Ecological Questions 35(2024)1 http://dx.doi.org/10.12775/EQ.2024.004

Trends and evolution in the concept of historical towns sustainability

Alessandra Moscatelli[1,2] *, Elvira Buonocore[1], Pere Fullana-i-Palmer[2], Pier Paolo Franzese[1]

[1] International PhD Programme / UNESCO Chair "Environment, Resources and Sustainable Development", Department of Science and Technology, Parthenope University of Naples, Naples, Italy.

[2] UNESCO Chair in "Life Cycle and Climate Change" ESCI-UPF, Universitat Pompeu Fabra. Barcelona, Spain.

***Corresponding author e-mail: alessandra.moscatelli@studenti.uniparthenope.it

Received: 7 October 2022 / Accepted: 27 March 2023

Abstract. Finding new solutions and strategies to enhance the sustainable management of urban systems is among the most important challenges of the 21st century. Currently, cities consume about 70% of the global energy while it is expected that in 2030 about 60% of the global population will live in cities accounting for only about 2% of the Earth's surface. At European level, there is a higher concentration of population in medium and small cities compared to mega-cities, with about 80% of the European population living in cities with less than 250,000 inhabitants. This is mainly due to the gradual expansion of the ancient (mostly medieval) settlements over time. Therefore, although their challenges in the sustainability transition vary significantly, their role is now crucial to achieving the global goals set by the European Green New Deal policy and the UN 2030 Agenda. The present study aims to review the scientific literature on sustainable towns by tracking its evolution and trends, with reference to the Sustainable Development Goals localization, and by applying social network analysis to bibliometric science. The bibliometric analysis, implemented over the timeframe 1996-2021, allowed the generation of maps based on network data displaying the relationships among scientific journals, researchers, and countries. Two different bibliometric analyses were performed to explore the scientific literature on "sustainable historical towns" and "sustainable towns' assessment". The results were useful to capture the multidimensional nature of sustainable towns by analyzing a large amount of literature data while identifying the main scientific patterns in this field of science. The paper is organized as follows. Sections 1 and 2 briefly introduce the topic and goal of the study. In section 3, the concept of "historical town" is defined by a qualitative and quantitative analysis. In section 4, governance issues related to small size municipalities are described with a focus on the inner peripheral areas. In Section 5, a review of sustainable urban policy evolution at the global and European levels is presented. Section 6 illustrates the state of the art in sustainability assessment of towns, analyzing the main issues and advancements of SDGs localization in the European historical

small and medium-sized towns and rural areas. Section 7 illustrates the methodology and results of the performed bibliometric network analysis. Finally, the main findings of the study and research perspectives are summarized in Section 8.

Keywords: Historical towns; bibliometric analysis; VOSviewer; SDGs.

1. Premise

The growing attention on cities that characterizes the global scientific literature in the last decades is strongly linked to urbanization (Shen et al., 2011; OECD and EC, 2020; Zhang et al., 2020). While in 1900 a mere 10% of the global population were urban dwellers, it is expected that this percentage will reach 60% in 2050, although the urban land cover is only about 2% of the Earth surface (UN-DESA, 2019; Seto et al., 2012). This phenomenon is even more accentuated in highly urbanized territories like Europe, in which urban dwellers are expected to reach 85% by 2050 (UN-DESA, 2019).

Cities are complex systems that integrate social, cultural, economic, and environmental dimensions in a living, continuously evolving setting, capable to drive global environmental change and sustainable development (EEA, 2021; Seto et al., 2012; Sharifi, 2021). However, paradoxically, they are typically associated with environmental degradation, congestion, and economic and social exclusion. Therefore, improving the sustainability of urban systems has become one of the major objectives of policymakers (EC, 2010; Servillo et al., 2016).

The "sustainable city" was defined by Shmelev and Shmeleva (2009) as *"a concept, characterizing the development of the city as a holistic system, in which social, economic, environmental, and institutional aspects of development are harmoniously integrated"*. Due to the environmental impacts of cities and the relevance of the urbanistic phenomenon, a substantial majority of the global scientific literature dealing with the topic of city sustainability focuses on megacities, while there is less focus on strategies to increase the sustainability of towns, which make up most of the historical urban pattern (Nabielek et al., 2016). An emblematic case is represented by Europe, with about 80% of the population living in cities with less than 250,000 inhabitants (UN-DESA, 2019).

2. Goal of the study

Given this premise, this paper aims to review the scientific literature on sustainable towns exploring its evolution and trend, identifying the main scientific patterns in this field of science with reference to the achievement of the UN 2030 Agenda Sustainable Development Goals (UN, 2015). In addition,

the present study explored the global scientific literature on sustainable historical towns using bibliometric network analysis. In particular, the VOSviewer software (version 1.6.17, Leiden University, Netherlands), a software tool based on social network analysis, was used allowing for the creation, visualization, and exploration of maps based on bibliometric network data. Finally, the scientific literature on the assessment of sustainable towns was also explored.

3. Definition of historical towns

3.1. Evolution in the concept of heritage: from historical centres to historical towns

It is difficult to find a comprehensive definition of "historical town" in the scientific literature. It is possible to conceptualize this typology of urban entity as a complex system *"with its own characteristics developed throughout history and shaped by its geography, inhabitants, and socio-political systems"* (EEA, 2021). However, the concept of *"permanency of settlement"* is crucial to assess historical towns. Considering that the majority of European cities have been continuously inhabited for centuries, it is necessary to consider not only quantitative aspects, but also social, environmental, economic, and cultural aspects to capture the essence of place (Nesticò et al., 2020_a; Steinführer et al., 2016; Portugali, 2016).

In this regard, from the second half of the last century, there has been a huge interest in the study of historical centres to protect the heritage from uncontrolled reconstruction after the Second World War.

The evolution in the concept of historical centre up to the current time has resulted in a geographical progressive expansion of the concept, encompassing the whole town, as well as of its meaning, from an urban-architectural identity, also including social and economic aspects (Coletta, 2010).

At international level, the importance of protecting historical towns with their natural and anthropized environments is recognized in the ICOMOS Charter on the Conservation of Historic Towns published in Washington in 1987 (Lazzarotti, 2011; ICOMOS, 1987). In the same year, the Italian Charter of Conservation and Restoration of artistic and cultural objects defined the historical centre as *"an inhabitative aggregation whose significance is irreplaceable in the history of a cultural area of humanity"* (Marconi, 1988).

Among European countries, Italy, which holds the highest number of sites included in the list of UNESCO World Heritage Sites, has always led the debate on these themes. In fact, one of the most important documents that started the urban planning debate on the issue of historical centres was the Italian Gubbio Charter in 1960. It primarily established priorities, particularly the need to conduct historical heritage censuses and to identify categories of intervention.

In 1964, the Venice Charter was formulated, acknowledging for the first time the whole historical urban settlement as "heritage" (ICOMOS, 1964) while providing a multi-scale definition of historical urban settlement (Nesticò et al., 2020_b). Since the '70s, the concept of "historical centre" has been consolidated in this widest sense.

With the issuing of the Charter of Krakow (2000) and the European Landscape Convention (2000), the landscape was recognised as an essential component of people's living environment, an expression of the wealth of their common cultural and natural heritage, and the foundation of their identity (Nesticò et al., 2020_a). The notion of landscape applies to the whole territory of European countries and covers natural (land, inland water, and marine areas), rural, urban, and peri-urban areas. It also refers to outstanding and degraded landscapes (Council of Europe, 2000).

Noteworthy is the classification of historical centres made by Alberto Predieri in 1971, who divided them into three categories: *"historical centres of large metropolitan areas", "small historical towns"* originally embedded in areas seats of important political, economic, and cultural functions today decayed, but of great historical-artistic-environmental value, and *"abandoned small historical towns"* in which *"the physical and technological degradation of the buildings seems to find its origin in the demographic exodus"* (Coletta, 2010).

Also significant in this regard is the contribution given by Di Gioia in 1975 stating that *"the term historic centre is understood to include all urban, architectural, and artistic values that should be protected today: that is, all the values that the city, the small town, or even the most remote and modest settlement has been able to express in its history, whether critical or recent"* (Nesticò et al., 2020_a). Based on these considerations, the subject of the present study is fully consistent with the Predieri's definition of "small historical towns".

3.2. Quantitative classification of towns: the degree of urbanization

Although introducing a quantitative definition of "town" is not enough to define the subject of this research, it is useful to compare some policy achievements among different settlements globally.

The harmonized global definition for the classification of cities, towns and semi-dense areas and rural areas is called "Degree of Urbanization Classification" which is based only on quantitative criteria, combining population size, contiguity, and population density. This methodology has been originally introduced in 1991 and then implemented in 2011 by the European Commission, Eurostat, and OECD with the term of Degree of Urbanization (DEGURBA) (Nabielek et al., 2016). To improve statistical consistency and comparability of data at global level which is essential for measuring policymaking initiatives effectiveness, this methodology has been upgraded and harmonized in 2021 by the joint work of the European Commission, the Food and Agriculture Organization of the United

Nations (FAO), the United Nations Human Settlements Programme (UN-Habitat), the International Labour Organization (ILO), the Organization for Economic Cooperation and Development (OECD) and The World Bank. The Degree of Urbanization divides the entire territory into 1 km^2 grid cells. The main settlement typologies are provided as follows:

- Urban centre (or high-density cluster) has a population of at least 50,000 inhabitants and consists of contiguous grid cells with a density of at least 1,500 inhabitants per km^2;
- Urban cluster (or moderate density cluster) has a population of at least 5,000 inhabitants and consists of contiguous grid cells with a density of at least 300 inhabitants per km^2;
- Rural grid cells (mostly low-density cells) do not belong to an urban cluster. Most of these have a density below 300 inhabitants per km^2. Some rural cells have a higher density, but they are not part of a cluster with a large enough population size to be classified as an urban cluster.

On this basis the Local Administrative Units could be classified as follows:

- Cities are densely populated areas with at least 50% of the population living in the urban centres;
- Towns and suburbs are intermediate density areas with less than 50% of the population living in urban centres and less than 50% of the population living in rural grid cells;
- Rural areas are thinly populated areas with more than 50% of the population living in rural grid cells (EC et al., 2021).

According to the harmonized definition of towns and suburbs by the Degree of Urbanization classification, they are represented as a residual category, defined by the principle of not being predominantly cities and not being predominantly rural areas. It is a shared belief among the scholars of towns that *"in handbooks of urban studies, for example, urbanity beyond metropolises is not a topic to which specific attention is paid"* (Steinführer et al., 2016). This disregard for towns is even more important considering that 31% of the European population lives in towns and suburbs and this percentage exceeds 40% in Germany, the Netherlands, Italy, and Malta, and the strongest population growth took place in towns and suburbs (Nabielek et al., 2016). However, small towns need to be defined with a positive meaning without referring to any other types of settlement (Steinführer et al., 2016). Instead, it is crucial for cities to build a harmonious relationship with their hinterlands to face together the environmental challenges that will characterize the future of metropolitan areas. In this regard, the debate on small towns is also involving large urban centres and the sustainable development of the whole nation (Nesticò et al., 2020_a; Berizzi and Rocchelli, 2019).

4.Governance issues related to the size of towns. Weaknesses and strategies to enhance inner peripheral areas.

Small towns' depopulation and marginalization is a consolidated phenomenon that affects all European regions, especially in the inner peripheral areas which, despite being rich in cultural, environmental and landscape resources, have lower general performance, levels of development, access to services of general interest, and quality of life compared to their neighboring territories (ESPON, 2017$_a$). Typically, inner peripheral areas are characterized by some common features, such as large distance to regional centres and to services of general interest, out-migration of young and highly skilled people, population decrease, high old-age dependency ratio, lack of skilled workforce, and an economic sector often based on traditional activities (ESPON, 2017$_b$).

This condition mainly derives from being outside or on the margins of the mainstream of post-World War II urban-industrial growth. Inner peripheries have been forgotten for too long in the political agenda at the regional, national, and European levels. The official entry of the term *"inner peripheries"* in the framework of the spatial typologies discussed by scholars and policymakers in Europe is due to the publication of the reports of the European Spatial Planning Observation Network (ESPON) projects (Ietri and Pagetti, 2019).

The importance of local governance - and the scale at which the integration of development strategies offers the best potential to solve the main problems - is well reflected in the literature (Martinez-Fernandez et al., 2012). Moreover, smaller municipalities, that most need to develop strategies to cope with shrinkage, are often those with the least capacity to act due to skills shortages, staffing, and spending constraints. Therefore, to face these challenges a policy response, a long-term perspective, and a coherent and simultaneous commitment at multiple levels of governance are required. While governance should address the problems of inner peripheral areas by connecting them with their surrounding areas generating synergies and networks, on the other hand, there is the need to preserve their ecological and cultural diversity (ESPON, 2017$_b$; ASviS, 2022).

The European Union is currently implementing strategies to enhance these areas, which are characteristic of almost all European countries, with the aim to reduce territorial disparities by developing cooperation frameworks between local technical, institutional, and private actors, and also by promoting public participation (ESPON, 2017$_b$).

An important contribution to the EU debate against the marginalization of inner peripheral areas has been provided by the Italian Strategy for Inner Areas (Servillo et al., 2016). In fact, inner areas make up 53 % of Italian municipalities (4261), are home to 23 % of the Italian population (13,540,000 inhabitants) and cover 60 % of the national territory. Therefore, the Italian Government pays particular attention to inner areas.

The Italian Strategy for Inner Areas represents a best practice in Europe for tackling the problems of shrinking local communities through an integrated and place-based approach (ENRD,

2018). The fundamental objectives of this strategy are the improvement of the quantity and quality of services for education, health, mobility, and the promotion of local development projects that enhance the natural and cultural heritage of these areas.

At the basis of the Inner Areas Strategy is the concept of protection. The reuse of cultural heritage, the provision of services for inhabitants, the development of sustainable, innovative and, above all, highly distinctive and recognisable tourism, are all actions that contribute to the creation of a valorisation strategy that is also fundamental to prevent the loss of cultivated land and hydrogeological instability (Barca et al., 2014). In this framework, special attention is paid to small historic towns to support the implementation of integrated public-private actions aimed at urban regeneration, enhancing areas of architectural and cultural interest while respecting the original typologies and structures (Russo, 2019).

5. Sustainable urban policy

The importance of cities in achieving sustainability goals has been recognized since the publication of the Brundtland Report "Our Common Future" in 1987 (WCED, 1987), after which sustainable development has become a key topic in academic, community, national and global contexts (Albertì et al., 2017; Bayulken and Huisingh, 2015). The need to promote sustainability in cities considering the crucial role of local authorities was further emphasized in the Agenda 21, the 1992 Rio Declaration on Environment and Development (UNCED, 1993). Since then, the pursuit of urban sustainability has been high on the agenda of scholars and policymakers and it has been highlighted in major international reports and policy frameworks.

Throughout the 20th century, due to the demographic transition and globalization, the crucial role of cities in sustainable development has been officially recognized. Indeed, in 2012, the United Nations Rio+20 Conference on Sustainable Development highlighted that cities are one of the most important issues to be prioritized for the transition to sustainable development (Ki-moon, 2012). In 2015, the 2030 Agenda for Sustainable Development and the Paris Agreement (UN-FCCC, 2015) were adopted. The 2030 Agenda consists of 17 Sustainable Development Goals (SDGs) framed within a broader integrated action program of 169 associated environmental, economic, social, and institutional targets by 2030, considering in a balanced way the three dimensions of sustainable development: economic, social and ecological (UN, 2015). Specifically, the SDG 11"Make cities and human settlements inclusive, safe, resilient and sustainable" distinctly refers to sustainable urban development. The inclusion of this goal reflects an increased awareness of the important role of cities for global development pathways (Dick, 2016). The *"Sustainable cities and communities"* challenge is defined by the UN Sustainable Development Solution Network as one of the six SDG

transformations needed for achieving the SDGs and the objectives of the Paris Agreement (UN, 2015; UN-FCCC, 2015).

At European level, the consensus on specific objectives and values in policies for the sustainable development of cities had already been reached with the drafting of the 2007 Leipzig Charter on the sustainable development of European cities, and the 2010 Toledo Declaration in which European nations committed themselves to *"green, ecological or environmental"* urban regeneration (Riccio et al., 2022; Van Lierop, 2018). Based on the principles of subsidiarity and proportionality, the Toledo Declaration aims to promote cooperation between the Member States, the European Commission, and cities, formalizing the decision-making process through multi-level governance in order to stimulate smart, sustainable, and inclusive growth to improve the quality of life in European urban areas.

The EU Urban Agenda (2016) focuses on the three pillars of EU policymaking *"to involve cities in achieving Better regulation, Better funding and Better knowledge"* (EC DG REGIO, 2021). To reach these results, in the years 2016 and 2017, partnerships between cities, Member States, the Commission, and stakeholders such as NGOs or businesses were defined on the inclusion of migrants and refugees, air quality, housing, urban poverty, circular economy, digital transition, urban mobility, jobs and skills in the local economy, energy transition, climate adaptation, innovative and responsible public procurement (Green Public Procurement), and sustainable use of land and nature-based solutions.

Implementing these policies is needed to territorialize the goals of the European Green Deal, which encourage the transition to a climate-neutral, green, and circular economy by prioritizing available funding support for the 2021–2027 period, and also the UN Agenda 2030 goals in Europe.

Following the SARS-CoV-2 pandemic crisis outbreak in 2020, the EU set up a Recovery and Resilience Plan, *"Next Generation EU"*, to tackle the economic and social damage caused by the pandemic. In this context, the economic recovery was closely linked to the purposes outlined in the EU Green Deal: the transformation of the EU into a competitive and resource-efficient economy that will generate no net GHG emissions in 2050 and that will reduce them by 55% compared to the 1990 scenario by 2030 (EESC, 2020). Therefore, it was mandated to the Member States to translate these requirements into their own National Recovery and Resilience Plans (NRRPs) to encourage the active involvement of local and regional authorities and their citizens for the success of the Green Deal, to stem the current problems and to respond effectively to the needs of future generations.

6. State of the art in sustainability assessment of towns

6.1. The crucial role of cities in the SDGs achievement

At the international level, the process of monitoring and evaluating the achievement of the 2030 Agenda SDGs takes place through an official statistical framework consisting of 231 universal indicators developed by the Inter-Agency Expert Group on SDGs (IAEG-SDGs) on the instructions of the United Nations Statistical Commission (UNSC). To address the lack of consistent data, the UN invites States to select and develop, in line with the 2030 Agenda and according to the needs of national statistical systems, both indicators and measurement methodologies to monitor progress on the SDGs at national level. Through the *"National Voluntary Reviews"* (VNR), a voluntary reporting mechanism carried out by individual states with the preparation of update reports on the 17 Goals, the 193 signatory countries participate in the follow-up and review phase of the Agenda, whose progress, challenges and results are examined annually by the High-level Political Forum on Sustainable Development (HLPF) under the aegis of the United Nations Economic and Social Council (ECOSOC) (Cavalli et al., 2021). Within this framework, sustainable cities are at the heart of the transformation needed to achieve the Sustainable Development Goals by 2030 (Cavalli et al., 2021). Urban areas are the backdrop for much of the thematic content of the SDGs, and they are fundamental for the implementation of all SDGs. By considering cities as complex systems using a holistic approach and exploring the relationships among different SDGs, addressing the sustainability of cities by acting synergistically on environmental, social, economic and institutional development means contributing to the achievement of all the goals of the 2030 Agenda, with reference to the fifth SDG transformation *"Sustainable Cities and Communities"* as defined by the UN Sustainable Development Solution Network. Each SDG transformation describes a major change in the structure of society (economic, political, technological, and social) to achieve long-term sustainable development and the goals of the Paris Agreement, which aim to strengthen the world's capacity to address the impacts of climate change through the subnational governments' local actions (Albertì et al., 2019; UN-FCCC, 2015). The organization of this fifth transformation is particularly complex due to the large number of actors involved and the distribution of responsibilities between national and local levels of government (Sachs et al., 2019). In this context, cities represent the "marker" of the SDGs achievement because the impacts of climate change, and the results of mitigation strategies, are more visible at the local level. Therefore, according to the International Council for Local Environmental Initiatives (ICLEI), "*the future of the planet depends on how cities grow, function and respond to stress"* (Woodbridge, 2015). For this reason, the Political Declaration adopted by Heads of State and Government at the United Nations General Assembly to launch the *Decade of Action* for the SDGs recognizes the crucial role of cities in strengthening local action to accelerate the implementation of the SDGs and commits to support cities, local authorities and communities in this effort. Since 2018, several cities have begun reporting to the United Nations on their progress on the SDGs, submitting Voluntary Local Reviews

(VLRs), a sub-national equivalent of the Voluntary National Reviews (VNRs) to report on actions and policy solutions to achieve the Goals (Eurocities, 2020). Despite their potential impact on the institutional and statistical capacity of local administrations, appropriate knowledge and technical guidance are required to support the preparation of these voluntary reports, harmonizing as far as possible the measurement indicators between VNRs and VLRs, in a perspective of systemic policy integration (ASviS, 2021).

6.2. The EU effort in the SDGs localization

The 2030 Agenda emphasizes the need for an inclusive and localized approach to the SDGs (Siragusa et al., 2020). Localization is intended *as "the process of defining, implementing and monitoring strategies at the local level for achieving global, national and sub-national sustainable development goals and targets. This involves concrete mechanisms, tools, innovations, platforms, and processes to effectively translate the development agenda into results at the local level."* (UNDG, 2014; Siragusa et al., 2020).

Although there is international consensus on the need to implement methods for integrating the local dimension in international reporting, currently there is no unifying framework used by cities to report on SDGs implementation. The OECD 2020 Report highlights the importance of the role that cities and local territories play in achieving the SDGs (OECD, 2020). The report published by Eurocities analyses the key actions to be taken to accelerate the localization process of the 2030 Agenda, offering specific recommendations and concrete examples of successful European cities. It also stresses the importance of financial instruments such as the European Green Deal, which can be used to promote local investment for sustainable development. Eurocities suggests identifying governance, economics, finance, partnership, and co-creation, in addition to science, research, and innovation, contained in the UN Global Sustainable Development Report (GSDR 2019) as levers of transformation (Riccio et al., 2022; Eurocities, 2020). Under the URBAN2030 and URBAN2030-II Projects started in 2018, the Joint Research Centre of the European Commission aims at supporting European cities and regions in SDGs localization. These projects focus on providing methodological support for the SDG Voluntary Local Reviews implementation. Among the outputs, the European Commission's "*Handbook for SDG Voluntary Local Reviews*" published in 2020 represents an important contribution to SDGs localization. The *Handbook* presents guidelines for researchers and policymakers to create VLRs, so that they do not only represent an analysis of the SDGs at the local level but also become an integral part of territorial policies. The *Handbook* also includes a useful overview of the reviews produced at the local level and presents a collection of useful indicators especially relevant to European cities (Eurocities, 2020; Siragusa et al., 2020).

The 71 indicators presented in the Handbook are gathered from: European institutions collecting official statistics, National Statistical System (NSS), intergovernmental organizations, universities and research centres or institutions; local administrations; NGOs, independent organizations, and foundations.

At the end of February 2021, there were 24 Voluntary Local Reviews available and published by 22 European local and regional governments for a total amount of 1,583 indicators on all 17 SDGs. Among these, about 37% of data are collected at the local level, 27% are extracted from national sources, 14% are from regional ones. About 9% of data comes from civil society, academia, and the private sector: these categories include most data and work of 'third-party' knowledge brokers (Ciambra, 2021).

Several international organizations, non-profits, foundations, and other 'knowledge brokers' have been researching sustainability policy and data within the 2030 Agenda framework for years.

Facing the challenge of organizing a reliable set of urban metrics, it is noteworthy the work that the United Nations Sustainable Development Solutions Network (UN-SDSN) has been conducting since 2012 under the auspices of the UN Secretary-General. Conformed to being a hub of technological and social knowledge for the provision of practical solutions and cross-boundary alliances for the implementation of sustainable development policies, it has had a significant impact on the way these policies are monitored and assessed and replicated at the local level. The SDSN, among others, is the author of the SDG index, which is composed of 75 indicators designed as a proxy for the official IAEG-SDGs sets, representing one of the first robust efforts to track the SDGs implementation (Lafortune et al., 2019). To date, the SDG index has been downscaled by overcoming the difficulties related to the disaggregation of indicators in the territorial spillover, in the following contexts: Africa (Sustainable Development Goals Center for Africa and SDSN, 2020), Europe (SDSN and IEEP, 2020), the United States (Lynch et al., 2019; Sachs et al., 2018), Spain (Sánchez de Madariaga et al.,2018; REDS, 2020) Italy (Cavalli and Farnia, 2018), Northern Europe, Arab countries, and Latin America (Ciambra, 2021). Despite these efforts, a research gap on the localization of the SDGs still remains. This is mainly due to the lack of data at the urban level that makes the assessment of SDGs more demanding compared to the national level (Lafortune et al., 2019).

Also, the few results are mainly focused on regions or capital cities while there is not a focus on monitoring SDG indicators at the local level for medium and small municipalities (Richiedei and Pezzagno, 2022). The same problem occurs analyzing the range of the population of cities that submitted the EU VLR varying from 100,000 to about one million inhabitants. Smaller cities have historically been underrepresented among VLR cities, often because the challenges of identifying valid and reliable indicators, selecting accessible data sources to measure localization performance,

and producing a report compliant with the UN requirements appear overwhelming to smaller administrations.

However, Europe is characterized by a multitude of small and medium-sized towns. As part of a polycentric urban system, composed of unique centers of exceptional cultural value that shape Europe's urban heritage and the identity of its citizens, these are functional areas with multiple potentials and challenges. Thus, culture is at the heart of any sustainable urban development, including preserving and developing built heritage and other cultural assets. Fitting urban policies to people daily lives, cities and towns should cooperate and coordinate their sustainability policies with the surrounding suburban and rural areas, enabling cultural, social, ecological and economic interaction to ensure a high quality of life.

7. Bibliometric network analysis

Bibliometric network analysis is a powerful tool combining bibliometric and social network analysis to obtain a comprehensive understanding of a research field. Due to an open and transparent approach based on mathematics and statistics, bibliometric network analysis allows to analyze thousands of articles, obtain useful information such as the main actors in a research field, and identify new and emerging research areas (Skaf et al., 2020; Buonocore et al., 2021; Reuters, 2008; Russo, 2014). In this study, the bibliometric analysis was performed using the VOSviewer software (version 1.6.17), allowing for the creation, visualization, and exploration of bibliometric network maps (Reuters, 2008).

A bibliometric network map is usually a weighted data network composed of nodes and edges. The nodes represent items, like countries, journals, organizations, authors, keywords, publications, and terms related to the investigated topic. The edges indicate relations between pairs of nodes (Galychyn et al., 2020; Marvuglia et al., 2020). A map usually includes only one type of item (Table 1). It is for example uncommon to have a map that includes both publications and terms (Acuto et al., 2018). Since the majority of the scientific literature dealing with city sustainability focuses on megacities and towns make up most of the historical urban pattern, the co-authorship, co-occurrence, and citation analysis were performed on “sustainable historical towns” and “sustainable towns assessment” (Table 2).

Table 1. Terminology used by VOSviewer software

Term	Description
Items	Objects of interest (e.g., publications, researchers, keywords, authors).

Link	Connection or relation between two items (e.g., co-occurrence of keywords).
Link strength	Attribute of each link, expressed by a positive numerical value. In the case of co-authorship links, the higher the value, the higher the number of publications the two researchers have co-authored.
Network	Set of items connected by their links.
Cluster	Sets of items included in a map. One item can belong only to one cluster.
Weight attribute: number of links	The number of links of an item with other items.
Weight attribute: total link strength	The cumulative strength of the links of an item with other items.

Table 2. Different VOSviewer types of analyses used in this study

Types of analysis	**Description**
Co-authorship	In co-authorship networks, researchers, research institutions, or countries are linked to each other based on the number of publications they have authored jointly.
Co-occurrence	The number of co-occurrences of two keywords is the number of publications in which both keywords occur together in the title, abstract or keyword list.
Citation	In citation networks, two items are linked if at least one cites the other.

7.1. Sustainable historical towns: Publications and citations trend analysis

The documents analysed in this study were collected by research on the Scopus web search engine using “sustainable historical towns” as a string. The research on the Scopus database produced 355 scientific articles published from 1996 to 2021 which were exported as *.csv files and imported into the VOSviewer software. Figure 1 shows that the scientific research on the topic has increased in the last decades.

In fact, from 2010 to 2020 the number of publications has increased by 7-fold.

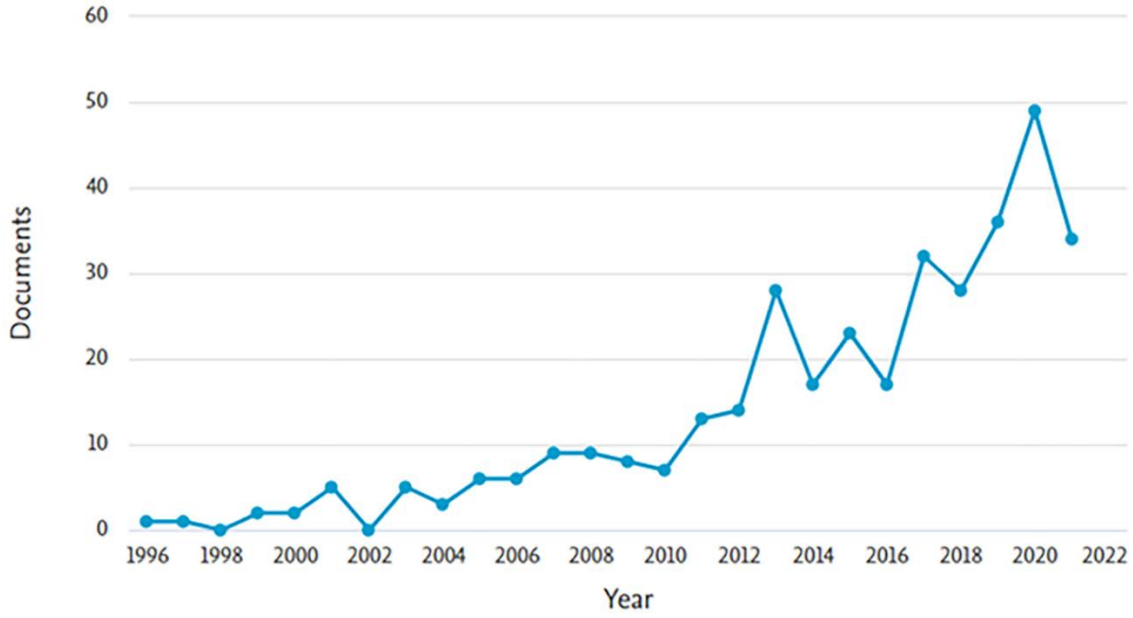

Figure 1. Documents by year related to "sustainable historical towns"

7.1.1. Keywords network analysis

The analysis of the keywords connected to sustainable historical towns generated a number of 2744 results. Among them, only 90 met the threshold of at least five co-occurrences. The first keyword was "sustainable development" with 139 co-occurrences. In the co-occurrence network map of keywords (Figure 2) the bigger circle size is proportional to the higher co-occurrence of an item. Moreover, the shorter distance among items is associated with their stronger relation. Colours were used to differentiate the average year of publication of the keywords.

It is worth mentioning that, in the timeframe 1996–2015 (blue and dark-green colour), the main focus of the research was placed on more sectorial technical aspects connected to economics, geography, and historical development. Instead, from 2015 to date, the main keywords are restoration, tourism development, sustainable urban development, smart city, decision making, and regional planning showing a higher attention to sustainability through a holistic approach to urban planning and higher governance accountability.

This is mainly due to the publication of the UN 2030 Agenda and of the UN Urban Agenda that has provided further momentum to urban sustainability making it a global priority (Zhang et al., 2020; Russo, 2014).

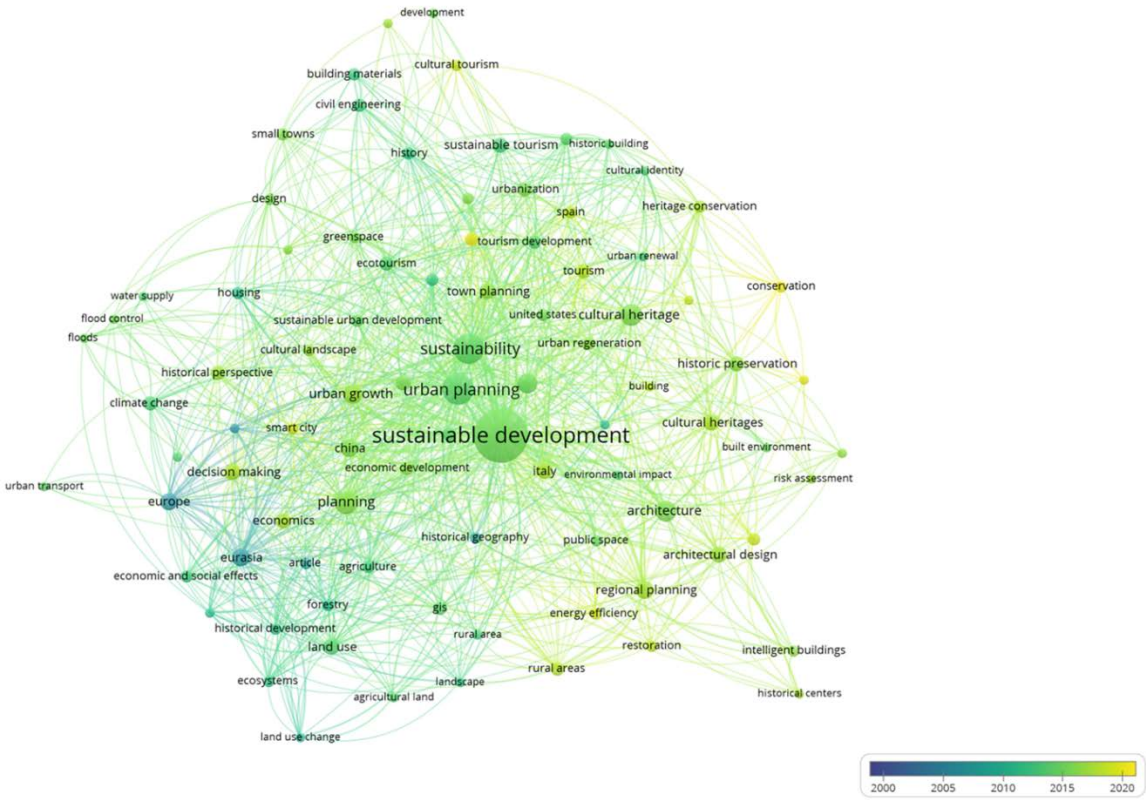

Figure 2. Keywords related to "sustainable historical towns" in the scientific literature

7.1.2. Country network analysis

The co-authorship analysis of countries provided 74 results. Using a threshold of five documents per country, 20 countries were selected and displayed in the co-authorship network map (Fig. 3). Italy resulted the country with the highest value of published documents, and it is characterized by a high level of interaction (high value of total link strength). This is mainly due to the morphology of the Italian urban fabric, whose municipalities with less than 60,000 inhabitants make up about 99% of cities. Likewise, it is noticeable that other European countries such as the UK, Poland, Spain, France, and Greece are also characterized by a high value of document production and citations.

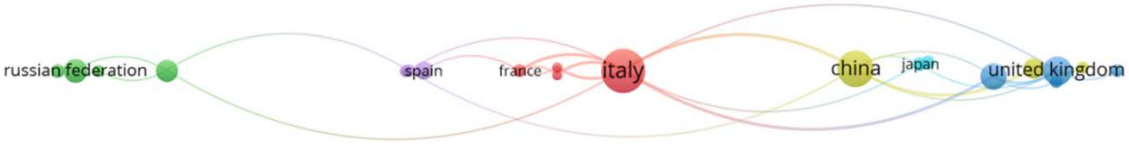

Figure 3. Co-authorship network map of countries related to "sustainable historical towns" obtained selecting a threshold of five documents per country

7.2 Sustainable towns assessment: Publications and citations trend analysis

The documents of this study were collected by research on the Scopus web search engine using "sustainable town* assessment" as a string. The research on the Scopus database produced 769 scientific articles published from 1994 to 2021 which were exported as .csv files and imported into the VOSviewer software. From these data, it is noticeable that the scientific research on the topic has shown a rapid increase in recent decades. In fact, the number of publications has increased by 3-fold (Figure 4).

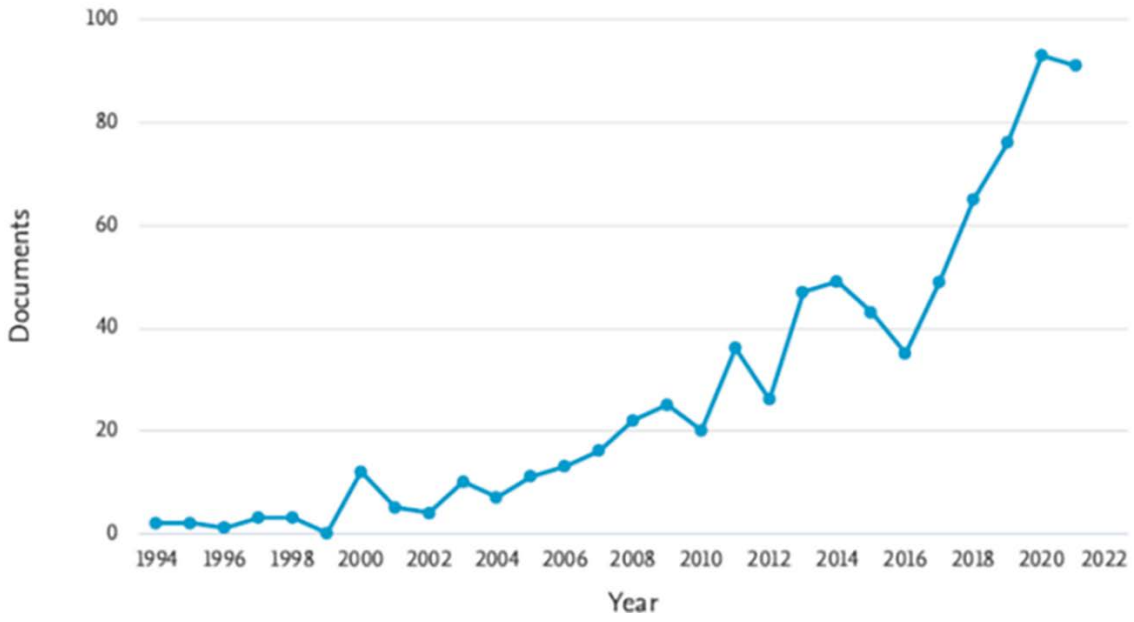

Figure 4. Documents by year related to "sustainable town* assessment"

7.2.1 Keywords network analysis

The analysis of the author keywords connected to sustainable towns assessment generated 2498 results. Among them, only 49 met the threshold of at least five co-occurrences. The keywords trend map in Figure 5, in which different colours were used to differentiate the average year of publication, shows the evolution of the research approach in sustainable towns assessment and the assessment tools in the last two decades. This is due to the growing attention of the international political agendas to the current themes related to environmental impacts, green economy, climate change, biodiversity, and sustainable development.

It is noticeable from Figure 5 how the approach toward the application of "urban science" has changed over the last decade. It is evident from the analysis of the keywords concerning the sustainable towns assessment that there has been a shift from "urbanization" and "urban planning" linked to "environmental impact assessment", "energy" and "environment" to "sustainable

development” linked to “climate change”, “vulnerability”, “urban metabolism”, “ecosystem services”, “remote sensing”, “GIS”, “green infrastructure” and “small towns”. Therefore, it is also evident from the map that the sustainability of small towns is an issue of more recent times.

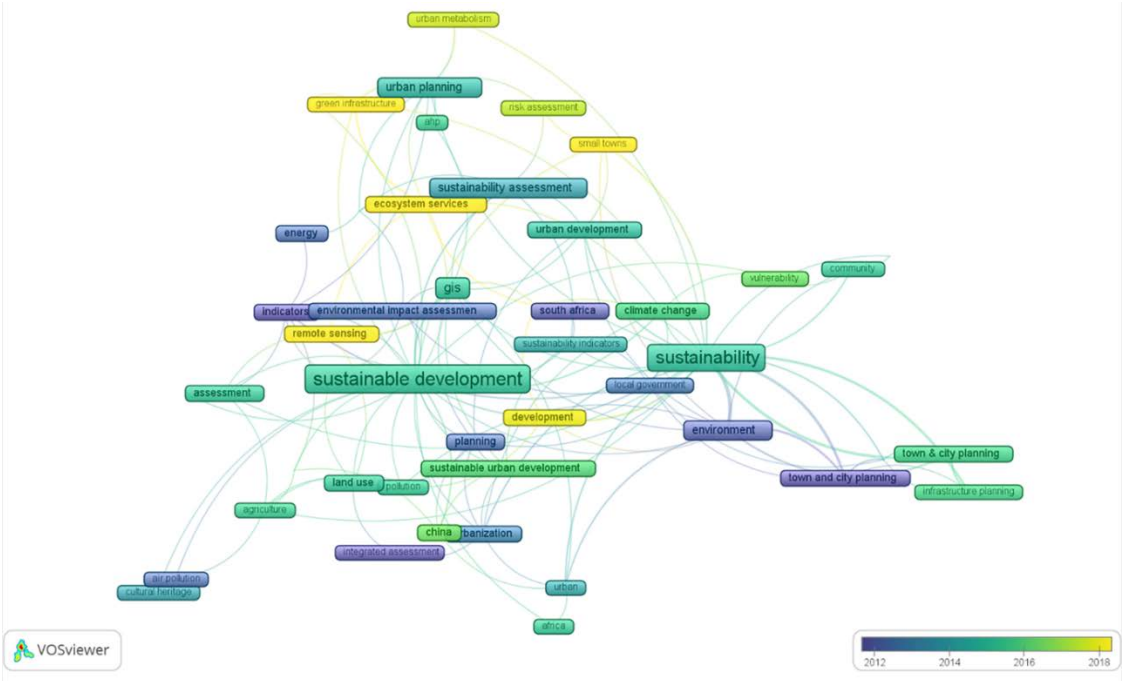

Figure 5. Keywords related to “sustainable town* assessment” in the scientific literature

8. Conclusions

The present study aims to explore the global scientific literature on sustainable historical towns and their assessment by following its evolution and trends, also applying social network analysis to bibliometric science.

In the last decades, the scientific literature on “sustainable historical towns” and “sustainable towns assessment” has rapidly increased by 7-fold and 3-fold respectively, especially among European academics while, in parallel, the concept has been integrated into several international regulations and policies.

In addition to the growing interest in assessing the sustainability of historical towns, the results show a marked shift from the topic of urbanization and urban planning to more holistic approaches linking sustainable development to important issues among which climate change, urban metabolism, and ecosystem services, especially following the publication of the UN 2030 Agenda and of the UN Urban Agenda.

Addressing global urban challenges requires the localization of SDGs through a holistic “urban science” approach encompassing environmental, social, and economic aspects while capturing the complexity and peculiarities of historical towns.

Therefore, future research efforts are needed to implement multicriteria assessment frameworks for the localization of SDGs in historical towns capable of providing a standardized set of indicators, the development of shared languages, operational management models and reference frameworks, performance requirements, guidelines, and technical support tools.

Such efforts are still needed to provide policymakers with easy-to-use and standardized methodologies and indicators to implement effective bottom-up strategies for sustainable management of historical towns that contribute to the achievement of the 2030 Agenda goals.

Acknowledgements

The lead author (Moscatelli A.) wishes to thank the UNESCO Chair on “Environment, Resources and Sustainable Development” of the Parthenope University of Naples (Italy) for funding her PhD thesis and the research staff of the UNESCO Chair in “Life Cycle and Climate Change” at ESCI-UPF of Barcelona (Spain) for supporting the drafting of the article. The authors are responsible for the choice and presentation of the information contained in this paper as well as for the opinions expressed therein, which are not necessarily those of UNESCO and do not commit this Organization.

References

Acuto M., Seto K., Parnell S., Contestabile M., Allen A., Attia S., Bai X., Batty M., Bettencourt L., Birch E., Bulkeley H., Cardama M., Ebikeme C., Elmqvist T., Elsheshtawy Y., Kickbusch I., Lwasa S., McCann J., McCarney P., 2018, Science and the Future of Cities, Report of the International Expert Panel on Science and the Future of Cities, London and Melbourne.

Albertí J., Balaguera A., Brodhag C., Fullana-i-Palmer P., 2017, Towards life cycle sustainability assessment of cities. A review of background knowledge, Science of the Total Environment: 1049-1063.

Albertí J., Brodhag C., Fullana-i-Palmer P., 2019, First steps in life cycle assessments of cities with a sustainability perspective: A proposal for goal, function, functional unit, and reference flow, Science of the Total Environment, 646: 1516-1527.

Barca F., Casavola P., Lucatelli S., 2014, Strategia Nazionale Per le Aree Interne. Definizioni, Obiettivi e Strumenti di Governance, Materiali Unità di valutazione degli investimenti pubblici (UVAL) 31, Rome.

Bayulken, B., Huisingh, D., 2015, A literature review of historical trends and emerging theoretical approaches for developing sustainable cities (part 1), J. Clean. Prod., 109: 11-24.

Berizzi, C., Rocchelli, L., 2019, Borghi Rinati. Paesaggi Abbandonati e Interventi di Rigenerazione, Il Poligrafo, Padova.

Buonocore, E. Grande, U., Franzese, P.P., Russo, G.F., 2021, Trends and Evolution in the Concept of Marine Ecosystem Services: An Overview, Water, 13: 2060.

Cavalli, L., Farnia, L., 2018, Per un'Italia sostenibile: l'SDSN Italia SDGs City Index. Fondazione Eni Enrico Mattei, Milano.

Cavalli L., Lizzi G., Toraldo S., 2021, Italy after five years from the adoption of the 2030 Agenda: a quantitative review, Fondazione Eni Enrico Mattei, Sustainable Development Solution Network (SDSN) Italy, Milan.

Ciambra A., 2021, European SDG Voluntary Local Reviews: A comparative analysis of local indicators and data, Publications Office of the European Union, Luxembourg.

Coletta T., 2010, I Centri Storici Minori Abbandonati della Campania. Conservazione, Recupero e Valorizzazione, Edizioni Scientifiche Italiane, Naples.

Council of Europe, 2000, Landscape Convention (ETS No. 176). Treaty open for signature by the member States and for accession by the European Union and by the non-member States, Florence.

Dick E., 2016, Urban governance for sustainable global development: from the SDGs to the New Urban Agenda, Briefing Paper 8, Deutsches Institut für Entwicklungspolitik (DIE), Bonn.

Eurocities, 2020, Paving the way for sustainable cities. Eurocities report on the implementation of Sustainable Development Goals at local level.

European Commission (EC), 2010, Making our cities attractive and sustainable, European Union Publications, Belgium.

European Commission Directorate General for Regional and Urban Policy Unit (EC DG REGIO), 2021, Urban Agenda for the EU Multi-level governance in action 2021 Update, Brussels.

European Commission (EC), Food and Agriculture Organization of the United Nations (FAO), United Nations Human Settlements Programme (UN-Habitat), International Labour Organization (ILO), Organisation for Economic Co-operation and Development (OECD), and The World Bank, 2021, Applying the Degree of Urbanisation, a new International Manual for defining cities, towns and rural areas, European Union.

European Economic and Social Committee (EESC), 2020, Annual Sustainable Growth Strategy 2021, COM (2020) 575, European Commission, Brussels.

European Environment Agency (EEA), 2021, Urban sustainability in Europe – Avenues for change, EEA Report 6/2021, Copenhagen.

European Network for Rural Development (ENRD), 2018, Strategy for Inner Areas Italy Working Document, European Commission, Bruxelles.

European Spatial Planning Observation Network (ESPON), 2017a, Inner Peripheries: National territories facing challenges of access to basic services of general interest. Applied Research. Processes, Features and Cycles of Inner Peripheries in Europe (PROFECY) – Final Report. Annex 5. List of Inner Peripheries (NUTS-3 regions) according to the four Delineations, Luxembourg.

European Spatial Planning Observation Network (ESPON), 2017b, Policy Brief: Shrinking rural regions in Europe. Towards smart and innovative approaches to regional development challenges in depopulating rural regions, ESPON EGTC, Luxembourg.

Galychyn O., Buonocore E., Franzese P. P., 2020, Exploring the global scientific literature on urban metabolism, Ecological Questions, 31(4): 89-99.

Ietri D., Pagetti F., 2019, La definizione di "inner peripheries": indicatori e unità territoriali, Bollettino dell'Associazione Italiana di Cartografia, 165: 89-97.

International Council on Monuments and Sites (ICOMOS), 1964, The Venice Charter: International Charter for the Conservation and Restoration of Monuments and Sites, 2nd International Congress of Architects and Technicians of Historic Monuments, Venice.

International Council on Monuments and Sites (ICOMOS), 1987, Charter for the conservation of historic towns and urban areas (Washington Charter 1987), Adopted by ICOMOS General Assembly in Washington DC, Washington.

Italian Alliance for Sustainable Development (ASviS), 2021, Report "I territori e gli obiettivi di sviluppo sostenibile, Rome.

Ki-moon B., 2012, "Our Struggle for Global Sustainability Will Be Won or Lost in Cities" (SG/SM/14249-ENV/DEV/1276-HAB/217), New York.

Lafortune G., Zoeteman K., Fuller G., Mulder R., Dagevos J., Schmidt-Traub G., 2019, The 2019 SDG Index and Dashboards Report for European Cities, Sustainable Development Solutions Network (SDSN) and the Brabant Center for Sustainable Development (Telos), Tilburg.

Lazzarotti R., 2011, Historical centres: changing definitions. Italian Journal of Planning Practice, 1(1): 73-89.

Lynch A., LoPresti A., Fox C., 2019, The 2019 US Cities Sustainable Development Report. New York: Sustainable Development Solutions Network (SDSN).

Marconi P., 1988, Carta della conservazione e del restauro degli oggetti d'arte e di cultura del CNR, coordinata da Paolo Marconi, Corrado Maltese e altri, Ricerche di storia dell'arte 35.

Martinez-Fernandez C., Audirac I., Fol S., Cunningham-Sabot E., 2012, Shrinking cities: urban challenges of globalization, International Journal of Urban and Regional Research, 36(2): 213-225.

Marvuglia A., Havinga L., Heidrich O., Fonseca J., Gaitani N., Reckien D., 2020, Advances and challenges in assessing urban sustainability: An advanced bibliometric review, Renewable and Sustainable Energy Reviews, 124: 109788.

Nabielek K., Hamers D., Evers D., 2016, Cities in Europe, PBL Netherlands Environmental Assessment Agency 2323, The Hague.

Nesticò A., Fiore P., D'Andria E., 2020_a, Enhancement of Small Towns in Inland Areas. A Novel Indicators Dataset to Evaluate Sustainable Plans, Sustainability, 12: 6359.

Nesticò A., D'Andria E., Fiore P., 2020_b, Small towns and valorization projects. Criteria and indicators for economic evaluation, Rivista valori e valutazioni, 25: 3-10.

Organization for Economic Cooperation and Development (OECD), European Commission (EC), 2020, Cities in the World: A New Perspective on Urbanisation, OECD Urban Studies, OECD Publishing, Paris.

Organization for Economic Cooperation and Development (OECD), 2020, A Territorial Approach to the Sustainable Development Goals: Synthesis report, OECD Urban Policy Reviews, Paris.

Portugali Y., 2016, What makes cities complex? Complexity, Cognition, Urban Planning and Design, Springer, Berlin, 3-19.

Red Española para el Desarrollo Sostenible (REDS), 2020, Los ODS en 100 ciudades españolas (2ª edición).

Reuters T., 2008, Whitepaper Using Bibliometrics: A guide to evaluating research performance with citation data, Thomson Reuters.

Riccio G., *et al*., 2022, La transizione delle città verso la sostenibilità, UNI Ente Italiano di Normazione, Editoria UNI, Milano.

Richiedei A., Pezzagno M., 2022, Territorializing and Monitoring of Sustainable Development Goals in Italy: An Overview, Sustainability, 14: 3056.

Russo A., 2014, Mapping Small and Medium Sized Town in Europe: Classifications, Spatial Trends and Ontological Issues, 54th Congress of the European Regional Science Association: "Regional development & globalisation: Best practices", St. Petersburg, Russia, European Regional Science Association (ERSA), Louvain-laNeuve.

Sachs J., Schmidt-Traub G., Kroll C., Lafortune G., Fuller G., 2018, SDG Index and Dashboards Report 2018. New York: Bertelsmann Stiftung and Sustainable Development Solutions Network (SDSN).

Sachs J.D., Schmidt-Traub G., Mazzucato M., *et al*., 2019, Six Transformations to achieve the Sustainable Development Goals. Nat Sustain, 2: 805-814.

Sánchez de Madariaga I., García López J., Sisto R., 2018, Los Objetivos de Desarrollo Sostenible en 100 ciudades españolas. Madrid: Red Española para el Desarrollo Sostenible (REDS).

SDSN and IEEP, 2020, The 2020 Europe Sustainable Development Report: Meeting the Sustainable Development Goals in the face of the COVID-19 pandemic, Sustainable Development Solutions Network and Institute for European Environmental Policy: Paris and Brussels.

Servillo L., Russo A.P., Barbera F., Carrosio G., 2016, Inner peripheries: Towards an EU place-based agenda on territorial peripherality, Italian Journal of Planning Practice, 6(1): 42-75.

Seto K.C., Güneralp B., Hutyra L.R., 2012, Global forecasts of urban expansion to 2030 and direct impacts on biodiversity and carbon pools, Proc. Natl. Acad, Sci. 109, USA: 16083-16088.

Sharifi A., 2021, Urban sustainability assessment: An overview and bibliometric analysis, Ecological Indicators, 121: 107102.

Shen L.Y., Ochoa J. J., Shah M. N., Zhanga X., 2011, The application of urban sustainability indicators - A comparison between various practices, Habitat International, 35: 17-29.

Shmelev, S.E., Shmeleva, I.A., 2009, Sustainable cities: problems of integrated interdisciplinary research, Int. J. Sust. Dev., 12: 4-23.

Siragusa A., Vizcaino P., Proietti P., Lavalle C., 2020, European Handbook for SDG Voluntary Local Reviews, Publications Office of the European Union, Luxembourg: JRC 118682.

Skaf L., Buonocore E., Dumontet S., Capone R., Franzese P.P., 2020, Applying network analysis to explore the global scientific literature on food security, Ecol. Inform., 56: 101062.

Steinführer A., Vaishar A., Zapletalova J., 2016, The Small Town in Rural Areas as an Underresearched Type of Settlement, Editors' Introduction to the Special Issue European Countryside, 8(4): 322-332.

Sustainable Development Goals Center for Africa and Sustainable Development Solutions Network, 2020, Africa SDG Index and Dashboards Report 2020. Kigali and New York: SDG Center for Africa and Sustainable Development Solutions Network.

United Nations (UN), 2015, Transforming our World: The 2030 Agenda for Sustainable Development, UN General Assembly.

United Nations Conference on Environment & Development (UNCED), 1993, Agenda 21, Rio de Janeiro, 1-351.

United Nations Department of Economic and Social Affairs (UN-DESA), 2019, World Urbanization Prospects: The 2018 Revision (ST/ESA/SER.A/420), New York.

United Nations Development Group (UNDG), 2014, Localizing the Post-2015 Development Agenda: Dialogues on Implementation, United Nations, New York.

United Nations Framework Convention on Climate Change (UN-FCCC), 2015, Adoption of the Paris Agreement, 21st Conference of the Parties, Paris.

Van Lierop C., 2018, Harnessing the potential of the Urban Agenda for the EU, European Parliamentary Research Service (EPRS), European Parliament, Brussels.

Woodbridge M., 2015, International Council for Local Environmental Initiatives (ICLEI) Briefing Sheet “Cities and the Sustainable Development Goals”, Urban Issues 2, ICLEI World Secretariat, Bonn.

World Commission on Environment and Development (WCED), 1987, Our Common Future: Report of the World Commission on Environment and Development, Oxford University Press, Oxford, 1-300.

Zhang D., Xu J., Zhang Y., Wang J., He S., Zhou X., 2020, Study on sustainable urbanization literature based on Web of Science, Scopus, and China national knowledge infrastructure: A scientometric analysis in CiteSpace, Journal of Cleaner Production, 264.