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NEW CHALLENGES FOR XXI CENTURY CITIES

Global warming, ageing of population, reduction of energy consumption,
immigration flows, optimization of land use, technological innovation

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The cover image shows railway street in Hanoi, Vietnam (Source: TeMA Journal Editorial Staff).

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Highlighting circular cities trends in urban planning. A review in support of future research tendencies

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Abstract

Circular economy is seen as an opportunity of overcoming the traditional linear model of consumption and production based on the "take-make-dispose" model, in favour of a more sustainable use of resources. It is acknowledged that the city scale is relevant in this transition towards circularity, even if there is a lack of implementation of the circular city through plans and policies. A higher understanding of the interrelations between circular economy and urban planning is therefore needed. This study, through a scoping review and a bibliometric analysis, allowed to systematize and analyse the knowledge about the existing trends in planning circular cities and to identify gaps for future research. What emerged is that a methodology to integrate circular economy principles into urban planning tools and procedures still does not exist in literature, even though some recurrent decision-making frameworks are frequently used and the topic is currently under debate.

Keywords

Circular cities; Urban planning; Scoping review; Bibliometric analysis.

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1. Introduction

United Nations announced that the 55% of the world's population lives in urban areas and that the trend is increasing, with a projection of the figure reaching almost the 70% by 2050 (United Nations Department of Economic and Social Affairs, 2019). In this scenario of growth, sustainable development depends on how successfully finite natural resources will be managed in order to meet the Sustainable Development Goals of the Agenda 2030 (United Nations, 2015). However, in the initial phase of its implementation, and in particular between the COP21 in Paris (2016) and the COP26 in Glasgow (2021), more than half a trillion tons of virgin materials were consumed going worryingly beyond the planetary safe environmental limits, depicting a framework far from being sustainable (Circle Economy Foundation, 2023). In this regard, cities have a twofold role: on one hand, they counts for the 80% of the global GDP (World Bank, 2023) and are engines for innovation but, on the other hand, they are responsible for the consumption of around 75% of global energy and material flows (United Nations Environment Programme & International Resource Panel, 2013), emit the 70% of greenhouse gases emissions and produce about the 70% of global waste, although they cover less than 3% of world's surface (Mukim & Roberts, 2023; OECD, 2020). Efforts should be made to shape a new framework for urban development that allows cities to thrive and prosper without compromising the regenerative capacity of the planet. The linear model of consumption based on the concept of take-make-dispose is not considered sustainable anymore and experts are proposing to shift and embrace circularity processes (Gillai & Ling, 2022; Jørgensen & Pedersen, 2018). Circular Economy (CE) is a concept that has gained momentum for the last decade, even though its roots are more ancient. CE has been defined in many different ways, and scholars have different - and sometimes misleading - understanding of the concept. In fact, not all the definitions conceptualize CE as a systemic change and the main focus is often on economic prosperity with a lack of consideration of the social dimension (Kirchherr et al., 2017). One of the most comprehensive and shared definition is provided by the Ellen MacArthur Foundation, a pioneer entity in the field, according to which CE is restorative and regenerative by intention and design, and is based on three principles: eliminate waste and pollution, circulate products and materials and regenerate nature (Ellen MacArthur Foundation, 2015).

The relevance of CE transition in Europe is also underlined within the policy framework. The European Union adopted the first CE Action Plan¹ in 2015 and the new CE Action Plan in 2020², listing specific actions to be undertaken at EU level to foster the circular transition and meet the climate target. Indeed, the new CE Action Plan is one of the building blocks of the European Green Deal and circularity has been defined as a prerequisite for climate neutrality.

Within this framework, the city-dimension of circularity is considered necessary to fully accomplish sustainable development and tackle climate change, which implies to create environmental quality, economic prosperity and social equity for current and future generations (Kirchherr et al., 2017)

As far as circular cities development is concerned, many cities are defining themselves as circular, thus they are implementing the model in different ways (Nocca & Girard, 2018; Franco, 2023), and many initiatives emerged at European level like the Circular Cities Hub and the Circular City declaration. However, it is unclear what circular cities look like and what urban circularity means in practice (Prendeville et al., 2018). Indeed, a well-established and clear definition of circular city is still lacking and often circularity in cities has been associated to the closure of resources' flow at territorial level (Federico et al., 2023) thus overlapping with the urban metabolism concept. Many existing studies mainly focus on a specific topic or Country and there is a lack of comprehensive studies about how it is possible to plan circular cities. Many action plans are enacted at city or regional/national level, but they consist of voluntary tools aimed to explain the vision of the city and its territory. Understanding how (and if) CE is addressed in the ordinary planning instruments is an open debate

¹ https://environment.ec.europa.eu/topics/circular-economy/first-circular-economy-action-plan_en.

² <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN>.

and requires further investigation. Therefore, this study mainly aims at summarising the existing interrelations between CE and urban planning, investigating the existing trends for planning circular cities through a scoping review. The objectives of the study are: i) to quantitatively assess the literature to find out which are the knowledge domains about this topic; ii) to systematize and analyse knowledge about the existing trends in planning circular cities; iii) to identify gaps and directions for further research. These purposes have been achieved through both a bibliometric search of the literature and a qualitative assessment. Following this introduction, the methodology is presented. Section 3 presents the results both in terms of bibliometric analysis outcomes and qualitative assessment. Review findings and their discussion is presented in Section 4, followed by the conclusions reported in Section 5.

2. Methodology

As already stated in the introduction, both qualitative and quantitative assessment have been conducted in this study, offering an understanding of domains definition of knowledge areas and gaps for future research. The research has been conducted through a scoping review carried out in Scopus³ and Web of Science⁴ databases, performed from October 2022 until May 2023, to collect and assess the available scientific articles, book chapters and contribution to conferences that are dealing with the planning dimension of circularity in cities.

In order to conduct this systematic scoping review, the PRISMA methodology (Page et al., 2021) has been used. PRISMA methodology allows to report in a transparent way the process of papers selection through a flow diagram that synthetize the process; the use of this well-established guideline eases the replicability of the adopted approach. The query that has been structured includes a combination of the keywords: "circular economy", "urban planning" or "spatial planning", "circular urban development", "circular cities", "indicator". Only publications in the timeframe 01 January 2015 – 31 March 2023 (date of the last access to the two databases) have been considered.

A total of 195 reports have been sought for retrieval after the screening of the title and the abstract that allowed to identify the coherence of the addressed topics with the research scope. On this sample, a bibliometric analysis has been conducted with the support of Biblioshiny for Bibliometrix software (Aria & Cuccurullo, 2017). Among others, the software allowed to examine the temporal distribution of the publications, the most frequent journals and the most used keywords by the authors. It is particularly useful in allowing to perform the thematic analysis based on the authors' keywords, that can reveal the focus areas of the research in the field and their distribution and correlation, allowing the understanding of emerging phenomena by identifying on which topics the attention is primarily posed by academics (J. Li et al., 2022).

In a second stage, 22 records not retrieved for the unavailability of the full texts have been excluded given the impossibility of reviewing the contents. Moreover, it has been defined through the review the relevance of each remaining paper to the research scope. Therefore, the 173 retrieved records have been classified in three groups, namely "Low", "Medium" and "High" relevance. Low relevance has been assigned to those papers not dealing with circular economy practices in cities nor adopting a European focus; medium relevance is attributed to research focusing only marginally on circularity in cities with few implications for urban planning; highly-relevant papers are those interpreting circularity at urban scale according to an holistic perspective and with a strong focus on urban planning dimension. As a consequence of this refining stage, a number of 119 medium-to-high relevant papers have been included in the review and deeply assessed through the full-text analysis. The results and the selection process are shown in Fig.1. The complete list is available in the Annex.

³ <https://www.scopus.com/search/form.uri?display=basic&zone=header&origin=savedsearch#basic>

⁴ <https://clarivate.com/products/scientific-and-academic-research/research-discovery-and-workflow-solutions/webofscience-platform/>

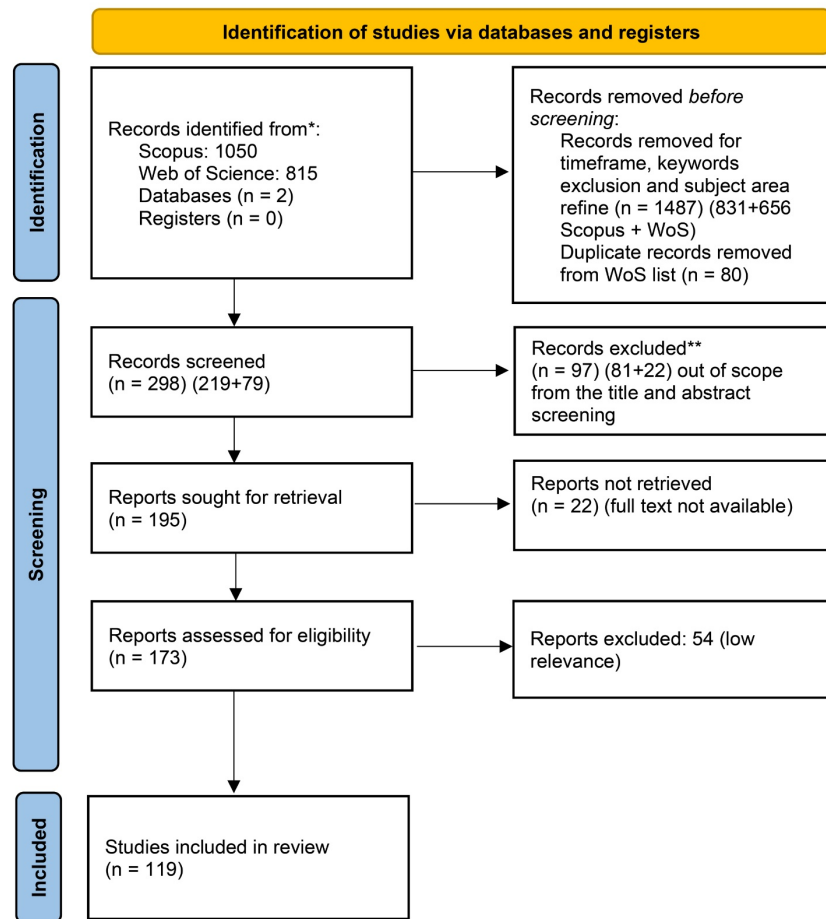


Fig.1 PRISMA 2020 flow diagram representing the selection and filtering process

3. Results

While the bibliometric review has served as a starting point to understand which themes have been associated to the circular city concept if the planning perspective is adopted, through a full text analysis a more in-depth assessment has been carried out and results have been clustered according to the planning focus categories described below. It is worth underlying that these latter have not been established a priori but have been structured according to the following outcomes of the review:

- *Specific focus areas*: if the paper is mainly addressing specific topics that are often associated with CE in the built environment like urban metabolism, natural resources recovery, waste management;
- *Spatial implications*: it is assigned to those papers that are dealing with the experimentation of circularity practices in specific urban areas and are analysing spatial consequences of those practices;
- *Monitoring*: if the paper is proposing a new monitoring framework for circular cities, theme that is central to the scientific debate;
- *Support decision-making*: tools and methodologies specifically designed in support of circularity in urban planning;
- *Participation and engagement*: if the publication is considering the social dimension of circularity and provide insights about participation in decision-making. This topic has been considered the less addressed by the literature about CE so far, but is acquiring importance in about the field of planning procedures;
- *Theoretical/methodological findings*: if the paper is proposing a methodology to interpret the circular city and how to plan for it. The same, if the publication is approaching the circular city from a theoretical perspective.

Moreover, publications have also been clustered according to the sustainability dimension they are referring to that have been extended over time to tackle the complexity of urban and territorial transformations (Sugoni et al., 2023). Social, economic, environmental, governance/institutional, cultural or multidimension are those spheres identified as relevant for the present research, based on a more comprehensive interpretation of sustainability. The two following paragraphs show the results according to the bibliometric review and the full-text analysis respectively.

3.1 Results from the bibliometric analysis

As mentioned in the methodology section, a total of 195 papers have been analysed through a bibliometric analysis, in the timeframe January 2015 – March 2023. As illustrated in Fig.2, the scientific production on CE is constantly rising from 2016 onward, with a peak reached in 2021. The boost has occurred in 2019 during which 30 papers have been published, especially if compared to the 9 published throughout 2018. Year 2021 is the most productive year with 54 publications recorded. This trajectory reflects the evolution of the European policy framework which started to focus on CE since 2015, when the first circular economy action plan has been enacted, followed by the new circular economy action plan in force since 2019. As far as the most relevant journals are concerned, the most quoted one is *Sustainability* followed by the *Journal of Cleaner Production* and *Resources, Conservation and Recycling* (Fig.3). Fig.4 shows the trend of the 5 most relevant journals production over time.

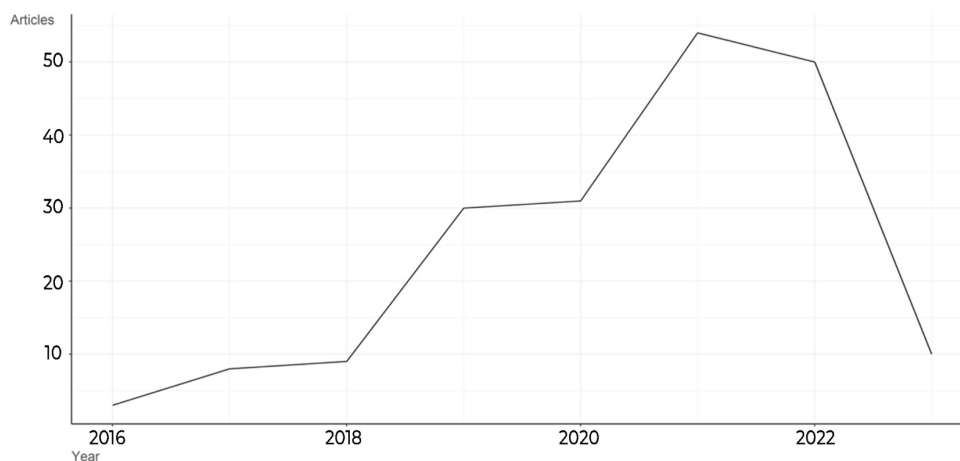


Fig.2 Annual scientific production (created with Biblioshiny)

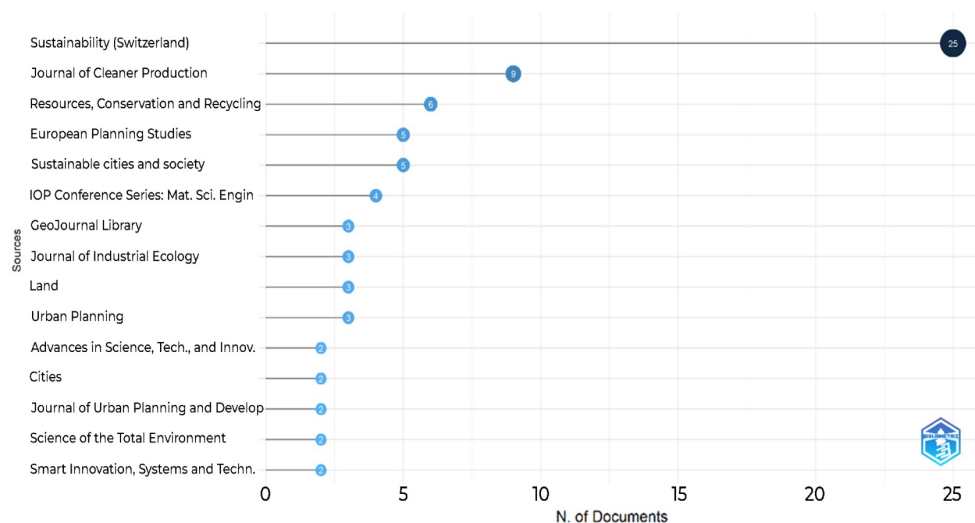


Fig.3 Most relevant journal (created with Biblioshiny)

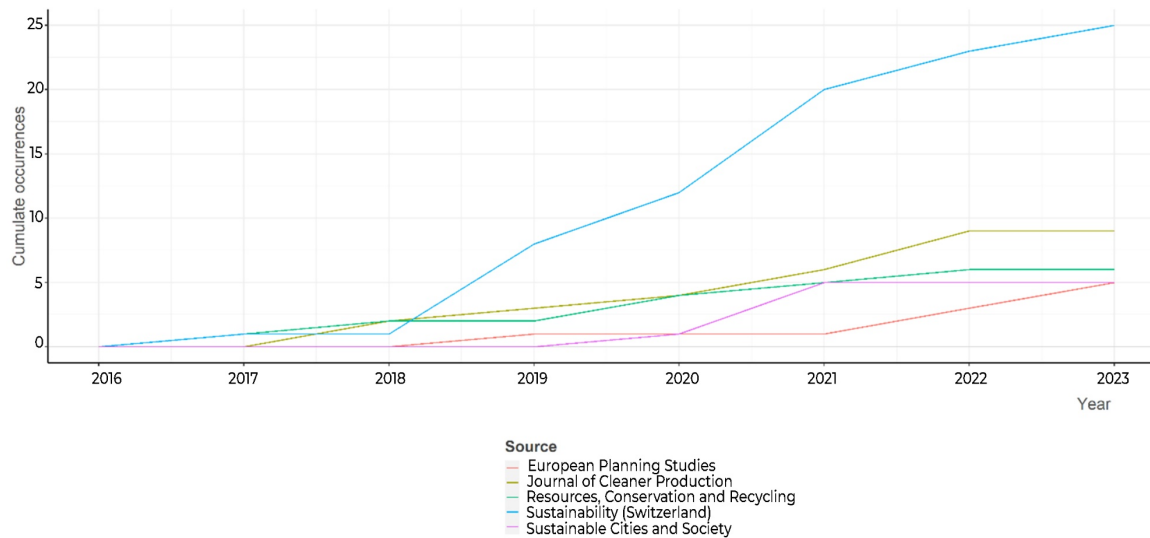


Fig.4 Journals' production over time (created with Biblioshiny)

The keywords analysis has been reported in the form of a word cloud (Fig.5) which emphasizes the most frequent keywords used by the authors associated to the concepts of circular city and urban planning. It has been found out that the most frequent ones associated with circular cities are "sustainability" and "sustainable development", "waste management", "urban metabolism" and "ecosystem services". In terms of thematic analysis, Fig.6 identifies motor themes, basic themes, emerging or declining themes and niche themes according to a thematic analysis conducted per authors' keywords (Aria et al., 2022). The algorithm is not able to cope with textual nuances like "cities" and "city" or "climate-change" and "climate change" that conceptually have the same significance but are producing different clusters. Consequently, in order to ensure clarity and the correct interpretability of the connected keywords, a list of synonyms has been created after a first keyword screening that has been manually conducted. In addition to the synonyms, the keyword "article" has been eliminated since not meaningful per se. As a result, 13 clusters are formed.



Fig.5 Word cloud based on the frequency of Authors' keyword excluding the words "circular economy", "circular cities" and "urban planning" (created with Biblioshiny)

The most central cluster is the one grouping CE, urban planning, sustainable development, urban metabolism and waste management, meaning that this cluster is linked with several other clusters. The density is high, but it is not the highest, and this can be interpreted as quite-high correlation with other clusters. Clusters formed by buildings (associated with adaptive reuse, cultural heritage and material flow analysis), spatial planning (with urban regeneration, resource management and monitoring practices) and recycling (with

life-cycle assessment, ecology and renewable energy) have high level of centrality and density, placing those topics as the strategic core of the fields, very close to each other's and also linked to several other topics. The clusters formed by circular city, climate change, economy and built environment are representing significant and cross-cutting issues, also among different research themes. It means that they are linked with numerous keywords, but not strongly interrelated with the other in the quadrant and can be considered quite generic but essential for a good understanding of the field (ibid.).

The group of concepts referred to ecosystem services and nature-based solutions (NBS) is placed in-between the basic and motor themes becoming more and more interrelated with the other clusters already present in the motor themes quadrant. Among the meaningful emerging or declining themes, there are the clusters formed by the systemic approach and Amsterdam metropolitan Area, and the one referring to the adoption of a new way of city planning. They represent topics that are not fully developed for the domain of research and that are still in their infancy and that can potentially originate new trends. Lastly, niche themes are those that result strongly developed but still marginal in the framework.

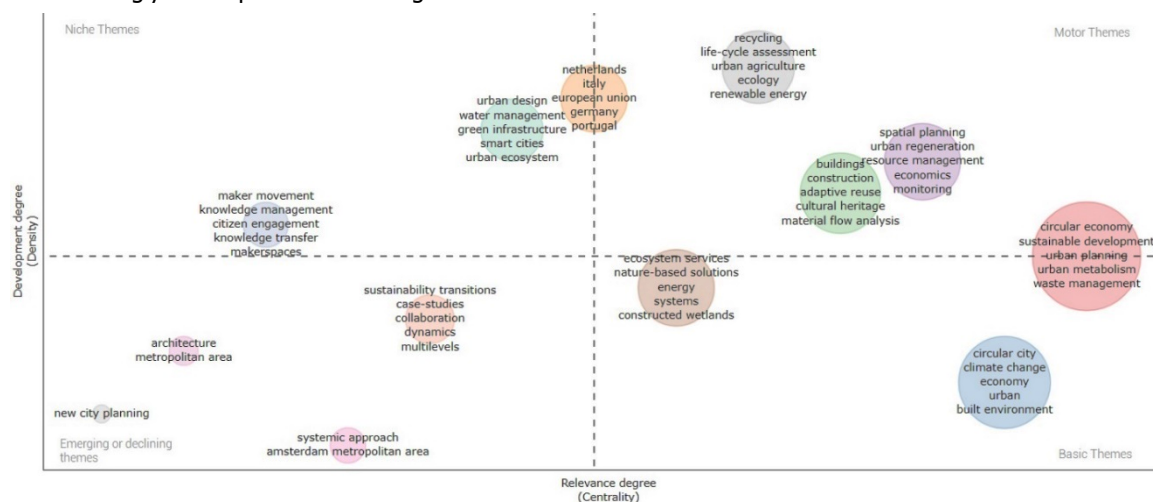


Fig.6 Thematic map of topics discussed in the period 2015 - March 2023⁵

3.2 Thematic analysis according to the full-text screening outcomes

This section is reporting the results of the full-text analysis carried out on the smaller sample of 119 medium-to-highly relevant papers. The distribution of the publications per dimensions covered by the documents are represented in Fig.7. The majority of the publications (56%) covers more than one dimension. Fig.8 provides details about the spheres touched by these latter.

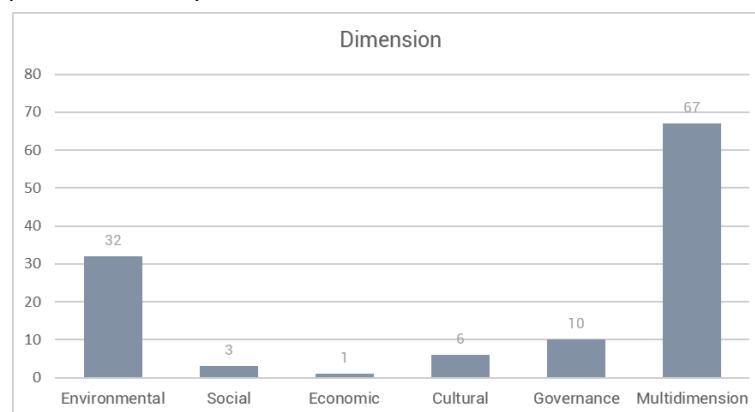


Fig.7 Distribution of the publications according to the touched dimensions

⁵ The keywords "circular cities" and "circular city" have been considered synonyms and the keyword "article" has been eliminated.

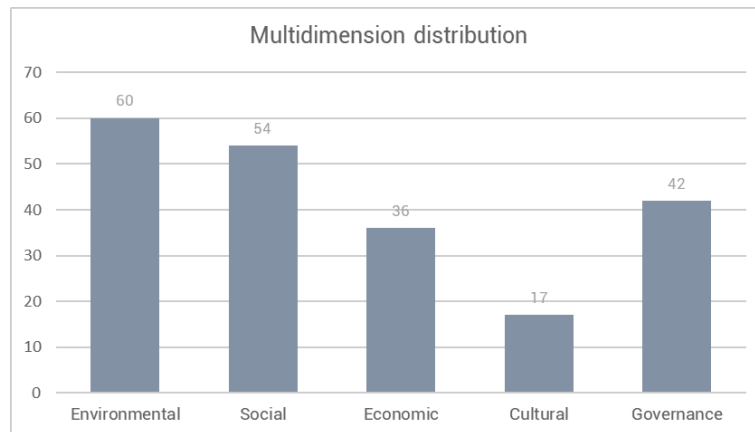


Fig.8 Dimensions considered by multi-dimension papers

As far as the planning focus is concerned, the majority of the publications (34%) are covering specific areas of investigation (see Fig.9), thus not providing a holistic picture of the circular city. Conversely, the 18% of the papers are investigating this latter concept both in terms of defining it and proposing methodologies to plan for circular cities. Participatory approach is the less represented area of analysis. Multi-perspective papers are constituting the 23% of the sample and they are mainly coupling theoretical findings with specific focus areas or monitoring proposals or methodologies for supporting decision-making (see Fig.10).

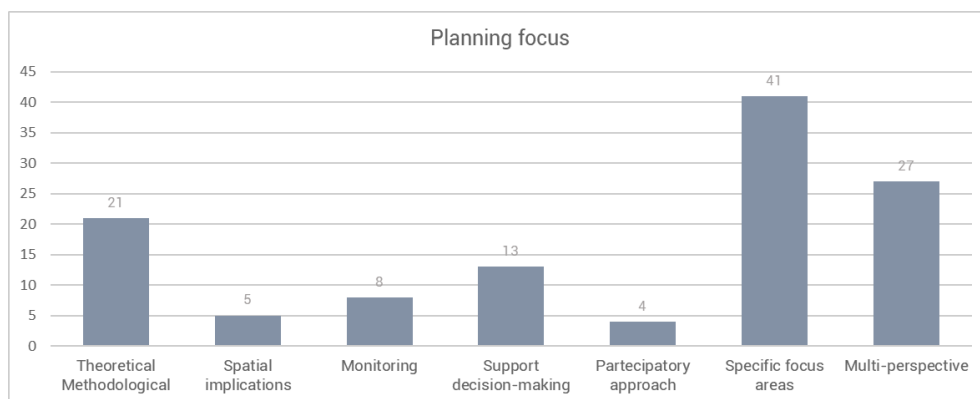


Fig.9 Distribution of the publications according to the touched planning focus

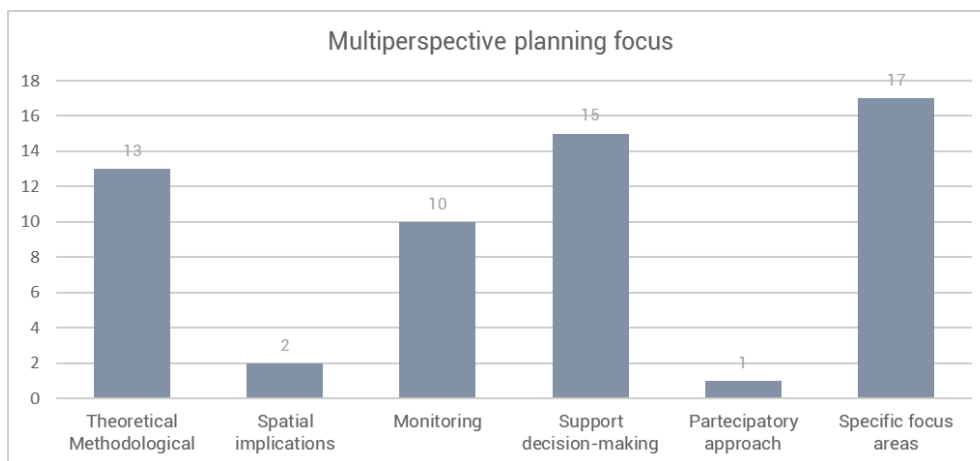


Fig.10 Aspects addressed by multi-perspective papers

4. Review findings and discussion

Based on the literature review, urban and spatial planning role in relation to CE is becoming more and more investigated in the last two years, period during which the majority of publications is considered as highly relevant. This is reflected by the evolution of the concept, since CE became relevant in the economic sector especially from 2010 when the Ellen MacArthur Foundation is born, becoming a pioneer in the field. In the first years, attention has been posed mainly to CE at micro-level and at industrial scale, while the city scale has gained attention more recently, also due to the European policy context evolution.

4.1 Highlighting the main theoretical/methodological key findings

Only 46 out of 119 papers contain the keywords "circular city" or "circular cities" and 13 of them are still dealing with sectorial approaches like recycling, NBS, ICT, material flows and urban agriculture. The lack of integration between CE and urban planning is thus confirmed, and a methodology to integrate the two dimensions still does not exist in practice. Petit-Boix et al. (2018), through a literature review, quantified the environmental balance of CE initiatives promoted at the municipal level, providing clear recommendation to increase the attention on social consumption and urban planning when addressing CE challenges that directly affect urban areas. The same recommendation of integrating CE in urban planning to further accelerate its implementation in urban areas is expressed by van der Leer (2018) while studying a vertical integration through scales (micro-meso-macro) and horizontal integration through socio-technical and socio-ecological systems and recommending that bottom-up and top-down efforts should reinforce each other (van der Leer et al., 2018). Moreover, Turcu & Gillie (2020) study the governmental aspects of CE, by analysing the planning practices and tools of 28 municipalities in London, highlighting the lack of integration of CE practices into the city Urban Plans but its potentialities (Turcu & Gillie, 2020).

As far as the conceptualization of circular cities is concerned, scholars started from highlighting the limitations of the CE frameworks and operationalisation methods when approaching the city scale (Prendeville et al., 2018; van der Leer et al., 2018; Williams, 2019a, 2021a, 2022). Williams, J. is the most recurrent author, with 6 publications in the field; her conceptualization of the circular development is based on looping, regenerative, and adaptive actions, starting from the examination of the well-known RESOLVE framework (Ellen MacArthur Foundation, 2015) and its limitations when applied to cities (Williams, 2019a). Her work depicts a clear and holistic approach towards circular urban development that is addressed also from the urban planning perspective (Williams, 2020, 2023) and through the analysis of four cities' actions: London, Paris, Stockholm and Amsterdam (Williams, 2021a). Benefits and challenges to circular urban development have also been assessed (Williams, 2019b, 2021b, 2022). Another holistic framework is the one proposed by (Girard & Nocca, 2019) who acknowledge the role of the circular city to tackle social inequalities and the ecological crises in a systemic perspective proposing a definition that goes in this direction, highlighting the need of holding together the objectives of environmental sustainability and the social justice.

The social dimension results as one of the less represented and premature (Prendeville et al., 2018) and only recently it is gathering more and more attention, with an increasingly number of publications integrating social aspects while applying CE in cities, at least in theoretical and methodological framework development. This is confirmed by both the quantitative and qualitative analysis: the social dimension is considered in many papers of the scoping review but only three are addressing it as the main topic of discussion, and it is clustered among the niche themes, meaning that it is strongly developed but still marginal in the framework.

Campbell-Johnston et al. (2019) analysed the Dutch key municipal instruments and noted that they include public procurement, zoning laws, capacity building and knowledge exchange as practices to be applied to municipal purchases. However, many limitations are presented in the study, concluding that multi-level policy integration is needed to change value chains enabling reduction in material input and changes in consumption practices (Campbell-Johnston et al., 2019).

4.2 Trends in supporting decision-making processes and citizens' engagement

According to the clustering made by the authors, decision-making processes supporting the development of circular cities appears from 2019 in literature both in the form of insights for policymakers or policy recommendation and as tools or models. GIS has been used by a few authors only and mainly to integrate CE principles in the built environment, including the historical part of the cities. The need of adopting a multi-disciplinary perspective for achieving circular cities is acknowledged (Chang & Chang, 2020; Paiho et al., 2021). The use of multi-criteria decision-making models goes towards this direction, trying to assess specific issues (e.g. mobility alternatives (Pamucar et al., 2021), optimal green areas location (Nesticò et al., 2022), alternative regenerative strategies (Cerreto et al., 2020)) but taking into consideration the effects on different spheres, like the social, economic and cultural ones. Among the most recurrent methodologies adopted by academics (Augiseau & Kim, 2021; Domenech & Borrión, 2022; Q. X. Li et al., 2022), the Sankey diagrams (Hanzl et al., 2020), the scenario-building methodology and the use of PROMETEE tool and its adaptation (Cerreto et al., 2020; Cerreto et al., 2020; Della Spina, 2022). In general, these are useful tools for investigating the state of the art of the considered territories; indeed, the results coming from the flows mapping allow cities to identify the priorities of intervention and possible actions based on what sector impacts the most in the city, however, how to integrate the results in urban planning tools and regulations is still to be recognised.

Another trend to highlight is the stakeholders' involvement in the decision-making processes, as a crucial factor for pursuing a holistic transition towards circularity in cities. Geodesign decision support environment and living labs (Arciniegas et al., 2019), semi-structured interviews (Yalcin & Foxon, 2021), collaborative spaces like makerspaces (Premyanov et al., 2022) are the methodologies used for the engagement of relevant stakeholders, citizens and policy makers towards a switch from a linear to a circular vision of the future in cities. However, the studies on this topic are still in their infancy, given the low numbers of results coming from the literature review. More efforts are needed to foster cross-sectorial collaboration, especially inside the public administrations and through an increasing of citizens' participation. In fact, bottom-up and top-down processes are complementary for a vision of a future-proof city (Prendeville et al., 2018; van der Leer et al., 2018). People's choices, behaviours and lifestyles plays an important role in achieving sustainable development, however only few papers address the challenges of developing community-driven initiatives providing recommendations for cities to address sustainability issues under the lens of CE, developing a human-centred framework (Bosone & Ciampa, 2021; Coskun et al., 2022; Ouillon et al., 2017).

4.3 The importance of establishing a monitoring procedure

Several monitoring frameworks have been proposed by scholars, starting from a review of the existing ones and embracing holistic visions of a circular city (Balletto et al., 2022; Birgovani et al., 2022; de Ferreira & Fusco-Nerini, 2019; Girard & Nocca, 2019; Paiho et al., 2020; Paoli et al., 2022; Papageorgiou et al., 2021).

However, the absence of a well-established and consolidated system of indicators is a critical point that reflects the complexity of the phenomenon and the absence of a consolidated definition of circular city. It is difficult to monitor something that is not well defined and for which a shared definition still does not exist. In particular, focusing on the urban planning perspective and the possibility of integrating CE principles into urban planning tools, much more effort is needed to select few but significant indicators, to allow the public administration in charge of planning and monitoring the transformation to effectively apply and manage them.

A first proposal of indicators for urban planning and circularity is offered by Girard & Nocca (2019) trying to embrace the different sectors of the discipline in a comprehensive way. Many other monitoring framework are proposed, but they focus only on specific sectors of CE in cities (e.g. social indicators, waste management, industrial symbiosis, adaptive reuse of cultural heritage) (Bosone et al., 2021; Bosone & Ciampa, 2021; Domenech & Borrión, 2022; Feiferytė-Skirienė & Stasiškienė, 2021; Gravagnuolo et al., 2019; Vanhuysse et al.,

2021)), confirming the fragmentation of the approaches in the field and the necessity of establishing a common reference framework with different levels of details, according to the addressed scale and specificities.

This approach would allow to make the results aligned and comparable among the European cities, thus maintaining their specificities and acknowledging the different territorial needs.

4.4 Focus areas. What is discussed the most?

The majority of the collected medium-to-high relevant publications are addressing a specific topic and, in particular, these publications cover all the clusters present among the motors and basic themes depicted in Fig.6. To draw some considerations, three areas of investigation will be followed: material flows, built environment and natural capital.

When it comes to this latter, a great attention is posed on NBS which is well explained considering that nature regeneration is one of the pillars of the CE. Therefore, scholars have assessed the potentialities of regeneration practices based on nature under a CE perspective, highlighting the role of NBS especially on resources recovery (Katsou et al., 2020; Kisser et al., 2020; Langergraber et al., 2020, 2021) and water management (Oral et al., 2021).

As for the built environment, many pieces of research are focusing on it since it is considered the sector that pollutes the most and consumes the major quantities of resources (Pomponi & Moncaster, 2017). Therefore, the transition towards a circular built environment is considered very relevant for achieving sustainability goals, introducing the concept of urban mining and life-cycle assessment as powerful tools for the analysis of the status quo and for providing interesting insights for policies (Balletto et al., 2021). However, even though some circular city frameworks are based on the conceptualisation of a circular built environment, they do not deepen the typology of the needed instruments and do not address how these policies can be operationalized, and which would be the dialogue with urban planning tools for their effective implementations (Ancapi et al., 2022). The adaptive reuse of cultural heritage buildings (as presented in Bosone et al., 2021; Foster, 2020; Foster & Saleh, 2021a; Giannakopoulos et al., 2022; Nocca & Angrisano, 2022; Pintossi et al., 2021) is considered coherent with an holistic vision of a circular city, especially concerning the adaptive actions and reuse practices that are mentioned in some methodological framework proposed (Foster & Saleh, 2021b; Girard & Nocca, 2019; Gravagnuolo et al., 2021; Nocca & Angrisano, 2022; Pintossi et al., 2021).

Another relevant sector is related to the study of resource flows and waste management, given the importance that every CE initiative gives to the closure of waste-resources cycles. Urban metabolism and circular urban metabolism are the translation at urban scale of these studies, even though there is the need not only to know which are the flows of the city but where the flows actually occur. In this regard, mobility and transports are only marginally addressed by scholars with few papers in the collection.

Given the low numbers of publications addressing the role of ICT in the paradigm shift, it can be argued that digital technology is theoretically recognized as a powerful driver for the circular transition, but still with a marginal role when it comes to CE in urban planning. This is also coherent with the thematic analysis reported above, in which smart cities are included in the cluster of urban design in the niche themes. In fact, they are well developed and relevant concepts but still marginal in the analysed research domains.

4.5 Spatial implication of CE in cities. What is the scale to be considered?

In a city, the definition of the scale matters, since scales implies different urban players and competences. The analysis of spatial implications connected to the application of the CE in cities brings up interesting reflections upon the role of urban planning, even if only few papers have been clustered as specifically dealing with the topic. This is also confirmed by the fact that case studies are among the niche themes in the bibliometric review, still having a marginal role in the framework.

Marin & De Meulder (2018) is interpreting circularity at regional level, asserting that landscape design is the discipline capable of addressing multi-scalarity and place-specificity in the circular transition. Their research is based on the flows' analysis. Some pieces of research are also focusing on lower scale like the district one, as Andreucci & Croci (2021) who provided outcomes from projects and case studied to test and validate circularity at local scales. Van den Berghe & Vos (2019) claim that there is a lack of clear definition of circularity in reference to spatial planning and area development and that different approaches are adopted. The cases studies of the research are in Amsterdam and Utrecht and the results show that circularity is not emphasizing the organization of space in a circular way, but it is accelerating the transformation of urban industrial areas into circular-built residential and commercial areas only. The authors stress the importance of coupling physical transformations pursuing circularity with circular functioning of the areas. Verga & Khan (2022) are analysing spatial factors fostering or hampering the embedding of urban circularity practices, stressing that their enablers are the re-thinking of land use preserving valuable urban functions (e.g. agriculture and fertile soil), exploiting public support (e.g. regulations, taxations, specific selection criteria in tendering) and embracing and fostering a cultural shift towards more frugal and inclusive behaviours. Therefore, urban planners have the role and the potentiality to assess projects according to their contribution in fostering urban circularity practices and ambitions.

5. Conclusions and research limitations

The present research has the main aim of understanding the state of the art about the interrelations between the concept of the circular city and the urban planning sphere, identifying the actual trends of discussion and further lines of research.

Even though the closure of resources' flow at territorial level is often paired with the application of CE principles at city scale (Federico et al., 2023), the first research trend that emerged from the review is the multi-disciplinarity of the topic, given the many different applications of the CE concept at city scale and the role of urban planning that is dealing with multi-dimensional transformations of the cities. Besides the material flows and waste management practices, other dimensions as NBS and cultural heritage adaptive reuse emerged. The interest in the social impacts of CE applications in cities is also increasing in respect to 2018 (Girard & Nocca, 2019), although it is still marginal in the framework. The same is true for participation processes, still not widely addressed in the publications, but considered as an important topic.

As also argued Franco S. (2023) it is proven that a unique definition and interpretation of the circular city concept is still missing, and it is verified also as far as the urban planning sphere is concerned. The necessity of establishing a shared framework with different levels of detail, according to the addressed scales and specificities is confirmed. In terms of scale, the analysis highlighted that the closure of resources and waste cycles can be hardly managed at city level, requiring synergies that have to be identified beyond the administrative boundaries of the municipality. Indeed, according to many academics, some of the cycles can be closed only at regional or even at national and European level. Conversely, to foster the transition towards circularity at city scale, the focus on the built environment and the natural capital of the city appears more relevant, as well as the role of citizens in being adaptive and supporting the transition. A change in social behaviour and values is indeed required. However, a one-size-fits all approach is not the solution to simplify and systematize the operationalization of the circular city concept. What should be instead pursued, is a flexible approach that serves as a guidance to fix the fundamental concepts of circularity in cities, but allowing the tailoring to the local specificities in its translation to the reality. Diversity and specific social values have to be preserved and maintained for a successful transition, which has to be shared with the citizens to effectively accomplish it.

Although this research aims at presenting a holistic analysis of circular cities studies and identified future directions, it has some limitations. First, only two databases have been selected and all the initiatives coming

from the implementation of cities circular strategies are not included in the repository as well as the grey literature. In addition, articles may be missing during filtering process through limitation of subject areas or keyword exclusion. Moreover, the authors analysed papers with full text available only, with the possibility of having missed relevant publications.

Nevertheless, it can be argued that the integration of CE principles into urban planning tools and practices is under discussion and a methodology in support of policymakers is not yet defined: in this regards, policy insights and recommendations are provided based on the analysis of specific case studies and usually dealing with one specific asset of the city.

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Image Sources

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