The major fields studied concerning SCs are computer science, Engineering, and telecommunications. Other topics are, in a decreasing sequence of numbers, science technology and other topics, urban studies, business economics, energy fuels, public administrations, environmental sciences ecology, transportations, automation controls systems, instruments instrumentation, chemistry, and other topics, described in Fig. 4. It is important to observe that most of the topics are related to information technology. Very few topics focus on the human and social aspects of the cities, and only one topic related to the environment.

Figure 4 Field of research
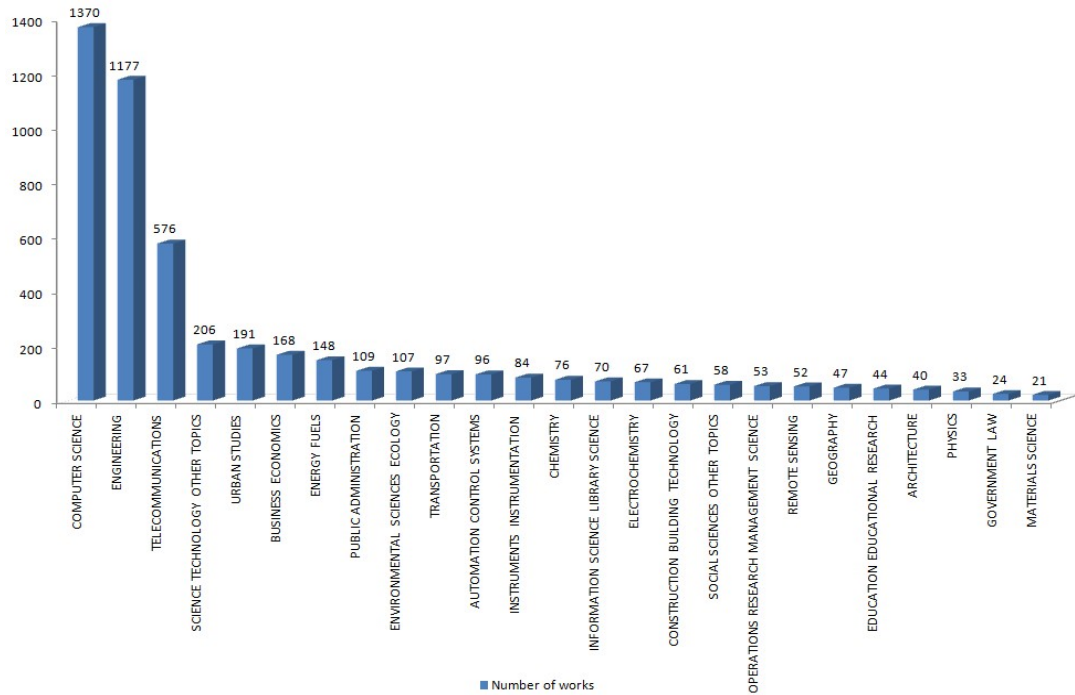
Source: The Author.

Among the 10 institutions that mostly study SCs we can find that four of them are Italian: Politecnico di Milano, Politecnico di Torino, e University of Bologna, and University of Naples Federico II. This can be explained due to the fact that Italy is the country that has the higher number of works on SCs. Therefore, if a researcher is interested in studying on this topic, Italy is certainly a good destination.

Figure 5 Research institutions
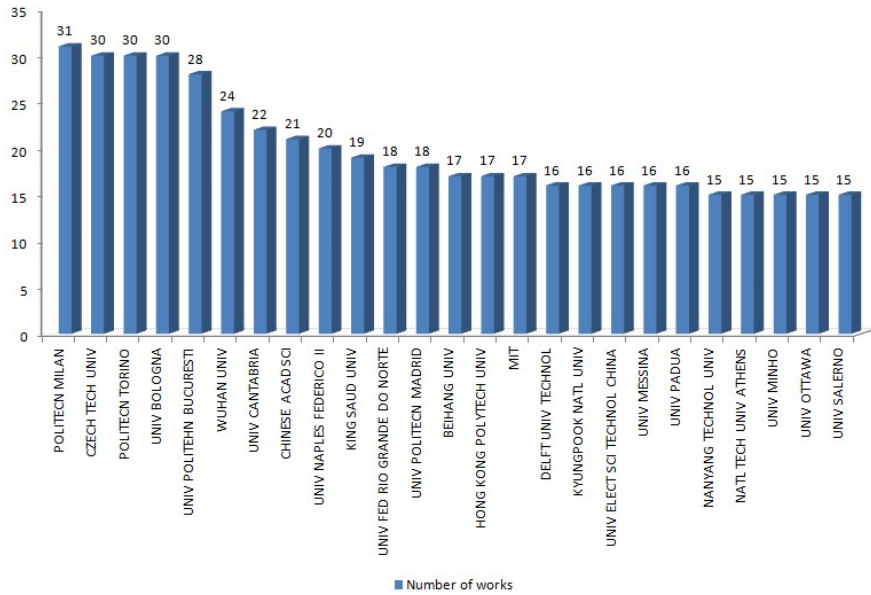
Source: The Author.

3.2 Map of content analysis using VOSviewer

The authors that mostly appear as papers' authors, with over five contributions each, are on Fig. 6. Among them, the mostly mentioned are on the red zones, then consecutively on the orange, yellow, and the ones less frequently mentioned are on the green zones.

*Figure 6 Density map of authors' names*
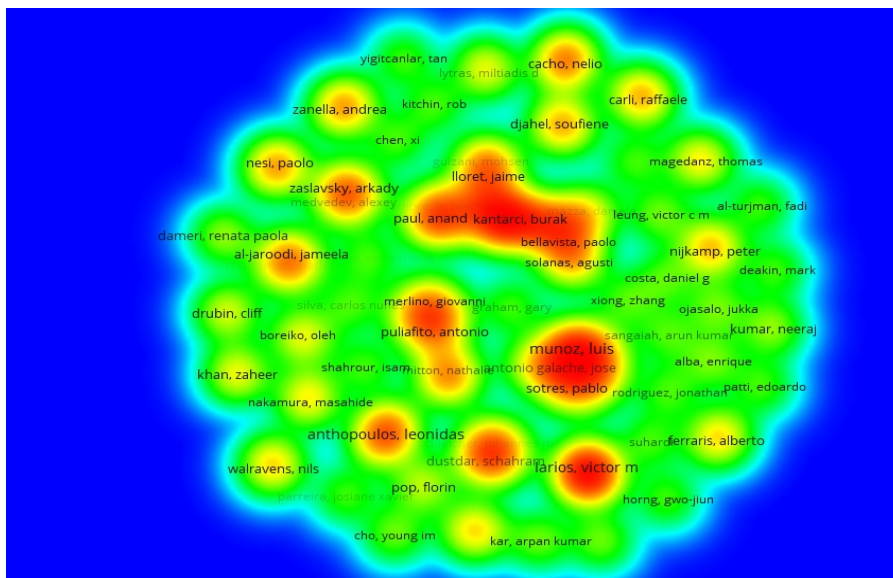
Source: Research data analyzed by VOSviewer.

Figure 7 shows the names of authors related to the years of publication. Authors that published

works in 2014 and 2015 appear in blue spots (darker and clearer, consecutively); the ones that published in 2016 appears in green; the ones that published in 2017, in light brown; and, in 2018, in red. It is interesting to observe that Anand Paul and Burack Kantarci have their names linked to the years of 2014, 2015, 2016 and 2017, meaning that they have been continuously publishing on this theme along these years.

Figure 7 Map of authors per year
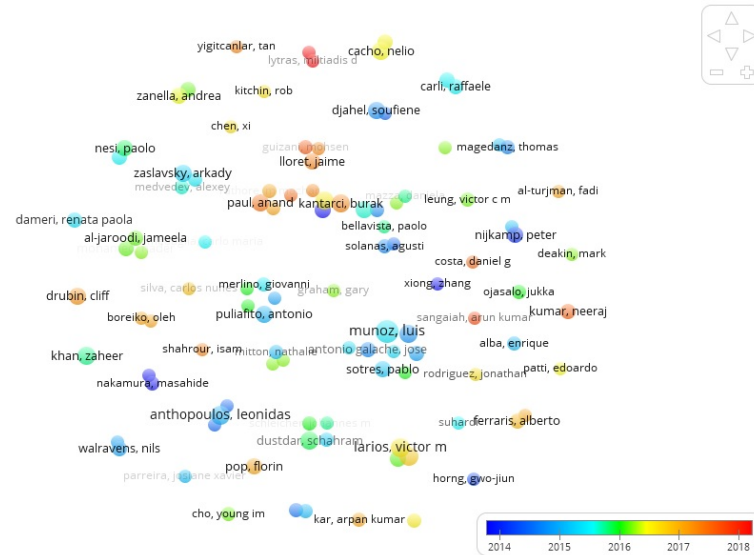
Source: Research data analyzed by VOSviewer.

The next element analyzed was the title of the works. Once the refining of the search determined that only the combination of words SC or SCs should return, these are the terms that mostly appears in the map (red zone). Other words that figured in title were: service, security, quality, approach, big data, challenge, research, application, governance, China, building, future. Words related to the SDGS are not mentioned among the most cited in the titles.
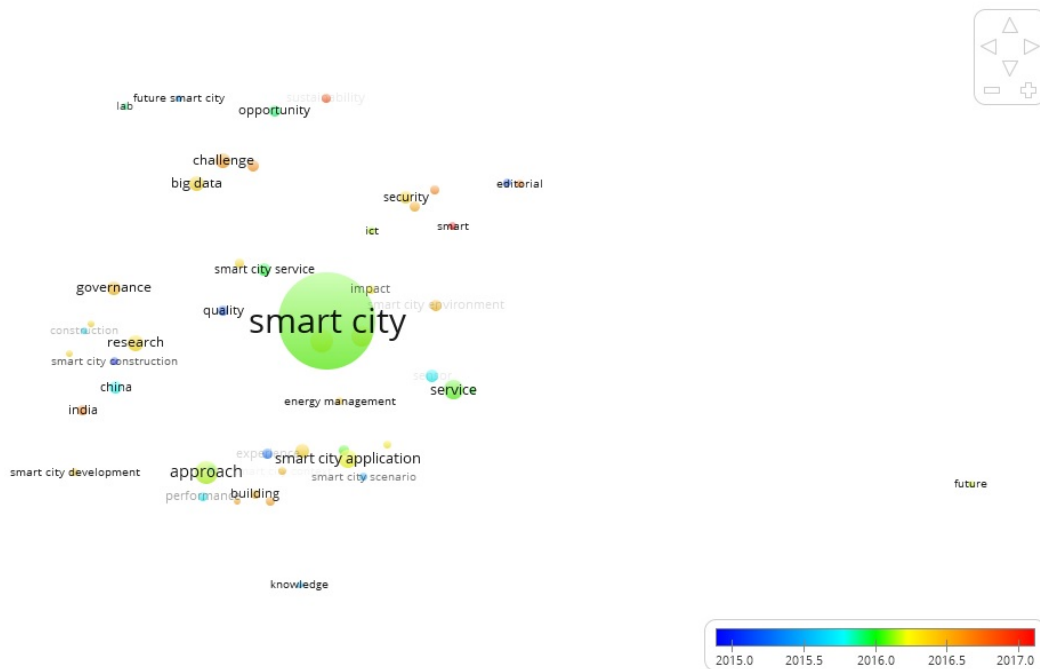
Figure 8 Density map of words in the titles
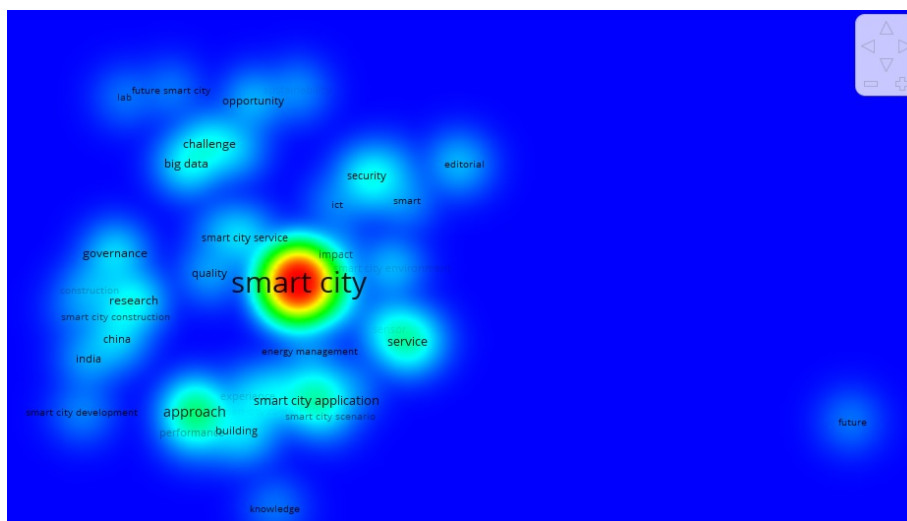
Source: Research data analyzed by VOSviewer.

The titles of the most recent works, from 2016, mostly presented the words research, challenge, big data, India, security, governance, and building (Fig. 9).

Figure 9 Words occurrence analysis by title per year

Source: Research data analyzed by VOSviewer.

The analysis of the abstract offers a deeper idea of what the work studies regarding SCs. Concerning the network of words, it is possible to observe (Fig. 10) that the words internet of things, in light blue, present an intensive relation; then, information, and communication technology, in purple; world, challenge, urbanization, energy, population, resource, vehicle, modern city and SC initiative, in red; the words in green are related study related vocabulary, and are not considered here as words related to SCs topics; the words in blue are related to governmental aspects. Finally, in yellow, most of the words are related to technology: sensor, future SC, and mobile device.

Figure 10 Keywords network by analysis of abstract
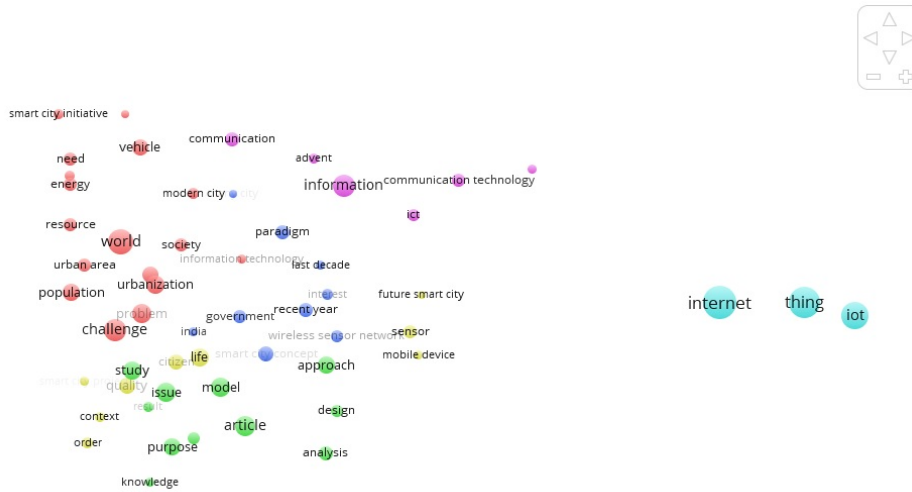
Source: Research data analyzed by VOSviewer.

The words that appear with most density on abstracts (Fig. 11) are internet of things (IoT), challenge, urbanization, study, life, world, information, population, need, energy and urban area.

Figure 11 Density map of words by abstract analysis
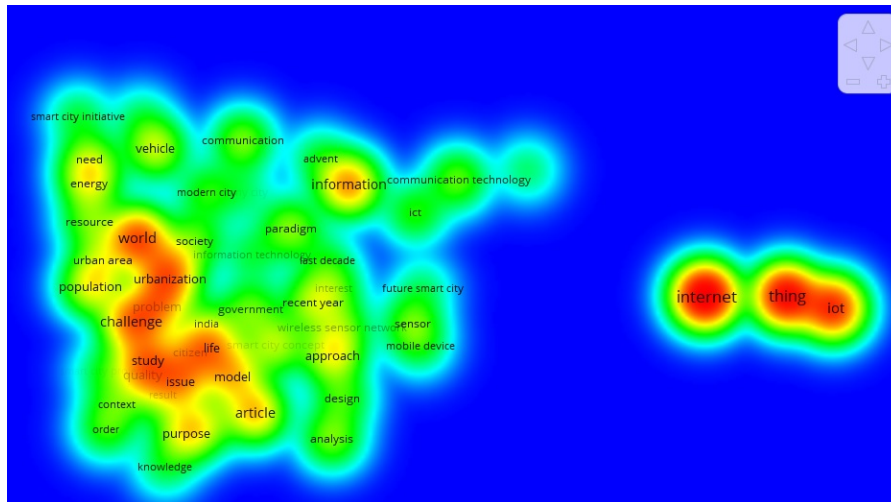
Source: Research data analyzed by VOSviewer.

The words that have been more intensively the object of study in the last works (Fig. 12) are internet of things (IoT), communication technology, and urbanization.

Figure 12 Map of words by abstract per year

Source: Research data analyzed by VOSviewer.

4   Discussion and analysis

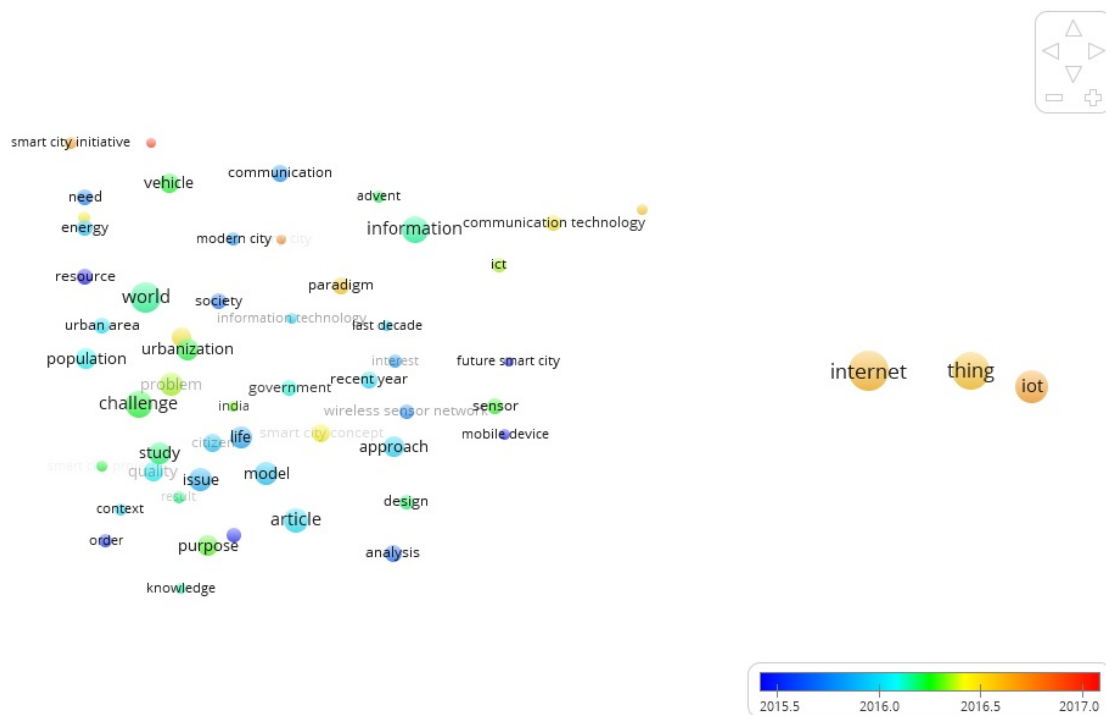The search for works combining smart cities and sustainable development goals returned no results. The search whose title presented the combination *"smart cities" OR "smart city"* returned 2.956 - 826 results only in the year 2017, and 263 in 2018. There is not an apparent reason for such a reduction, considering that there is still a lot more to study regarding this theme, and the final results of the works do not present a final solution for the countless challenges governments and private initiative face when coming to such complex topic.

The works on SCs were mostly published as proceedings papers, with 58% of the works. Then, events seem to be the main focus of the researchers to present the advances on the theme. A hypothetical reason to explain the large search for events is that such theme involves innovation and, sometimes, fairs showing disruptive devices that need to be broadly discussed, exchanging experiences and questioning in real time the doubts concerning the topics and products presented.

This hypothetical scenario may not happen through a scientific publication in journals, which might take over a year to come to public.

Articles in journals had 36% of the works found in the search. Therefore, if one intends to obtain more recent data concerning SCs and exchange innovative ideas, going to events on smart cities seems to be a faster way.

The country with a larger number of works is Italy, with 391 works. The European continent together contributed with 1.490 works, over the half number of the works retrieved. Therefore, Europe seems to be the best place to study on SCs, especially Italy.

In this same sense, the institutions that appeared in larger number were from Italy, with four institutions mentioned among the 10 that mostly contributed. Brazil was the only representative of Latin America among the works presented in this search.

The mostly studied areas are computer science and engineering. Themes implicitly related to SDGs are: urban studies, energy fuels, public administration, environmental sciences and ecology, social sciences and other topics, geography, government law.

The words that mostly appeared on the abstracts were internet of things, information, communication technology (which also appears as one of the most cited words in concepts and definitions, on Table 1), world, challenge, urbanization, energy, population, resource, vehicle, modern city and SC initiative, governmental aspects, sensor, future SC, and mobile device. That is to say that the words that mostly appear on the abstracts are technology related. The information management, and its proper dissemination, seems to be central in many works.

There is no direct mention of SDGs on the works on SCs retrieved. The linkages that can be made is by analyzing Table 1 and Table 2 and inferring connections due to the subthemes studied on SCs. The connections we inferred are on Table 3.

Table 3 Connections inferred from SCs definitions and SDGs

Goal Number	Sustainable Development Goals	Inferred Connections (authors)
1.	No poverty	Caragliu, Del Bo, and Nijkamp (2011)
2.	Zero hunger	Caragliu, Del Bo, and Nijkamp (2011)
3.	Good health and well-being	Giffinger, Fertner, Kramar, Kalasek, Pichler-Milanovic, and Meijers (2007), Washburn, Sindhu, Balaouras, Dines, Hayes, and Nelson (2010), Chen (2010), Nam and Pardo (2011) Bakıcı, Almirall, and Wareham (2012), Lazaroiu and Roscia (2012), Greco and Cresta (2015), Caragliu and Njkamp (2009), Cavalcante, Cacho, Lopes, and Batista (2017), Basiri, Azim, and Farrokhi (2017)
4.	Quality education	Washburn, Sindhu, Balaouras, Dines, Hayes, and Nelson (2010), Kourtit and Nijkamp (2012), Lombardi, Giordano, Farouh, and Yousef (2012), Zygiaris (2013)
5.	Gender equality	Thite (2011), Kourtit and Nijkamp (2012), Basiri, Azim, and Farrokhi (2017),
6.	Clean water and sanitation	Thuzar (2011), Giffinger, Fertner, Kramar, Kalasek, Pichler-Milanovic, and Meijers (2007), Thuzar (2011), Barrionuevo, Berrone, and Ricart (2012), Kourtit, Nijkamp, and Arribas (2012), Lombardi, Giordano, Farouh, and Yousef (2012), Zygiaris (2013), Greco and Cresta (2015), Caragliu and Njkamp (2009)
7.	Affordable and clean energy	Thuzar (2011), Giffinger, Fertner, Kramar, Kalasek, Pichler-Milanovic, and Meijers (2007), Thuzar (2011), Barrionuevo, Berrone, and Ricart (2012), Kourtit, Nijkamp, and Arribas (2012), Lombardi, Giordano, Farouh, and Yousef (2012), Zygiaris (2013), Greco and Cresta (2015), Caragliu and Njkamp (2009)
8.	Decent work and economic growth	Eger (2009), Thite (2011), Kourtit and Nijkamp (2012), Marsal-Llacuna, Colomer-Llinas, and Melendez-Frigola (2014), Greco and Cresta (2015), Caragliu and Njkamp (2009),
9.	Industry, innovation and infrastructure	Hall (2000), Harrison, Eckman, Hamilton, Hartswick, Kalagnanam, Paraszczak, and Williams (2010), Washburn, Sindhu, Balaouras, Dines, Hayes, and Nelson (2010), Chen (2010), Thuzar (2011), Gartner (2011), Nam and Pardo (2011), Bakıcı, Almirall, and Wareham (2012), Marsal-Llacuna, Colomer-Llinas, and Melendez-Frigola (2014)

10.	Reduced inequalities	Kourtit and Nijkamp (2012), Greco and Cresta (2015), Caragliu and Njkamp (2009), Cavalcante, Cacho, Lopes, and Batista (2017)
11.	Sustainable cities and communities	Giffinger, Fertner, Kramar, Kalasek, Pichler-Milanovic, and Meijers (2007), Thuzar (2011), Barrionuevo, Berrone, and Ricart (2012), Kourtit, Nijkamp, and Arribas (2012), Lombardi, Giordano, Farouh, and Yousef (2012), Zygiaris (2013), Greco and Cresta (2015), Caragliu and Njkamp (2009)
12.	Responsible production and consumption	Bakıcı, Almirall, and Wareham (2012), Kourtit and Nijkamp (2012), Lazaroiu and Roscia (2012), Lombardi, Giordano, Farouh, and Yousef (2012), Zygiaris (2013), Hudson, Kortuem, Wolff, and Law, (2016)
13.	Climate action	Zygiaris (2013), Thuzar (2011), Giffinger, Fertner, Kramar, Kalasek, Pichler-Milanovic, and Meijers (2007), Thuzar (2011), Barrionuevo, Berrone, and Ricart (2012), Kourtit, Nijkamp, and Arribas (2012), Lombardi, Giordano, Farouh, and Yousef (2012), Zygiaris (2013), Greco and Cresta (2015), Caragliu and Njkamp (2009)
14.	Life below water	Gartner (2011), Giffinger, Fertner, Kramar, Kalasek, Pichler-Milanovic, and Meijers (2007), Thuzar (2011), Barrionuevo, Berrone, and Ricart (2012), Kourtit, Nijkamp, and Arribas (2012), Lombardi, Giordano, Farouh, and Yousef (2012), Zygiaris (2013), Greco and Cresta (2015), Caragliu and Njkamp (2009)
15.	Life on land	Gartner (2011), Thuzar (2011), Giffinger, Fertner, Kramar, Kalasek, Pichler-Milanovic, and Meijers (2007), Thuzar (2011), Barrionuevo, Berrone, and Ricart (2012), Kourtit, Nijkamp, and Arribas (2012), Lombardi, Giordano, Farouh, and Yousef (2012), Zygiaris (2013), Greco and Cresta (2015), Caragliu and Njkamp (2009)
16.	Peace, justice and strong institutions	Thuzar (2011), Greco and Cresta (2015), Caragliu and Njkamp (2009)
17.	Partnerships for the goals	Nam and Pardo (2011)

Source: The author.

It is important to reinforce that the connections established are a simple inference of this paper's authors.

Making an analysis with the SDG, it was observed that the less approached SDG as found by this search were No poverty; Zero hunger; Partnerships for the goals; Gender equality; Peace, justice and strong institutions; and Reduced inequalities. The most approached, as revealed in this search, were the ones related to environment. This might lead us to ponder that the environment is on the top of the search. Would that be because of the strong environment laws? Anyway, despite the robustness of the literature, there is still a lot to do regarding the human being itself.

5   Conclusion

This paper was an attempt to find direct mentions of sustainable development goals on smart cities works. The two themes were born as "soulmate themes" since both of them works towards the wellness of human beings in its collective and broad approach, including the environment.

To achieve this purpose, a systematic literature search was done. The preliminary search revealed no direct connections between the two themes. Therefore, the bibliographic mapping was done using only the theme on smart cities.

The literature review brought concepts and definitions of SCs. The core term that most appears on the concepts, as well as on the content analysis of words from the abstracts, revealed that the

works' main topic studied is related to technologies, more specifically ICTs. We can infer that there is still a lot more to study and evolve in order to embrace all the elements and aspects as so SCs will seek the welfare and wellness of what really matters: human and social aspects, and environment.

By now, it sounds that the major concern of the works, on a not deep content analysis, is to produce technologies and goods and advertise them thorough events and, maybe, papers, and sell them. The main concern towards the information management of many papers makes us ponder: we have the information! Now what? This might be a cold conclusion, then we pose (since many might not agree with our findings) the question for future works: What is on smart cities and sustainable development goals?

Another observation, when trying to make a connection towards the SDGs, is that most of the papers are related to the environmental studies; a small amount of them was directed to study the human conditions itself. Would this context be due to the environmental regulations, which forces companies to search for solutions in order to comply with the laws? Those are questions that future works could strive to answer.

The main contributions of this paper is to set an agenda for future works: find out direct and clear connections between SCs and SDGs; propose SCs strategies that are committed to achieve the goals; and measure the effects of such strategies.

This study has some limitations. The main limitation is that it presents the content analysis of only the abstracts and title of papers rather than an in-depth analysis of the whole works. Therefore, this is another suggestion for future works. Another limitation is that the connections made between the SCs and SDGs were made on the conceptions and definitions base. If the inferences are made having the whole papers as base, certainly more connections, and more trustworthy ones, might be found. Thus, making these connections based on the whole work analysis is another suggestion for future work. Finally, one other limitation is that a broader study with more scientific databases could be done, in order to refute or confirm the questions posed here.

Acknowledgments

6   References

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