

Article

Modern Conceptions of Cities as Smart and Sustainable and Their Commonalities

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Abstract: The present work aims to determine the existence of commonalities between two modern conceptions of cities, i.e., smart and sustainable. To accomplish this, the authors carried out a systematic review of the most-cited scientific contributions chosen by the scholars proposing conceptualisation of the two topics, according to the H-index determined by Web of Science. The findings show that the most important contributions representing the antecedents with respect to the concepts of a smart city and a sustainable city can be classified into three groups: labelled as what, how and with, and describing the definitions, the role of technology, and the pillars (in the case of a smart city); the groups labelled as what, how and with depicts definitions, change and challenges, and key features (in the case of a sustainable city). Starting from the conception of a smart city as the evolution of a digital city, the smart city concept not only considers aspects related to technology and innovation but adds the human features of city life. The sustainable city concept can be understood as a new approach through the filter of a new philosophy; it is an equitable and balanced setting of goals in line with the principles of sustainable development. Both concepts cannot be thought of as contrasting; in fact, they share many commonalities. This is because the attention focused on social, environmental and economic issues has framed the debate over sustainability and converged in the definition of a smart city and—obviously—in the notion of a sustainable city. The main contribution of this paper is in considering the smart city as mainly setting the guidelines of a transforming city, while the sustainable city is mostly thought as an approach and a philosophy to modern cities.

Keywords: smart city; sustainable city; digital city; smartization; sustainability

1. Introduction

Cities have faced several challenges in recent years, and scholars have studied the numerous approaches that cities have taken to confront these challenges. The interventions aiming at the achievement of better conditions through services and a higher quality of life were observed by scholars, favouring the emerging of a wide debate on cities' transformation that is still going on (e.g., [1,2]). This debate has been stimulated even by the new framing of cities as functional urban areas [3]: this concept embedded core municipalities and the surrounding areas based on their relationships, especially those based on travel-to-work flows. The need expressed by the inhabitants of the urban areas are multiple and may contrast, thus leading to the need for planning interventions to balance daily challenges with the creation of better conditions in a long-term perspective. The multiplicity of needs emerged even from recent contributions and can be exemplified as cultural [4], social processes [5], strategic [6], and environmental [7].

In the above cited debate, scholars have stressed the evolution of the various interventions in cities (e.g., [8,9]) and highlighted the commonalities among some of these definitions, as well as the elements useful in describing the way the theoretical debate and the main activities shaping cities' transformation took place in the last few years. Other scholars have proposed combinations of such definitions due to the existence of common goals to be attained with respect to cities' transformations and the chance to achieve various aims through different paths, or the proposal of additional conceptualizations to embed and combine extant notions (e.g., sharing cities, as theorized by McLaren and Agyeman [10], or the smart sustainable city, as proposed more recently [11,12]). The ways to describe the transformation and the chance to analyse actual changes and planned ones are several and this is one more reason the debate is particularly hot [13]; this multitude of perspectives and fields of science focusing on the changes occurring in cities led to critiques (e.g., [7]), the proposal of new frameworks (e.g., [14]), and calls for clarifications, especially because of the overlapping aspects of definitions ([15–17] and the need to highlight the main features describing the concrete transformation [18,19]. Furthermore, even firms are joining this debate, with a perspective mostly based on technology: for instance, KPMG [20] described smart cities as an example of the benefits provided by the Internet of Things (IoT), while EY [21] framed the smart city as the context where cloud technologies can improve quality of life. As it regards the sustainable city, the approach adopted by businesses is totally different, with a wider set of elements considered; for instance, innovative thinking, standard of living, and care of the environment are the three key factors in the vision by E.On in Sweden [22], while Ericsson [23] focused on the tie between the collaborative approach of local inhabitants and the economic, social, and environmental challenges in a context with scarce resources.

This paper aims to shed more light on the current scholarly debate, focusing on the potential mutual influence and ties between two notions: the smart city and the sustainable city. The influence to be tested is related to the opportunity to identify a potential evolutionary path when observing the conceptions of the smart city and the sustainable city; the ties to be depicted are the elements representing either a common background or a joint understanding of the two conceptualizations. The choice of these two conceptions is based on their prevalence and on their being up-to-date with the interventions that cities have recently been implementing. In the first months of 2018, supranational institutions have stressed the role these two approaches play in improving cities' conditions, encouraging a smart transformation [24] and the achievement of a more sustainable context [25]. The context of these transformations had been previously expanded by the Organization for Economic Cooperation and Development [3] when depicting the ties between the core area of a city and the surrounding context shaping 'functional urban areas'; the benefits to be achieved were even recently highlighted by the McKinsey Global Institute [26] together with a focus on the advantages to be achieved through new technologies. The relevance of the topic and the ties it has with technology, quality of life, and citizens' wellbeing have been stressed by other relevant sources with reference to several areas of the world (e.g., [27,28]).

With the aim of describing the path scholars adopted, this paper will start by proposing a meta-theoretical analysis that describes the modern configurations of cities and urban contexts through a focus on the main sources considered by scholars when defining smart cities and sustainable cities. Then, to describe some of the overlapping elements between these two conceptions and anticipate the paper's core contribution, the paper will focus on the role that sustainability plays in smart cities. Next, after describing the methodology, the paper will deploy an analysis that will lead to a discussion, implications, and conclusion on the main features of the recent conceptualizations on transforming cities. This will be useful in highlighting the converging elements in the two conceptions and the distinguishing features of both smart cities and sustainable cities.

2. Theoretical Framework

Cities are changing due to new challenges emerging because of the needs of a society ([1,9]) and even because of the opportunities offered by technologies and new instruments ([8–12]), as in

the emerging paradigm of the IoT, as described by Zhang et al. [29]. The awareness of social and environmental issues forced local and supranational institutions to act.

The large number of definitions emerging from both academic debate and business perspectives led to the debate on cities' transformation. Indeed, in this paper attention is paid to key theoretical contributions, since they can favour a better understanding of this ongoing debate; the paper's contribution will differ from existing ones since it focuses on the analysis of previous theoretical perspectives and their contribution to the conceptualizations. The main advantage of a meta-theoretical analysis is to highlight both differences and similarities underlying the conceptualizations considered [30], in line with the content of the recent call for research on cities (e.g., [17,31,32]).

The next two paragraphs are offering an overview on the most common configurations of the urban contexts under transformation and highlighting some of the overlaps emerging when considering the two most common approaches, namely the smart city and the sustainable city.

2.1. Modern Urban Contexts' Configurations

The introduction and conceptualization of modern configurations of the urban context has led to various definitions proposed by scholars, central and local institutions, and large corporations (i.e., cyber, virtual, digital, intelligent, ubiquitous, hybrid, information, creative, learning, knowledge, green, eco, smart, sharing, sustainable) to shape cities according to the aforementioned goals [10,33–38].

In most cases, describing the difference between the labels is difficult. In particular, this is due to the commonalities—or, at least, the terminological confusion—that often emerges when one determines the elements of the various labels [39,40].

Because of their broad approach to the various features of an urban context, the most prevalent and longest-lasting labels are 'digital city' (introduced for the first time by Rheingold [41]) and 'smart city' (introduced at the beginning of the century, i.e., [42–44]). Most scholars and players consider them to be the most suitable terms for evaluating cities. The former is shaped mainly by technological features [45], while the latter is often considered an evolution of the first, adding the human features of city life to the contributions of technology [33,36].

In detail, according to Talen [46], the digitalization process of urban contexts is essentially based on technological infrastructure and innovation systems, while the smartization process considers all the aspects of everyday life and local growth from a sustainability perspective and through the support of the information and communication technologies (ICTs) [46,47]. Several definitions described digital city as the implementation of technologies in cities' management and features as it has been thought of as a city with the aim "to provide infrastructure for networking local communities and to promote social interaction among people who visit or reside in a city" ([48], p. 438).

Indeed, the smartization process, as well as the digitalization process, is supported by technological tools and innovation systems. However, the first case adopts a wider approach that includes the most important aspects of people's everyday life, such as transportation, communication, energy savings, the reduction of air pollution, and local growth [44], through the involvement of different categories of stakeholders (with citizens being first among them) and from a sustainability perspective.

Among the above cited labels, special reference is due to the 'intelligent city' since, together with the 'digital city' and 'smart city', this is the most considered configuration and the intermediate step in the transformation from digital to smart city [45,49]. In 2008 Komninos [50] described the 'Intelligent city' as "an urban system as capable of developing learning skills, creativity, memory, interaction, innovation features, etc., which authors identify as features of intelligence when otherwise referring to living organisms. In any case, intelligence does not lie in the 'stones' and the building materials of cities, but in the organised human community and the intelligent tools and infrastructure it disposes" ([50], p. 113). It emerges that the topic proposed in 2000 focused on human capital more than on digital tools.

2.2. Sustainability in a Smart City

Because of this paper's aim, it pays particular attention to sustainability, considered the most relevant element leading to urban development. Indeed, sustainability is considered even more in the urban context. In the debate over the smartization of cities, both in the literature and in projects, different initiatives have emerged in which sustainability could be intended according to the Triple Bottom Line model [8,51], involving environmental, social and economic dimensions. Sustainability is usually considered to be "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" ([52], Chapter 2); hence, only the integration of all three spheres can lead to sustainable growth.

Actually, recent contributions introduced two more pillars to enhance the concept of sustainability considering culture [53,54] and security [55] as essential elements to be considered when managing the urban context through a smart perspective.

In general, the management of sustainability in urban contexts has been one of the most discussed issues in the contemporary debate. In line with this approach, a smart city can be considered a starting point for developing initiatives that ensure the sustainable development of urban contexts [56]. Hence, the integration of sustainability-oriented actions has made the smartization process a means of facilitating "sustainable urban development" and improving "quality of life" [57,58].

In terms of the theoretical contribution, various scholars link sustainability to the development of the local context. Particularly fitting is Talen's contribution [46], which considers smart interventions in a city as being aimed at changing unsustainable contexts into sustainable ones. Another interesting contribution [38] centres on the role of knowledge as a tool to facilitate the design of a city using strategies that focus on the three dimensions of sustainability.

3. Methodology

3.1. Research Approach

According to the main goal of the present research, namely exploring the theoretical debates connected to the perspectives of smart and sustainable cities, a meta-theoretical approach is the most suitable, as suggested by other scholars (i.e., [59]). In addition, the approach used is in line with an ontological analysis, because authors determine a set of concepts and groups in the smart and sustainable city domains, that shows the key features and the relations between them. The meta-theoretical assumptions authors will propose derive from an in-depth focus, not just based on the definitions as they are, but on the antecedents of these definitions to understand the features actually affecting two of the most relevant ways to depict the cities' transformation.

The study intends to be a contribution to clarify the reasons for the gap between the two conceptions mainly due to the numerous definitions and different approaches.

3.2. Data Collection

To accomplish the previously stated aim, the authors carried out a systematic review of the most-cited scientific contributions—according to the H-index determined by Web of Science—concerning the two topics. The debate on the smart city and on the sustainable city has grown in recent decades, and the attention scholars have paid to this recently has increased; indeed, the debate on the smart city started at the beginning of last century as proposed above, while the contributions on sustainable cities began at the end of the last century, with some contributions framing sustainability from either an architectural or a political perspective. Thus, our data collection focused on all contributions proposed on Web of Science from the 1990s until 2018. Then, starting with the results of the literature analysis in the time-span mentioned above, the authors compared the most relevant aspects of each of the two conceptualizations to stress the commonalities, differences, and influence of the results in the evolution of smart and sustainable approaches towards city transformation.

3.3. Research Procedures

The authors approached the previously cited goal using a two-step process. Firstly, a bibliometric analysis was performed to highlight the most relevant contributions that scholars consider when dealing with both topics. The choice of this methodological approach stemmed from the need to analyse both current contributions and the papers cited to theorize the main concepts [60]—namely, those describing the evolution of cities. A query on Web of Science produced two lists of contributions related to either a smart city or a sustainable city. The first dataset consisted of 2241 contributions (1898 articles and 343 book chapters) in a time span ranging from 1991 to 2018; however, over 98% of these contributions dated back to the period 2013–2018. The second dataset consisted of 912 contributions (791 articles and 121 book chapters) published over the last 27 years, since the issuance of the first publication in 1991; however, even in this case, most of the contributions were quite recent (73% from 2011–2018). Next, an analysis of reference lists was conducted using bibliometric coupling performed by BibExcel [61]. This enabled the authors to prepare a list of the most influential contributions. The H-index—namely a metric measuring the citation impact of a publication—of the entire datasets achieved through the previous query on Web of Science was used as a driver to set the number of contributions necessary for this analysis. In particular, 46 and 48 were the respective values of the H-index for the two datasets. Thus, the 46 most-cited contributions were considered in relation to the smart city concept and the 48 most-cited contributions were considered in relation to the sustainable city concept. All contributions with the exact same number of citations were considered. This led to the consideration of 46 entries (book chapters and journal articles) related to the smart city concept and 54 items (book chapters and journal articles) related to the sustainable city concept. Secondly, the 100 contributions underwent a systematic review, representing the second step of the research process. The systematic review was chosen because it is considered more reliable than a traditional narrative review [62,63]; indeed, it provides the opportunity to select scholars' contributions through a scientific and transparent selection process performed through Web of Science, with the aim of avoiding the bias that could emerge should significant papers be left out [64]. In more detail, a review of the definitions and their antecedents through a selection based on an objective procedure can lead to both a reliable and significant analysis, since the key papers are considered and the perspective of the authors are scrutinized. Additionally, Web of Science has been considered the most suitable platform to scan literature; according to several scholars [65–68]. This choice depends on previous studies that highlighted the frequency of updating, the amount of available documents, the time span covered, the main fields of interest, the accuracy of the results, and the tools provided.

This process led us to identify three blocks of papers: namely, those considered in the process of defining both 'smart city' and 'sustainable city', those supporting a focus on smart cities, and those favouring theorization on sustainable cities.

4. Results of the Theoretical Analysis

4.1. The Key Contributions of Both Smart City and Sustainable City Debates

The first block out of the three we will present in this section is shaped by the most-cited contributions among scholars focusing primarily on smart cities, and those focusing primarily on sustainable cities (see Table 1). These most-cited papers represent the most-common antecedents used by scholars debating both the smart city and the sustainable city, so they track the path shaping the ongoing debate on the modern conceptions on transforming cities.

The oldest among these contributions are the books authored by Graham and Marvin [69] and Florida [70]. Graham and Marvin paid attention to an issue known as "splintering urbanism"—namely, the condition in which some areas of a city are unable to progress as the remaining parts of the same city. The accessibility of services and the development of suitable networks to provide these services are factors indicating the fast modernisation of some areas and, parallel to this, the *demodernisation* of other areas. As a consequence, the book calls for actions that improve cities' quality of life

without compromising on the development of any areas. This approach regards sustainability as the achievement of living conditions that are more than passable in every area of a city. However, it should be noted that Graham and Marvin [69] did not propose “smart city” as a context in their discussion. Instead, they focused on the smart transformation of services. Their main areas of interest related to smart transformation were smart houses, smart energy, and smart highways. Their perspective on city development was related to the need to face cities’ challenges and achieve the best results from the introduction of new technologies. Florida [70] offered suggestions for smart development; he referred to creativity as the key feature of a social class and some factories, leading to the potential growth of cities. This pursuit of better conditions depended not only on the available technologies, but also on cities’ openness and tolerance. These two features are crucial to the development of the creative industries—a reason why the author stressed the rise of the creative class as a relevant opportunity to support growth. Even in this case, the author did not cite “smart city” as a new issue; however, it is crystal-clear that cities remained an area of focus in the consideration of creativity’s potential benefits. One of the most concrete examples involves considering creativity to be a new path towards the improvement of liveability and sustainability in both cities and suburbs.

Some years later, Giffinger et al. [44] offered more clarification about what a smart city is, doing so by depicting the six characteristics of a smart city and testing them in medium-sized cities in Europe. Evaluation of the cities was based on a model consisting of “smart economy”, “smart people”, “smart governance”, “smart mobility”, “smart environment”, and “smart living”. These features formed a model that, in the last 10 years, has often been used to plan interventions in cities and to measure the results achieved. One year later, Hollands [71] labelled these results as progressive. The authors stressed the need to clarify what a smart city is, as differences can exist in the understandings of the interventions performed, as well as in the perceptions of each actor involved. The differences that emerged in the analysis in terms of the meaning of ‘smart transformation’ depended primarily on the approach, as some cities considered equality, while others did not. Additionally, Hollands’ core contribution—useful for further research—depended on the perspective that the definition of a smart city is not based only on cables, new buildings, and technology, but must also centre on changes, living conditions, and progress. These aims were linked to sustainability as a way to frame different goals and combine them in a feasible way while considering the consequences for both society and the economy. Furthermore, from both social and environmental perspectives, sustainability was considered a necessity in addressing the problems that cities face in this era.

A few years later, the multi-disciplinary approach of Chourabi et al. [72] proposed similar considerations, deepening the elements that shape the path towards cities’ development and considering sustainability to be the strategy that cities wishing to be “smart” should adopt. Furthermore, the combination of liveable and sustainable conditions was considered the crucial factor favouring the achievement of a smart city. Moreover, the authors proposed a framework that depicted smart city initiatives. Most of the items shaping this framework were the same items that Giffinger et al. proposed [44]. Some of the main differences that emerged during a comparison of the contributions of Chourabi et al. [72] and Giffinger et al. [44] were the attention paid to policy and technology as elements directly affecting the development of smart city initiatives. Caragliu et al. [47] stressed the role of policy makers when describing the relevance of human capital in promoting the improvement of a city’s living conditions; policy makers were urged to focus additional attention on the achievement of equitable urban growth to avoid a situation in which some social classes faced difficult conditions while others reaped great advantages from progress and new initiatives. Additionally, people’s growth in terms of knowledge was considered the key to success, as no policies will last forever and most of the resources that the new initiatives create will decay over time. Consequently, knowledge—and its transfer, sharing, and increase—are crucial to advancing a community’s development. Parallel to this, Batty et al. [73] adopted a multi-disciplinary perspective by considering the necessary contributions of different fields of science; however, they stressed the role of new technologies in managing, optimizing, and controlling activities in cities. In addition, towards

the future city, they drew a path including sustainability, resilience, and rapid changes. In this way, they proposed the description of some scenarios for a smart city through a focus on the main elements such as Information and Communication technologies (ICT), competition, and new proposals for development. The key and novel feature of the model they proposed was its complexity, as it simulated the effects of a project for cities and considered new elements favouring additional interventions [15]. Complexity is embedded in the notion of sustainability, due to several issues affecting it and the wide set of actors impacting on the achievement of more sustainable conditions.

The results of the aforementioned interventions can be recalled when scholars consider the contribution of Neirotti et al. [74], who proposed a framework that measured the interplay between socio-economic impact, the resources used to transform a city and its services, and the gap resulting from the comparison between project definition and implementation. Moreover, in line with previous contributions, Neirotti et al. [74] stressed the relevance of knowledge in relation to all actors: ICT providers should not be the only ones holding knowledge, as open democracy requires the participation of all actors. Only through adequate knowledge can they accomplish their tasks. The need to spread knowledge becomes even more pronounced when one considers that a focus almost entirely on technology would not be enough to achieve liveable cities and favour accessibility. Finally, Vanolo [75] combined the smart and sustainable perspectives when describing the new paradigms of cities, as a way to think about changes, plan new tangible and social actions, and stress the crucial role that public-private partnerships play in driving cities towards a more participative and successful context for daily life. As a consequence of the focus on participation, to better support the ongoing changes, Vanolo [75] highlighted the need to assign responsibilities to citizens as concerns their awareness in understanding the context.

Table 1. Most-cited contributions from smart cities' and sustainable cities' authors.

Most-Cited Papers	Citations (from Smart City Scholars + Sustainable City Scholars)	Year
Batty et al. [73]—Smart cities of the future	127 + 13 = 140	2012
Caragliu et al. [47]—Smart cities in Europe	181 + 17 = 198	2011
Chourabi et al. [72]—Understanding smart cities: an integrative framework	78 + 12 = 90	2012
Florida [70]—The rise of the creative class	46 + 11 = 57	2002
Giffinger et al. [44]—Smart cities	171 + 10 = 181	2007
Graham and Marvin [69]—Splintering urbanism	52 + 10 = 62	2002
Hollands [71]—Will the real smart city please stand up?	186 + 18 = 204	2008
Neirotti et al. [74]—Current trends in smart city initiatives: some stylised facts	129 + 19 = 148	2014
Vanolo [75]—Smartmentality: the smart city as disciplinary strategy	83 + 19 = 102	2014

Authors' elaboration from Web of Science.

4.2. Key Contributions in the Smart City Debate

In the aforementioned analysis, the most frequently cited contributions with respect to dealing with smart cities stressed several elements, although from different approaches. To exemplify the main issues, this paragraph embeds the second block of papers that emerged and will present only some of the elements shaping the debate on smart cities. The most relevant issues in this second block are described in terms of the following three groups, namely the *what* (the academic debate over definitions), the *how* (the role of technology), and the *with* (an overview of the pillars of a smart city). The authors consider these three groups as crucial in supporting the understanding of the antecedents of smart city conceptions; the first group embeds *what* a smart city is, namely the definitions and the debate about them, while the *how* depends on the contributions of scholars stressing the role of

technology as the way to achieve the planned goals, and the *with* is representing the pillars depicting the main elements leading to the attainment of the objectives of a smart city. Grouping the contributions represent a process favouring the emergence of topics mirroring the approaches of scholars to a smart city and leading the authors to a comparison with the results of the third block of papers.

The first group of contributions considered consisted of definitions of “smart city”—namely, some of the efforts performed to clarify what a smart city is. In most cases, definitions were compared to each other as a means of stressing which advances were achieved—or least likely to be achieved—when moving from previous approaches to smart transformation. Lee et al. [76] analysed smart city projects, focusing on the research and development characterising them. Through this research, they achieved a definition of the “smart city context”, doing so through the use of multiple devices and different technologies, but based on roadmaps describing both services and technologies. Thus, they proposed something different from the actors focusing mainly on technology, as the context and its features are more relevant in affecting the transformation. In any event, the roadmap(s) driving cities towards smarter conditions should be customized for the context itself, as alignment with a city’s strategy is necessary. A few years later, Albino et al. [36] proposed an in-depth analysis of the extant notions of a smart city, seeking to clarify the concept. As an output of their research, they proposed that a smart city is an urban context embedding projects that seek a better quality of life for communities and the use of ICTs. Moreover, they highlighted the difficult task of measuring the results that cities achieved, as a city’s vision greatly affects its aims and, therefore, its achievements. Priorities, resources, and conjunctural conditions significantly affect the goals on the horizon and those that can actually come to fruition. Finally, Shelton et al. [77] sought to verify the main content of “smart city” definitions, with a focus on those cities implementing projects for transformation and firms supporting local agencies. The authors focused most of their attention on the advantages to be achieved by implementing data-driven governance; thus, they described the limitations deriving from the application of fixed models, due to the fact that they cannot act in line with the specific needs of local communities and conditions.

The second group of contributions highlighted consists of technology, due to the role it plays in the development, monitoring, and management of a smart city. One of the most-cited contributions was Atzori et al.’s [78] paper about the IoT, as tracking technologies, wireless sensors, and the process of accumulating and sharing knowledge are fundamental to the development of new services in a smart city. Schaffers et al. [79] expanded the debate when they directly addressed the role of the so-called Future Internet in driving innovation in cities; the authors identified cooperation among actors, open innovation, and both virtual and physical spaces where innovation should take place. In more detail, the focus on living labs is considered particularly relevant when highlighting the interplay among actors, priorities, resources, and policies in favouring cities and urban development. In addition, Gubbi et al. [80] proposed a focus on the IoT in smart cities and described the elements and technologies that support the achievement of smart environments. Cities are regarded as one of these contexts because a city represents a level in between local communities and national institutions. Furthermore, several elements—such as end-users, local firms, policy makers, and a community’s basic services—affect the development of new policies and interventions. Following this trend in the debate and proposing the new elements arising from other fields of science, Townsend [81] wrote a book about big data and smart cities; the author described the changes taking place in cities and the ways in which technologies already supported it. Moreover, he stressed the role that big data can play in favouring design, monitoring, and service provision in the smart city of the future.

Finally, the third group of contributions is based on the pillars of a smart city, as in the paper by Nam and Pardo [33]. They described the role that technology, people, and institutions play in favouring the achievement of smart transformation. Their contribution is relevant because they used the adjective “smart” in relation to people, technology and new elements that should be easy to use, responsive, and useful for providing feedback. All these items are crucial to achieve the goals that the new policies cite. In addition, Angelidou [82] recalled policies. She stressed the strategic approach towards city

transformation; strategies are not easily planned and deployed due to the need to align local strategies with national strategies and to coordinate the actions of several actors. Moreover, deploying a strategy can be complicated because a city's existing elements can constrain the development of new policies and interventions. Because both tools and goals are new, Lombardi et al. [83] suggested a focus on innovation when they proposed a model favouring the identification of priorities, the need to create and share knowledge, and the definition of practices to measure performance and, thereby, monitor the goals attained. To describe their model, they table-crossed the six characteristics of smart cities with the three helices. Leydesdorff and Deakin [51], who maintained a very similar perspective, was often considered because helix-based models are useful in describing the interactions among university-industry-government and the systemic approach to successful innovation. Additionally, innovation was considered the suitable theoretical framework to describe changes taking place in a multi-actor context. This led Zygiaris [84] to propose the "smart city innovation ecosystem"; the presence of several actors can be observed by analysing the relationship among layers composing the structure necessary to advance smart cities.

To sum up, the following table (Table 2) shows the three groups of contributions achieved and the main content and contributions related to each of them.

Table 2. Groups of contributions cited by smart city scholars.

Group of Contributions	Main Contents	Main References
1. What	Services, implementation of technologies, measures.	Albino et al. (2015) [36], Lee et al. (2013) [76], Shelton et al. (2015) [77]
2. How	Development, management, monitoring, big data, living labs.	Atzori et al. (2010) [78], Schaffers et al. (2011) [79], Gubbi et al. (2013) [80], Townsend (2013) [81]
3. With	People, institutions, policies, innovation.	Angelidou (2014) [82], Lombardi et al. (2012) [83], Nam and Pardo (2011) [33], Zygiaris (2013) [84]

Authors' elaboration.

In this way it has been possible to provide evidence on the main contents and favour the comparison with the topics emerging from the block of contributions in the following subsection.

4.3. Key Contributions in the Sustainable City Debate

In this subsection, authors propose the third block of papers, namely the one containing the most frequently cited contributions in the debate over sustainable cities and the key elements shaping this debate. However, as stated before, authors are highlighting only some of the contributions to provide evidence of the main issues and indicate the differences shaping the debate. As done in the previous paragraph, authors gathered the contributions based on the main topics shaping them, and achieved three groups. The first proposes elements of the academic debate over the definition of a sustainable city. The second deals with both social changes and the challenges leading to sustainable cities. The third stresses the key features of this new perspective on cities. As stated in the previous paragraph, authors achieved an overall perspective on the key issues in the debate on sustainable cities and created the right conditions to compare the two conceptions on transforming cities.

The first group proposed includes contributions that involve definitions of sustainable cities, due to this concept's relevance in the current debate and also because of the numerous comparisons with other notions describing transformations in cities. One of the first contributions proposing such a definition is based on the role of people, as Dempsey et al. [85] paid more attention to sustainable communities than sustainable cities. In any case, the two topics are greatly intertwined because they both focus on communities as contributors to the attainment of a sustainable context and as beneficiaries of the outputs of transformation in cities. The dimensions useful for depicting the expected advantages

for citizens and the pillars of a sustainable city are the interactions in the community, the participation of local members, the stability of the community itself, the pride in being part of a community, and the safety and security of the context. Kennedy et al. [86] proposed a different approach. They framed a city as a natural system and, consequently, used the metaphor of an ecosystem to describe urban contexts' need for self-sufficiency. The key concept describing the working mechanisms in a city is described as the metabolism of a natural entity, leading to the proposal of "urban metabolism". This concept is useful in describing a sustainable city as a bounded context exchanging inputs and outputs with the surrounding area, using technologies and policies to achieve sustainability, and integrating social and scientific perspectives. Finally, authors chose to stress the role of transformation, as Nevens et al. [87] proposed, when describing actions taken towards a sustainable city. This approach is particularly useful for embedding the planning and implementation, the intervention of local agencies' and citizens' contributions, and the urban labs as contexts favouring interactions towards actions. Furthermore, the urban labs—or urban transition labs—are proposed as contexts favouring learning for governance. Therefore, to enable the most suitable actions to be proposed with respect to the changing urban conditions, the managerial approach towards sustainable cities should change along with external elements.

The second group includes all those contributions that deal primarily with the social change framing the context in which sustainable cities are developed. One of the first changes that scholars have highlighted is the increasing density of urban centres and the potential link to the improvement of social equity. Campbell [88] stressed the contrasting conditions in the planning of urban development and the focus on sustainable conditions. The author believed that a city's goals compete against each other; thus, sustainability can be achieved only over the long term and through great effort. A balance among the three typical axes of sustainability—social, environmental, and economic—seems to be merely an illusion or something that can be presented only when one is theorizing, as the constant changes taking place in real life make this balance difficult to achieve. With a similar focus on the social scenario containing the features that enable or impede the achievement of sustainable cities, Burton [89] joined the debate by focusing attention on the link between sustainability in cities and the emerging changes. She began her research using a previous definition of an innovative approach towards cities, namely the "compact city". This represents the context hosting citizens in a developed world through sustainable models. Urban compactness embeds both consolidation and densification, leading to a city. However, the author observed decreases in terms of liveability when one considered living spaces, the existence of affordable housing, and the availability of spaces for cycling and walking. Meanwhile, transport services, social aggregation, and facilities had greatly improved. Finally (and more recently), global changes have been considered from a wider perspective that embraces natural features and increasing urbanization around the world; Grimm et al. [90] focused on effects moving from the regional to the global scale and vice versa, underlining the changes affecting human beings and the environment, as well as the interplay between them. This interplay takes place at different levels—local, regional, and global—and is useful for shaping the "urban socioecosystem"—namely, the entire context where changes are taking place and interventions are required.

Finally, the third group consists of contributions that focus on the features of sustainable cities and on strategies to be adopted to challenge current issues. One of the most commonly cited features is resilience; in some cases, this has led to the definition of resilient cities [91]. Authors often recall a "resilient city" because they think that sustainability should retain its essence even when the unexpected becomes real. A city can be considered resilient when interventions in the infrastructures are based on efficiency and the use of renewable resources. Ways to achieve such a goal with energy are evident; therefore, Newman [91] encourages identifying mimicked standards as regards the economy, other services such as transport, and biodiversity, as the latter favours the long-term protection of the environment. A similar approach has been proposed in describing the so-called eco-city [92] as a new form of managing and developing a city from a new mindset. The decision-making processes favouring the emergence of such cities should consider several issues, such as the replacement of

new high-tech services with traditional ones, the achievement of social redistribution, the greening of local government practices, and citizens' participation in defining public policies. An eco-city can be regarded as an initiative to counteract urbanization's negative effects through a multi-phase project that improves environmental conditions, socio-economic factors, the development of businesses, culture, politics, and international cooperation. Another contribution [93] considered "resilience" and "eco-city" together; the author regarded resilience as a feature affecting all of a city's levels and mechanisms. Additionally, resilience should not focus only on external elements and the ability to counteract negative conditions depending on external issues, but also be regarded as a skill necessary to act properly in society. Therefore, the author stressed internal social resilience to highlight the importance of a city being able to face internal shocks.

In summary, Table 3 describes the three groups of contributions proposed and the main contents and contributions shaping each of them.

Table 3. Groups of contributions cited by sustainable city scholars.

Group of Contributions	Main Contents	Main References
1. What	People, advantages, natural system, governance, learning.	Dempsey et al. (2011) [85], Kennedy et al. (2011) [86], Nevens et al. (2013) [87]
2. How	Social changes, equity, balanced conditions, triple bottom line.	Campbell (1996) [88], Burton (2000) [89], Grimm et al. (2008) [90]
3. With	Resilience, decision-making process, urbanization, counteractions.	Newman (2010) [91], De Jong et al. (2013) [92], Caprotti (2014) [93]

Authors' elaboration.

5. Discussion and Implications

The scan of the literature revealed that, often, the sustainable city is considered an evolution or an advanced version of the smart city. In alignment with the main aim of this paper, authors focused on common topics by observing the most relevant contributions representing the antecedents in each research stream, thereby pinpointing the relevance and significance of the common elements [47,77].

The results enable three blocks of partially overlapping topics to be identified. The first block contains the most common topics emerging from the literature on the smart city and the sustainable city. The second block contains the main topics emerging from the literature on the smart city. The third block contains the main topics emerging from the literature on the sustainable city.

Somewhat unexpectedly, the first block of contributions is the smallest, because both the smart city and the sustainable city maintain a set of uncommon characterizing elements. These results align with previous research on the evolution of the urban context and its definitions ([9,12]), stating that a smart city and a sustainable city have various elements in common but must be considered to be different research streams—i.e., neither can be considered the evolution of the other [94]. Thus, this paper contributes to an understanding of smart city and sustainable city as called for by other scholars (i.e., [17]) by depicting the two conceptions as partially overlapped instead of being the replacement or the evolution of the other. Some more details on this evidence are offered in the following table (Table 4) comparing the main issues emerged in the three groups of antecedents of the debate on the smart city and the sustainable city.

Table 4. A comparison between the main elements suggested by scholars.

	Smart City	Sustainable City
What	Services, implementation of technologies, measures.	People, advantages, natural system, governance, learning.
How	Development, management, monitoring, big data, living labs.	Social changes, equity, balanced conditions, triple bottom line.
With	People, institutions, policies, innovation.	Resilience, decision-making process, urbanization, counteractions.

Authors' elaboration.

In summary, the study describes that the different topics underpinning the debates and only a minor part of literature—as highlighted in the first block of contributions—had a crucial role in defining both the smart and the sustainable city. Some of the most evident differences are related to the three groups proposed; firstly, *what* a changing city is, since a smart city is achievable through upgraded services, while people and local natural systems are essential in the sustainable vision. Moreover, people can represent a key element in defining a sustainable city, while it was basically an actor of the change in smart city. Secondly, the *how* is mainly shaped by technology in a smart city, while an equitable development based on the spheres of sustainability is at the core of a sustainable city. Thirdly and finally, the change taking place in cities is mainly inspiring the philosophy of sustainable city when dealing with resilience, while the innovation attracted most of the attention in the debate on smart city.

In general, both smart city and sustainable city debates have recognized elements observed in the configuration of the digital city as recalled in the theoretical framework—namely, the new technologies used to improve citizens' everyday quality of life [36,45]. With respect to these commonalities, it is important to state that the paths of the three conceptions of the modern urban context do not have to be regarded as evolutions of the same single way, but rather as changes in the approach adopted in the city's new configurations.

The attention that authors have paid to the digital city stems from the relevance given to the relationship between the digital city and the smart city—such as the relevance conferred on this topic as a conception collecting different approaches towards the importance of digital tools in modern configurations of the urban context (e.g., *virtual city*, *cyber city*, or *cyber town*) [95–97].

As described in the following table (Table 5) and represented in the figure (Figure 1), each of the three previously cited conceptions has elements that are, in part, present in the others. By contrast with previous contributions considering the connection among digital, smart and sustainable city as an evolutionary path [12,16], this paper focuses on the keyword “change” because it represents a suitable way to describe the evolution that cities have experienced in recent years, regardless of the perspective.

Table 5. Changes in the main conceptions of cities' transformation.

Conception on Transforming Cities	Main Element of Change	Expected Goals
Digital city	Technology and innovation.	Mainly instrumental goals: the implementation of new technologies.
Smart city	Technology and services. Human side of changes.	Mainly guidelines about how to achieve changes in services based on innovative approaches.
Sustainable city	New approaches to services. Human side of changes. Perspective towards the future.	Mainly the achievement of goals both in a community-based view and on a long-time horizon.

Authors' elaboration.

Furthermore, even if the figure below shows a direct connection among the three conceptions, it emerges that each of them has a different approach as it concerns the urban context of planning and management.

Specifically, as anticipated, the main feature characterizing the digital city is the role of ICT, considered a necessary tool to improve citizens' quality of life [73]. As concerns the smart city, this second conception considers the role of new technologies but focuses on citizens' roles as passive actors and active co-creators because they can contribute to the city's governance [75]. Moreover, elements related to sustainability emerge but are intended mainly to maintain, for the long term, the results obtained through the smartization process [47,79,98]. Finally, with respect to the sustainable city, as in the previous cases, many elements characterizing the first two conceptions described are recalled but are done so using a new approach and through the filter of a new philosophy: an equitable and balanced setting of goals in line with the principles of sustainable development [52,99,100].

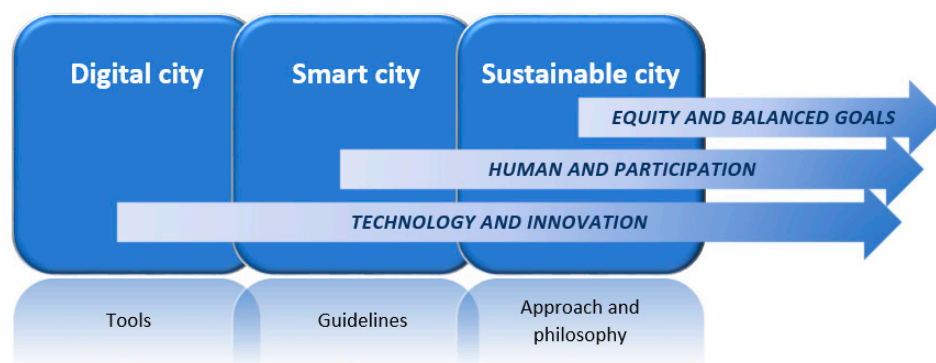


Figure 1. Modern conceptions of cities. Source: Authors' elaboration.

In conclusion, the main contribution of this study reflects equity and balanced goals as a new philosophy and a new approach to adopt in urban context development.

6. Conclusions and Further Research

Because only the most-cited contributions have been considered, fewer elements (which could have been useful to mention) were available for consideration. Also, recent insights achieved by scholars were not analysed in detail because they have not yet achieved the relevant number of citations. Moreover, the theme's novelty, with special reference to "sustainable city", led to the relatively low number of contributions, at least with respect to accomplishing a study based essentially on the literature review. However, the authors' focus did lead to a concentration on those contributions most influential in stimulating the theoretical debate over what smart cities and sustainable cities are. Thus, this paper stressed the key factors in the scholarly debate and sought to shed light on the main differences between the two conceptions. Emerging from the implications was the notion that the two concepts cannot be regarded as contrasting; in fact, they maintain many commonalities. The attention paid to social, environmental, and economic issues framed the debate over sustainability and converged in the definition of a smart city and—obviously—in the notion of a sustainable city.

Furthermore, apart from identifying the key elements of the two conceptions deriving from the meta-theoretical analysis, the study identified the relevance of each element and the relations between them: indicate the tools, provide guidelines, and suggest a new approach and a new philosophy to adopt in order to achieve the sustainable development of cities.

Further research focusing on empirical evidence obtained through the analysis of documents provided by local administrations and international institutions, as well as through interviews with key actors and city managers, would help highlight similarities and gaps in theoretical trajectories and practical initiatives.

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