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REVIEW ARTICLE

Driving circular tourism pathways in the post-pandemic period: a research roadmap

Rocío González-Sánchez[1] · **Sara Alonso-Muñoz**[1] · **María-Sonia Medina-Salgado**[1] · **María Torrejón-Ramos**[1]

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Abstract

The transition towards circularity is fundamental in tourism. This paper investigates state-of-the-art research on the relationship between circular economy and tourism, identifying the latest trends and future opportunities. Through a bibliometric analysis and a review of the literature, this paper puts forward research hotspot issues, which mainly focus on circular business models, competitiveness in tourism destination and promoting sustainable behaviour. It provides guidance for future research in post-pandemic times and highlights the lack of research on technology in circular tourism. Main contributions to the topic are considered from a strategic perspective, in line with Sustainable Development Goals and responsible tourism.

Keywords Circular economy · Sustainability · Tourism industry · Resilient · Sustainable Development Goals

1 Introduction

The tourism sector has traditionally caused numerous negative impacts on the planet due to the excessive use of some resources, mainly for transportation and hospitality purposes (Rodríguez-Antón and Alonso-Almeida 2019). Over-tourism creates a negative effect on historical and cultural heritage due to increased pollution and harmful effects to biodiversity along with local habitants being adversely affected by overcrowding and uncivil tourist behaviours (Martín-Martín et al. 2018). These major problems are compounded by a highly unstable environment experiencing frequent crises in various fields: energy, health, and climate. The COVID-19 health crisis has had unprecedented health, economic and social impacts on the tourism

✉ Sara Alonso-Muñoz
sara.alonso@urjc.es

[1] Department of Business Economics (ADO), Applied Economics II and Fundamentals of Economic Analysis, Rey Juan Carlos University, Pº de los Artilleros, s/n, 28032 Madrid, Spain

sector. The effects are still lingering for travellers, businesses and destinations. This scenario could make it difficult to implement measures that favour environmental, economic or social sustainability, as required by the 2030 Agenda.

Research on the negative effects of the pandemic on the tourism sector has been extensive, yet a further step is required. Crises are a source of opportunity and learning. Sustainable Development Goals (SDGs) 11 and 12 call for a shift from conducting business from a passive, status quo approach to implementing changes in line with effective and efficient sustainable tourism. Thus, the current situation is a challenge and presents opportunities to achieve a more sustainable tourism. However, to do so, new proposals are required meaning the need to study business strategies that allow changes to be made both within the sector and in business models in the post-pandemic period (Su 2022). In times of crisis, tourism companies should deploy well-executed, well-developed, cost-optimised and market-oriented strategies (Bremser et al. 2018).

Perceived risk has become a critical factor in tourist decision making (Yoo et al. 2022). Beyond negative emotions such as fear, or irrational behaviours, COVID-19 has also awakened collective awareness of the finitude of human life and promoted more rational behaviours in tourists, such as those related to enhancing personal resilience or pursuing the common good. "New ways of being, knowing and doing things in the world are emerging as conscious citizens, consumers, producers, travellers, entrepreneurs, and community leaders are calling and acting upon the necessary transformation towards the regenerative paradigm" (Ateljevic 2020 p. 467). In this way, there is an evolution in the tourist's priorities towards eudemonic well-being as opposed to a tourism that has prioritised the hedonic paradigm (Assiouras et al. 2022).

At the same time, a redesign of destinations is required that, from the perspective of greater flexibility and sustainability, allowing travellers to be segmented according to critical events or their needs and demands (Veréb et al. 2022). During the pandemic crisis, certain destinations achieved a formula for success through new visitor relation protocols and new innovations and digital services that allowed for travel experiences in compliance with health regulations (Lebrun et al. 2022). These formulas open the door to a change that has been long awaited within the tourism sector, with commitment to a service that is non-massive and regenerative with respect to the environment (Alonso-Muñoz et al. 2023). Consequently, business models must be established to allow for the implementation of strategies that facilitate crisis management in different tourism sectors or destinations. Services and experiences developed in the circularity framework could help make tourism destinations and businesses more cost efficient and resilient in line with the SDGs.

Circular economy represents a new step forward in the application of sustainability principles in the tourism sector (Martínez-Cabrera and López-del-Pino 2021). Jones and Wynn (2019) reveal the importance of resilience management in addressing circularity in tourism and hospitality. This economic paradigm has led to an increased interest in research, reflected in a higher number of published papers (Piesik et al. 2018). The social dimension and environmental concerns in

the transition to circular practices are presented in tourism literature (Padilla-Rivera et al. 2020). Previous bibliometric analyses are published in the period of years 2018 to 2021. These studies share the same link in terms of tourism and sustainability criteria oriented towards the circular economy, although the topics studied are diverse. From topics related to tourism marketing (Cavalcante et al. 2021), competitiveness in the tourism industry and tourism destinations (Seguí-Amortegui et al. 2019) or employment and income (Garrigos-Simon et al. 2018), to the study of the effects associated with the 17 Sustainable Development Goals (Jiménez-García et al. 2020) or perceptions of sustainability in the sector (Santos et al. 2020).

Despite the existence of previous review articles, the results remain fragmented and limited by the time scopes selected, offering an incomplete overview of the research area on the circular economy as it pertains to tourism. Thus, a quantitative review approach to this topic is required and can provide a more complete, in-depth picture, accounting for the pandemic period and its effects on research in the "new normal" (Ateljevic 2020). To fill this gap, the analysis proposes not only providing visual data (Leung et al. 2017; Vallaster et al. 2019), but also identifying emerging research trends (Tandon 2021). This would make it possible to design a research agenda more in line with research needs, considering the limitations of the work already published. In essence, it analyses the most recently published literature, establishing the conceptual and intellectual structure of the tourism industry and the circular economy from a bibliometric approach. Additionally, key information to address future lines of research need to be provided. Considering this gap, we defined our first two research questions as follows:

RQ1 What is the current development of circular economy research in tourism?

RQ2 Which field topics are the most studied in connection to recent research trends?

RQ3 What research agenda needs to be set to fill the current research gaps in the post-pandemic period?

The main contribution of this research focuses on both revealing the main research pillars and highlighting research gaps. The most important research streams consider waste management, the quest for more sustainable transport, SDG compliance and the development of circular indicators that enable measurement and benchmarking of results. Recent research trends focus on the development of training, communication and technological tools to enable the implementation of circular tourism. However, further empirical research is required mainly in the post-pandemic stage and, specifically, on technological tools.

The study is organised as follows: following the introduction (Sect. 1), Sect. 2 presents the literature review on the circular economy and its link to the tourism

industry. Section 3 presents the methodology. Section 4 presents the results. After the discussions (Sect. 5), the conclusions are presented in Sect. 6.

2 Literature review

The concept of circular economy was first introduced by Pearce and Turner (1989), following the previous study of Boulding (1966), who indicated that the circularity of systems is essential to achieve the sustainability of the planet, seeking a balance between the economy and the environment (Ghisellini et al. 2016). Circular economy is based on industrial ecology, which establishes a new model of productive and economic development that seeks the recovery of products. This paradigm is linked to the 3R principle: reduce, reuse and recycle (Lieder and Rashir 2016). Circularity aims to avoid negative effects on the environment, restoring the damage caused by waste generation and resource acquisition during production and throughout the product life cycle (Murray et al. 2017). Therefore, these circularity principles are a tool that facilitate the path towards sustainability in different sectors and, consequently, they are closely tied to the Sustainable Development Goals, SDG (Geissdoerfer et al. 2017).

Circular systems aim to promote a more sustainable and rational use of resources, fostering new business models and innovative employment opportunities (Ellen MacArthur Foundation 2012; Ghisellini et al. 2016). The circular model tries to create economic, social and natural capital based on three fundamental principles: (1) the regeneration of natural systems, (2) the maintenance of materials in use and (3) the elimination of pollution and waste from product design. (Charonis 2012; Ellen MacArthur Foundation 2012). It pursues a regenerative system following the principle of material balance, considering all material flows (Kneese et al. 1970; Andersen 2007; Geissdoerfer et al. 2017). Its application has not been limited to the productive sectors, playing a significant role in service sectors (Manniche et al. 2021). Interest in circular economy, linked to the tourism sector, has grown in recent years in scientific literature, although its application is still limited (Piesik et al. 2018). Circular tourism is a model that limits the waste of resources, energy, water and raw materials (Girard and Nocca 2017).

Tourism is a service sector that uses high flows of natural resources and follows linear production based on a take-make-dispose model. At this point, to achieve circular tourism practices, a reduction in CO_2 emissions, waste and consumption of natural resources is paramount (Rodríguez et al. 2020; Manniche et al. 2021). In the tourism industry, transport is the main generator of CO_2 emissions, 40% of the carbon footprint being caused by aviation, followed by vehicles and accommodation, at 32% and 21%, respectively (Gössling and Peeters 2015). To change this paradigm, pursuit of sustainable and circular practices is fundamental, following regenerative principles in production and consumption (Manniche et al. 2021). Growing interest in research on the application of circularity principles and routines in business models and strategies in the tourism sector is reflected in an increase in relevant publications in journals. Such journals have

had a significant impact on the sector. However, reaching a more holistic perspective of this important flow of academic literature would allow us to know latest trends in the development of the circular economy within the tourism sector.

The challenges facing tourism in relation to environmental issues are significant. Most of these relate to reducing the direct impact the development of tourism activities has on natural resources. It is essential that these negative environmental impacts be reduced, particularly the levels of greenhouse gas emissions from transport, deforestation, scarcity of natural resources and high concentrations of waste generated (Cornejo-Ortega and Chávez-Dagostino 2020). Some tourism destinations have focused on achieving sustainability and becoming more competitive through certain strategies to reduce environmental impacts, especially in the more sensitive 'sun and beach' destinations (García Leaniz and Rodríguez Bosque 2015). In recent years, these strategies have been reinforced by the pandemic which has required social distancing and minimisation of activity, compatible with tourism that offers slower experiences and greater commitment to such (Lebrun et al. 2022). To achieve more sustainable practices in the tourism industry, circular economy policies offer many opportunities (Manniche et al. 2021; Cornejo-Ortega and Chávez-Dagostino 2020).

However, the implementation of circular economy principles in minimising environmental impact requires greater permeability with the environment. In this new framework for action, many actors are actively involved. In this way, the relationships between companies, tourists, residents of tourist destinations and public institutions become closer (Brears 2016). Therefore, it is also essential to include other stakeholders such as suppliers, customers, industry workers, owners, and managers in the transition (Manniche 2017). Research on circular tourism must consider both internal and external aspects of the organisation, modifying service production routines and the relationship pattern. This study analyses whether and to what extent current topics are addressing the challenges outlined above.

Orienting research according to the needs identified in the most relevant literature on the circular economy and tourism will facilitate its application and, consequently, the translation of research into business practice. Vargas-Sánchez (2019) in his work points out the scarcity of initiatives in the application of the circular economy to the tourism industry. Consideration of social and partnership aspects could facilitate this process, complementing economic and organisational aspects. In this vein, in Cornejo-Ortega and Chávez-Dagostino's study (2020), the implementation of circular practices in Puerto Vallarta, Mexico, is explored through collecting information about visitors' attitudes.

The recent impact that COVID-19 has had on tourism means improved adaptability to change is required within the sector (Zenker and Kock 2020). This crisis has highlighted new environmental and social needs, whose development would be supported by a circular perspective. Given the awareness of tourism stakeholders, this is an appropriate context to accelerate the path towards sustainability. Moreover, the goals of the 2030 Agenda are halfway to being achieved (Alonso-Muñoz et al. 2023). Academia should promote and guide future research in this regard. The adoption of innovative solutions related to circular economy would enable the transformation of the tourism value chain towards slower forms

of tourism, less consumption, low impact activities and mitigation of climate or natural disaster risks (Kampel 2021).

3 Methods

Bibliometric methods use a quantitative approach to synthesise research past findings on a specific topic. Science mapping is used to visualise the development of a research field to represent the structure according to elements such as authors, words, journals and documents (Zupic and Cater 2014). Bibliometric analysis has two principle uses: (1) science mapping and (2) performance analysis (Cobo et al. 2011). Bibliometric analysis uses bibliographic published databases to evaluate the scientific literature (Boyack et al. 2005). The use of this kind of method is currently growing in most disciplines (Zupic and Cater 2015). Bibliometric analysis is a technique widely used by scholars in the field of tourism (Kabil et al. 2022).

As can be seen in Fig. 1, the process is divided into three phases: the selection of documents, the analysis of the results using bibliometric overview, and the examination of the research trend topics in the field. In the first phase, we used the Web of Science (WoS) Core Collection Database. The search period is up to September 2021. Firstly, we looked for the different combinations of terms that produced the best results for the analysis. The first selected terms were "circular" AND "tourism", with 185 results, then we adjusted the search to ("circular economy" AND "tourism") OR ("circular tourism") OR ("circularity" AND "tourism") obtaining 141 papers. Subsequently, this was filtered by articles only, excluding books, and proceeding citations, leading to 132 results. The whole sample was double-checked to eliminate inconsistences. The second phase was sorted by co-occurrence of keywords. To carry out the bibliometric analysis we used VOSviewer software to create maps of the data and collected scientific publications to construct a network (Eck

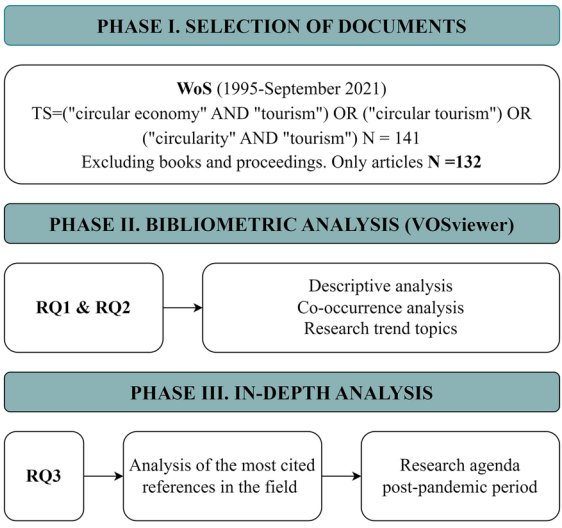

Fig. 1 Methodological process

and Waltman 2010). In the third phase, we examined the results, in depth, on the most cited articles in the field according to their background, article category, key contribution, and major limitations as a valuable addition to this work for future studies.

4 Results

4.1 Number of publications in the field

Figure 2 shows the number of publications in the field of circular economy and tourism from 1998 to 2021. The total number of publications is 132 articles. A remarkable fact to explain why the number of publications began to rise from 2015 onwards is the United Nations 2030 Agenda for Sustainable Development. A project that was launched to achieve equity, seeking an end to poverty and in its place, prosperity and opportunities for everyone on a healthy planet. 17 Sustainable Development Goals (SDGs) were included to accomplish transformation of the financial, economic and political systems present in our society to ensure the human rights of all people (United Nations 2015). Furthermore, the concept circular economy gained momentum with the work of the Ellen MacArthur Foundation in 2010, aiming to accelerate the transition to the circular economy (Rodríguez et al. 2020). However, according to the data observed, research on tourism and the circular economy is more recent.

The number of publications related to the circular economy and tourism started to become more relevant from 2019 onwards, coinciding with the signing of the European Green Deal where The Commission proposes the transformation of the

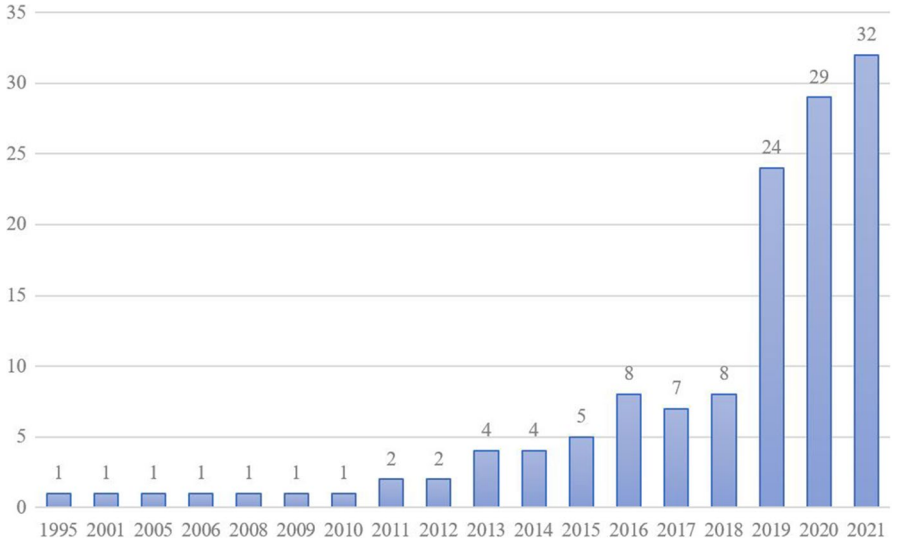

Fig. 2 Historical evolution of publications

EU economy and society to respond to climate needs. In addition, it highlights the Action Plans for the Circular Economy proposed by the European Commission from 2015 and updated in 2020 (European Commission 2019). Gradually, interest in publications has increased, in line with a society that is more committed to the environment and the conservation of our planet. The evolution towards practices based on the circular economy are quite beneficial, and due to this, various authors, coinciding with numerous pacts worldwide are raising awareness of sustainability (Liu and Chang 2020; Pilving et al. (2019)).

There is exclusively one previous bibliometric analysis in the sample, which emphasises the main contribution and application of circular economy to the tourism industry, highlighting agriculture in rural tourism, renewable energy, cultural tourism, waste management and hospitality, among others (Rodríguez et al. 2020). The indicated article carried out the review without the use of software and considered publications up to January 2020.

4.2 Topics studied in the field of circular economy and tourism

4.2.1 Circular tourism research hotspots

From the 132 articles retrieved from WoS, there were 962 keywords, VOSviewer software considered a minimum number of 4 occurrences and 32 keywords met the threshold. The co-word analysis carried out with VOSviewer can be seen in Fig. 3.

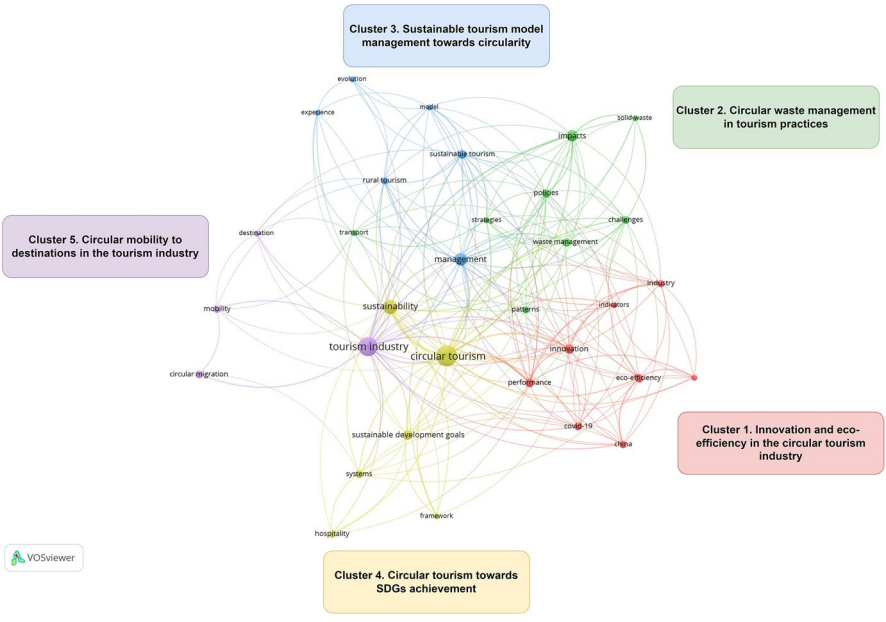

Fig. 3 Co-word analysis

The size of the sphere is determined by the weight of the keyword. The higher the weight of a word, the greater the sphere (Eck and Waltman 2010). Many of the concepts with the greatest weight in the co-word analysis will be the basis for the development of clusters shown in Fig. 3.

In addition, Annex 1 shows keywords' occurrence, documents' average publication year in which a keyword appears, their average citation, links—relationships between keywords,—total link strength—publications in which the two items appear together—(Eck and Waltman 2010) and the five most co-occurring keywords for each term. This is to complement the interpretation used and the relationships between keywords, considering both the relationships in the cluster that includes them and in the clusters to which they are related.

4.2.1.1 Cluster 1. Innovation and eco-efficiency in the circular tourism industry The red cluster includes concepts associated with the pandemic and shifts in tourists' patterns towards new tourism business models. This node is highly affected by COVID-19' that co-occurred with terms such as 'circular tourism', 'patterns', 'innovation' and 'policies' (Annex 2). 'Innovation'—the most cited keyword in this cluster—is an enabler in the transition towards more circular activities in hotels management. For instance, optimising and reducing the use of energies (Florido et al. 2019). In addition, innovation appears in terms of 'policies' (green cluster) during post-COVID-19 pandemic in urbanism, mobility and transport—issues portrayed on the purple and green clusters (Cooke and Nunes 2021).

'Eco-efficiency'—the most recent keyword in this group—emerges associated to challenges in circular waste management, linked to the green cluster.

'Indicators' to measure sustainable development 'performance' in different aspects of the circular tourism industry are represented in this node. For instance, regarding cultural heritage and SDGs. Nocca (2017) points out the financial actions as an indicator, in terms of the total amount of expenditure to protect cultural heritage.

'China' emerges in this node owing to the large volume of published articles and because of restrictions that negative affected to tourism sector caused by COVID-19' (Song et al. 2021).

4.2.1.2 Cluster 2. Circular waste management in tourism practices Regarding the most co-occurring keywords, the main topic addressed in this green cluster is linked to 'impacts', 'policies' and 'challenges' in 'waste management' following circular practices (Annex 3). An improper waste management implies negative 'impacts' leading to health, environmental issues and economic costs (Zorpas 2020). The tourism industry implies high amounts of waste which affects to municipal 'solid waste' and its 'eco-efficiency'—connected to the red cluster—(Llanquileo-Melgarejo and Molinos-Senante 2021). Circular economy 'policies' could promote responsible waste management in tourist destinations. A change to enable the development of circular waste management 'strategies' that consider waste impact on the environment and society is needed (Zorpas 2020). In this regard, 'challenges' is the most recent keyword, considering the barriers and change of 'patterns' the transition towards cir-

cularity requires. The large amounts of waste generated during COVID-19—linked to the red cluster – implied negative impacts on circular tourism. 'Policies' in this period blocked circular models, triggered by plastic items for single-use and disposable masks in the hospitality industry (Martínez-Cabrera and López-del-Pino 2021).

This node addresses one of the tourism's highest impacts: transportation. Mitigation 'policies' and 'strategies' to reduce pollution from transportation are fundamental, such as to promote the use of public transport or bikeshare programs (Buning and Lulla 2020).

4.2.1.3 Cluster 3. Sustainable tourism model management towards circularity The concept of 'sustainable tourism' and its 'management' pertains to the blue cluster. 'Management' is the most co-occurred keyword in this group and presents interconnections with terms from all the clusters (Annex 4).

'Sustainable tourism' has important links mainly related to new circular business 'model' focused on customer 'experience'. Tourists, as co-producers of tourism experiences play a key role in sustainable and circular tourism. Thus, it is important to enhance the attractiveness of these tourism practices to achieve experiences with less environmental 'impacts' (Sorensen 2020) such as those related to waste management—connected to the green cluster-.

The development of certain types of tourism presents a strong tradition on sustainability, such as 'rural tourism' (Pilving et al. (2019)). From a 'circular tourism' approach (yellow cluster) rural tourism implies a balance between rural resources management and sustainable consumption (Immacolata 2018).

4.2.1.4 Cluster 4. Circular tourism towards SDGs achievement This yellow cluster focuses on the 'Sustainable Development Goals' (SDGs) as a conceptual 'framework'—the most recent keyword—towards 'systems' focused on 'circular tourism'—the most occurred term (Boluk et al. 2019). In 2015, the United Nations General Assembly adopted the 2030 Agenda, which included 17 SDGs. These objectives are interconnected and foster a spirit of collaboration in making the most appropriate decisions regarding future generations (Tourism for SDGs n.d). SDGs targets are linked to circular 'strategies' and 'policies'—from the green cluster—(Annex 5). Circularity is highly represented on SDG 12 'responsible consumption and production' associated with tourism sector (Padilla-Rivera et al. 2020). Nocca (2017) highlights the importance of evaluating and identifying cultural heritage economic value—linked to 'sustainability' in tourism—and how this could be consistent with SDGs, particularly with Goal 11 'sustainable cities and communities'.

Referring to 'hospitality', circularity implementation is gaining momentum for this industry. Sorin and Sivarajah (2021) pointed out recommendations about circularity opportunities to create value in Scandinavian hotel operators.

4.2.1.5 Cluster 5. Circular mobility to destinations in the tourism industry The purple cluster contains the keyword 'tourism industry' which presents a high link strength with most of the terms in this study (Annex 6). 'Mobility' implies

a remarkable issue in this sector. Since this related-tourism activity is the most greenhouse gas emissions contributor (Sorensen 2020).

From a socio-economic perspective, the term 'circular migration' highlights the importance of population 'mobility' towards job opportunities in the tourism industry. And how it may affect to environmental degradation (Surya et al. 2021).

Transportation—from the green cluster—is strongly linked to this node. In addition, related to 'mobility' are the 'experiences' (from the blue cluster) linked to transportation, considering that transport is part of the circular tourism experience.

Moreover, managing tourist mobility from a circular perspective would inspire new models of vehicles (Prideaux and Yin 2019) following more green design of mobile elements, infrastructures, and subsequently, adjustments to tourist routes and accessibility (Li et al. 2019).

4.2.2 Circular economy and tourism research fundamentals

To gain an appreciation of the theoretical and methodological keys behind the research on circular economy and tourism, the ten most cited articles in the period under study are analysed first (Table 1). Secondly, research topics were investigated by analysing the top 20 most cited articles published in the last two years, the period in which most of the articles have been published (Table 2). Analysing these papers, we can better understand the nature of current research in this area.

The most cited article in the research topic studied is the paper by D'Amato et al. (2017). This work, mainly on a conceptual basis, compares the terms circular economy, green economy and bioeconomy with the purpose of informing research and policy implementation. The following work (Scheepens et al. 2016), with more than 100 citations, is based on analysis of the circular economy process by applying the LCA-based Ecological Cost Value Relationship (ECVR) model. It examines the possible negative environmental effects of organisation initiatives at the system level and through a three-dimensional approach to costs, eco-costs and market value, towards a theoretical approach to the development of sustainable business models. The next two articles are Nocca (2017) and Hens et al. (2018). The first considers sustainable development and cultural heritage, an essential tourism resource. The second discusses fundamental changes in cleaner production and its relationship to sustainable tourism (Hens et al. 2018).

As can be seen, these four articles come from areas of knowledge other than tourism and are from the years prior to the explosion of research in circular economy and tourism. This reveals the need to draw on conceptual and methodological bases from other fields. At the same time, it offers a clear opportunity to build theoretical foundations that can explain circularity in an industry based on service rather than material consumption.

Interestingly, the most cited references in the field of tourism are older and related to problems of sustainability (Cater 1995; Li et al. 2005; Gascón 2013) revealing the first attempts to consider tourism as an activity that generates negative environmental impacts (Li et al. 2005) that must be addressed by building positive links between tourism and the environment (Cater 1995). And not only with the environment, but also by using tourism as an instrument of cooperation with which natural and social resources can be adapted in a balanced manner (Gascón 2013; Comerio and Strozzi 2018).

Table 1 Ten most cited references in the field of circular economy and tourism sorted by year

C	Reference	Journal	Topic
44	Cater (1995)	Geographical Journal	Need to build on the positive links between the environment and tourism and break the negative links
52	Li et al., (2005)	Enviromental Monitoring and Assessment	The impact of tourism and hiking trails in a protected area
47	Gascón (2013)	Journal of Sustainable Tourism	Development cooperation instrument focusing on community-based tourism. Concept of Social Vocation of the Territory (SVT)
138	Scheepens et al., (2016)	Journal of Cleaner Production	Study of metrics for analysing complex corporate models in the circular economy
264	D'amato et al., (2017)	Journal of Cleaner Production	Comparative analysis of the terms Circular Economy, Green Economy and Bioeconomy
71	Nocca (2017)	Sustainability	Role that cultural heritage can have in sustainable development
73	Hens et al., (2018)	Journal of Cleaner Production	Review of the key issues that have contributed to the fundamental changes in Cleaner Production (CP)
55	Boluk et al., (2019)	Journal of Sustainable Tourism	Tourism in the United Nations Sustainable Development Goals 2030
57	Prideaux et al., (2020)	Tourism Geographies	Adaptation to new strategies of the tourism sector after COVID-19 under the perspective of climate change
39	Zorpas (2020)	Science of the total Enviroment	Manage waste through strategies based on the circular economy

C number of total citations

Table 2 Most cited references in the field of circular economy and tourism published in years 2019–2020

C	Reference	Background	Journal	Article category	Key contributions	Major limitations
57	Prideaux et al., (2020)	Disruption & resilience literature Transformation & change perspective Leadership	Tourism Geographies	Theoretical, for reflection	Help to the tourism sector to understand how it can confront the future transformation of the global economy from a climate change perspective	Specify the field of study to determine the actions in each geographical area would be necessary
55	Boluk et al., (2019)	Gender perspective Indigenous engagement Respectful tourism development Degrowth & circular economy Ethical tourism consumption Vs neoliberalism	Journal of Sustainable Tourism	Theoretical, for reflection	Inspire future research to promote sustainability beyond the 2030 Agenda	Necessary to continue the research on selected aspects to promote inclusive sustainability within the tourism system
39	Zorpas (2020)	Strategic management (SWOT) Circular economy principles	Science of the total Environment	Methodological tool	Offer a useful tool to those in charge of developing strategies on household solid waste reduction based on the circular economy	Motivate citizens and companies to collaborate with the proposed activities
32	Fuldauer et al., (2019)	Holistic integrated approach from decision analysis & sustainability planning literature	Journal of Cleaner Production	Methodological tool & pilot experience	Contribute to the achievement of the SDGs by identifying and evaluating waste management strategies based on participatory processes in small islands	Improve the results of the study through more detailed research by expanding the data

Table 2 (continued)

C	Reference	Background	Journal	Article category	Key contributions	Major limitations
26	Falcone (2019)	Multi-level perspective Sustainability transition Strategic management (SWOT) & Analytic Network Process Framework	Social Sciences Basel	Methodological tool Empirical	Contribute to the direction of policy strategies towards a circular economy based on tourism in Salento (Italy)	Use quantitative methods to be able to assess the financial support for each of the measures and identify the most effective policy strategies
25	Ateljevic (2020)	Transformative Tourism (Global relational consciousness & Hopeful tourism scholarship) Regenerative Tourism (Holistic perspective)	Tourism Geographies	Theoretical, for reflection	Take advantage of the situation caused by COVID-19 trying to bring people and nature together	Use quantitative data to improve the study
20	Agamuthu et al., (2019)	Real impact of marine litter and global initiatives to reduce it Circular Economy	Waste Management and Research	Review	Adding literature with information about marine pollution and demonstrating that the only long-term solution is the circular economy	More effort local, regional and global is needed, and an update after COVID-19
19	Noll et al., (2019)	EU Waste Framework Directive (EU-WFD) 2008/98/EC Applied dynamic stock-driven modelling approach	Resources Conservation and Recycling	Methodological tool Empirical	Highlighting opportunities for the sustainability and contributing to a much deeper understanding of the socio-economic challenges in Samothraki, Greece	Consider a breadth of data as it only considers buildings and infrastructures and extending the study to peninsular areas would be beneficial

Table 2 (continued)

C	Reference	Background	Journal	Article category	Key contributions	Major limitations
17	Pencarelli (2020)	Impact of ICT: Tourism 4.0 Smart concepts: sustainability, circular economy, social value Digitalization	Information, Technology and Tourism	Theoretical, for reflection	Contribute to the literature by offering a vision of a new tourism ecosystem including smart tourism perspectives	Further studies considering the collaborative economy would be helpful
14	Jones and Wynn (2019)	Circular economy, resilience and natural capital for sustainability theory development	International Journal of Contemporary Hospitality Management	Literature review	Tourism as an international industry that, due to its relationship with the environment and society, can contribute to the understanding of sustainability. To explore a developmental role for information systems in support of sustainability-related programmes	Primary sources should be used and opinions from more organizations should be sought to implement the circular economy
10	Florido et al., (2019)	RESOLVE Framework of CE 3R principles Multi-level process (macro, meso, micro)	Administrative Sciences	Methodological tool	Showing a model for the transition of the hotel sector towards the circular economy and sustainability	The study could be extended by focusing on designing a circular strategy for a hotel and designing certificates
10	Uche-Soria and Rodríguz-Monroy 2019	Waste Management Municipal Solid Waste Management (MSWM)	Sustainability	Case study	Demonstrating that sustainable municipal solid waste management is possible on the island of La Gomera (Canary Islands, Spain)	Real-time monitoring of the evidence and comparison of the study with other Islands or areas with similar characteristics would be useful

Table 2 (continued)

C	Reference	Background	Journal	Article category	Key contributions	Major limitations
9	Prideaux and Yin (2019)	Climate change Tourism circular economy operation model	Asia Pacific Journal of Tourism Research	Theoretical inductive	Contributing to the literature by raising debates on climate change mitigation and the adaptation of autonomous vehicles to tourist mobilities	The horizon of such research should be broadened to address questions about the impact of autonomous vehicles and the potential impact on tourist mobility
7	Rodríguez-Antón and Alonso-Almeida (2019)	Circular economy strategies: eco-innovation, water, energy and waste management, collaborative consumption and industrial symbiosis)	Sustainability	Multi case study	Underline the need to promote the circular economy in the hospitality sector, especially in independent hotels	Achieving results to generalize could broaden the study area
7	Pilving et al. (2019)	Rural tourism and partnership Tourism partnership life cycle model (TPLCM) Multi-grounded theory (MGT)	Tourism Management Perspectives	Case study	Tourism partnership in rural areas generate positive externalities which contribute to social sustainability The development of partnership can follow different paths (formal and informal) and some internal and external variables could affect its vulnerability and sustainability	Focusing on the practical study in the initial phase could improve existing constraints. Extending to other geographical areas

Table 2 (continued)

C	Reference	Background	Journal	Article category	Key contributions	Major limitations
6	Rubino et al., (2020)	Sustainability of Built Heritage Resources (BHR)	Sustainability	Case Study	To reflect the need to establish a specific environmental pressure indicator for the future, taking Turin (Italy) as an example. The value of spatial analysis	It would be beneficial to extend the study to other geographical areas
6	Valls et al., (2019)	Slow tourism as a mechanism for circular economy and for ensuring economic feasibility	Sustainability	Case study	Contributing to the literature highlighting the benefits and development of slow tourism in Madeira	To test through an empirical study whether tourists would pay more for a better experience, as well as companies. Extend to other areas

C total number of citations

In the last three years of the sample, two articles constitute the most current reference to the situation faced by the tourism industry. The circular economy plays a key role here for two main reasons. Firstly, as part of degrowth paradigm and resource conservation included in the SDGs of the UN 2030 agenda, on which the industry should focus (Boluk et al. 2019). And secondly, because of phenomena such as COVID-19 and climate change, which are forcing the transformation of tourism to alternative models (Prideaux et al. 2020). Finally, Zorpas (2020) provides holistic and practical methodology on how to approach the application of the circular economy to waste management, becoming a key reference for tourism studies.

It is important to note that the need to apply sustainable methods to protect the environment from the harmful effects of tourism has increased since the 1990s, although researchers have only recently started to write about the term 'circular economy'. This shows the origin of the almost indissoluble link between sustainability and circular economy, which should be explored in depth to understand their true relationship.

To better understand recent trends and needs in the advancement of knowledge, the foundations of research in recent years were explored. Accordingly, the 20 most cited papers published in the last two years were analysed; the period in which most articles were published. Table 1 shows the theoretical basis, the main contributions and major limitations of the most cited articles of that period, sorted by number of citations.

From the sample, the first three papers produced insufficient information on the circular economy and tourism and for that reason, we exclusively analysed the other seventeen papers. From a general overview, seven of the most cited works are of a theoretical or literature review nature, while thirteen correspond to empirical studies, the majority of which are qualitative in nature, in particular, case studies.the most cited theoretical works coincide with considering the circular economy in achieving sustainability; whether as a complementary theoretical reference to understand the disruptive changes taking place in the tourism industry (Prideaux and Yin 2019), or to achieve more neutral or environmentally friendly tourism models (Prideaux et al. 2020). In addition, as a conceptual and action framework to validate sustainability objectives (Boluk et al. 2019).

Another notable aspect of these studies is that they do not delve into theories to explain the circular economy and its role in tourism. It is true, however that some of them address other approaches as complementary to the circular economy in the pursuit of their research objectives. Such is the case of the degrowth paradigm (Prideaux and Yin 2019; Boluk et al. 2019), the green economy (Prideaux et al. 2020), resilience (Jones and Wynn 2019) or natural capital (Jones and Wynn 2019; Ateljevic 2020). This shows that there is a lack of work on grounded theory, as highlighted by Jones and Wynn (2019).

Regarding qualitative studies, some case studies deal with the application of circular strategies in the hotel sector (Florido et al. 2019; Rodríguez-Antón and Alonso-Almeida 2019). Others use the circular economy in a marginal way, as a mechanism to achieve sustainability through other concepts such as slow tourism (Valls et al. 2019), rural tourism (Pilving et al. (2019)) or waste management in destinations (Uche-Soria and Rodríguez-Monroy 2019). Chavez et al. (2020) attempted to turn threats to tourism and the environment into an opportunity to promote sustainability, as seen in the case of the presence of sargassum in the Caribbean, where the principles of the circular economy were applied. Empirical works, more quantitative in nature (Falcone 2019; Noll et al. 2019)

contribute to deepening the understanding of the circular economy to develop policies and strategies in tourism destinations that enable their socio-economic sustainability.

Finally, there are works from areas of knowledge other than tourism that offer methodological tools to tourism companies, especially hotel companies. These are designed for management and decision making to move towards more sustainable circular models or models committed to the SDGs. The proposals of Florido et al. (2019) with the RESOLVE framework and Zorpas (2020) and Falcone (2019) with the application of SWOT analysis based on circularity principles stand out. The SDGs are indeed a recurring theme, as in the case of Boluk et al. (2019) whose work constructs a conceptual framework for questioning the SDG Agenda in terms of tourism, or development of a methodology, combining foresight with waste infrastructure modelling and participatory visioning of the SDGs (Fuldauer et al. 2019). While some papers focus more on economic-social sustainability (Pilving et al. (2019); Noll et al. 2019), others focus on waste management (Zorpas 2020; Fuldauer et al. 2019; Noll et al. 2019; Uche-Soria and Rodríguez-Monroy 2019; Rodríguez-Antón and Alonso-Almeida 2019).

It is noteworthy that almost all the theoretical papers correspond to tourism journals, while the case studies or methodological studies are mostly from cross-sectional or environmental journals. In general terms, all papers aim to contribute to the literature with information on the need to establish sustainable measures based on the circular economy and directly related to tourism.

Regarding limitations, there is a clear need for studies to generalise results (Rodríguez-Antón and Alonso-Almeida 2019). As can be seen in Table 1, the limitations relate to: the needed to extend the geographical areas for further studies (Valls et al. 2019; Danner et al. 2019; Rubino et al. 2020; Pilving et al. (2019); Uche-Soria and Rodríguez-Monroy 2019; Noll et al. 2019; Prideaux et al. 2020; Agamuthu et al. 2019); broaden the field of study after COVID-19 (Liu and Chang 2020); expand and collect quantitative data to provide a more specific view of each case (Ateljevic 2020; Falcone 2019), and the use of primary data and opinions (Jones and Wynn 2019) or the collaboration of organisations and citizens (Zorpas 2020). Figure 4 shows the main trends that have emerged from the analysis.

5 Discussion

According to the research trend themes analysed in this section, based on the clustering and articles reviewed, the main points of discussion are set out and the following research agenda in the field of circular tourism is proposed:

The application of circularity principles in tourism has been investigated in two major topics—mobility and waste management. Regarding to the future of mobility, *new technologies and R&D investment* are key, and together with the application of circular principles, can enable smart cities to produce less emissions (Hens et al. 2018). Concerning waste management, research has mainly focused on the design of strategies for solid waste. With regards to the current energy crisis, the use of new, more efficient technologies is fundamental. The tourism industry can enhance its energy consumption following circular economy practices, minimising dependence on fossil fuels, which positively affects environmental reduction in greenhouse gas emissions and a shift

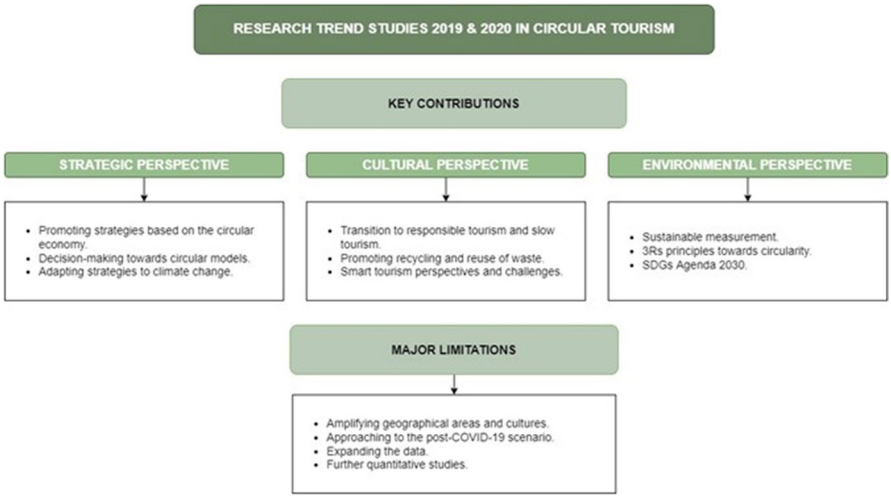

Fig. 4 Research trends studies

towards more renewable energies (Banga et al. 2022). However, it is noteworthy that the most cited studies analysed, and the clusters obtained from the co-word analysis, are not focused on technology as an enabler of circularity in the tourism industry. Taking advantage of *new and smart technologies* plays a key role in the transition towards smart tourism, following circular economy practices (Vecchio et al. 2021).

In addition to technologies, two tools are also fundamental for the implementation of circularity principles and still require further research. On the one hand, *indicators for measuring circularity* are required as a tool for decision makers on sustainability performance (Glyptou 2022), to help tourism organisations and institutions implement circular economy practices. On the other hand, the *development of training and communication tools* is also essential. Considering new consumption patterns and behaviours of tourists,—more environmentally aware—thanks to environmental education and campaigns on tourism activities (Machado-Toffolo et al. 2022). After all, the emergence of "greenwashing" marketing strategies presents future opportunities for scholars in the field of circular tourism. There are previous studies focusing on hospitality, such as Singh and Agarwal (2022). However, a broader approach is needed in relation to the tourism industry and the application of circular sustainability.

The correct use of these tools undoubtedly requires a *regulatory framework* that allows the processing and exchange of data and information, considering the potential of new technologies related to Big Data or the increased cooperation of suppliers and customers in the circular supply chain. Therefore, further work is required to analyse the current regulatory framework and the requirements with respect to the needs of the circular economy.

Finally, regarding the contribution of circularity to achieving more sustainable tourism, the most analysed issues pertain to rural tourism, customer experience and the development of circular tourism destinations. Researchers should consider new studies that consider *types of tourism that have traditionally been less associated*

with sustainability, such as luxury tourism. The contribution of the circular economy to meeting the SDGs is undoubtedly recognised in numerous works, but insufficient compliance with the SDGs (European Commission 2021) requires further research efforts for their subsequent implementation.

6 Conclusions

Circular economy breaks with linear models and involves the recovery of resources to be reused. Implementing this new model involves the transformation of the tourism sector towards good sustainable practices. Circular tourism seeks to balance the flows of renewable resources and control resource stocks, maintaining their usefulness by optimising them, and minimising negative externalities and losses of energy flows (Cornejo-Ortega and Chávez-Dagostino 2020). The tourism sector should follow a model of interlinked and circulated, mostly closed, resources and materials (Manniche 2017). The pandemic caused by COVID-19 is not only considered a health crisis, but also an environmental crisis, since it has significantly increased the use of materials such as masks or plastic gloves, thus, increasing the pollution of the planet (Martínez-Cabrera and López-del-Pino 2021). Regarding the United Nations (2015), a more sustainable and inclusive economy and society must be created and redesigned to cope with climate change and future pandemics, to be more resilient.

To answer RQ1, this study analyses the current intellectual and cognitive structure of the circular economy and tourism industry, considering the growing commitment to these issues, driven by the recent COVID-19 crisis (Ateljevic 2020). For this purpose, information related to current research in the scientific literature is provided through a bibliometric analysis. This work assumes to fill the gap in the research topic and its evolution over the last years. A co-word analysis with VOSviewer was carried out providing a visualisation of the scientific clusters with nodes about the most frequent and influential keywords and their links between them. These links have been analysed both intra-cluster and inter-cluster, which gives the full picture, as the clusters are not independent. Waste management generated by tourism towards circularity regarding its eco-efficiency and policies is essential, considering how the volume of waste was increased by Covid-19 scenario (red and green clusters). It is worth highlighting the innovation (red cluster) that applies to policies developed during the pandemic (green cluster) to achieve more sustainable mobility and transport (purple cluster). More emphasis on tourism transportation and mobility issues establishing sustainable tourism experiences is required (green and purple cluster). Highlighting the importance of developing further linkages between the SDGs and their application in tourism (yellow cluster), since only seven articles of the sample consider them.

Regarding RQ2, the most cited articles refer to the transition to sustainable models, climate change or tourism in general from a circular economy perspective (Uche-Soria and Rodríguez-Monroy 2019; Prideaux and Yin 2019; Prideaux et al. 2020). Likewise based on sustainability terms, it highlights some articles related to COVID-19 and the effects this has had on various sectors, such as tourism and on the environment (Ateljevic 2020; Liu and Chang 2020). Other papers focus on aspects associated with promoting the circular economy in the hospitality sector

(Rodriguez-Antón and Alonso-Almeida 2019; Florido et al. 2019). Some papers emphasise different recycling opportunities or strategies (Chavez et al. 2020) or link to the 2030 Agenda, such as the article by Fuldauer et al. (2019).

Key aspects are suggested as a research agenda to establish the future opportunities in the related field (RQ3): (1) the need for circularity indicators for measurement; (2) the key role of new technologies in the transition towards a circular tourism industry for greater energy efficiency; (3) further studies on waste management strategies applied to the tourism industry; (4) expanding the typology of tourism to which the circular principles are applied, and (5) paying attention to new strategies based on greenwashing in the tourism sector.

6.1 Theoretical implications

This paper presents four main theoretical contributions: (1) The paper helps to understand the state of current scientific literature that can be useful to organisations and researchers in the field of circular economy and tourism issues. (2) This study combines systematic literature review to identify the most influential articles in the literature by citation analysis, and co-occurrence analysis to detect the conceptual building blocks of this field. (3) There is a scarcity of bibliometric analysis in the scientific literature that focused on the relationship between circularity and the tourism industry. Mostly of previous bibliometric studies are focused on sustainability. Thus, the present paper fills this research gap. (4) This article provides future research guidelines that contemplates the post-pandemic scenario in the implementation of circular economy practices in the tourism sector.

Findings reveal significant information for researchers about the thematical structure. The clusterisation analysis developed in this study—intra-cluster and inter-cluster—enriches the circular economy and tourism literature by identifying and visualising the most representative topics in this field. Many of the keywords with the highest number of links and important implications for this study, for instance COVID-19 and SDG have relationships with terms from other clusters such as policies or strategies that enable their development. Ignoring these relationships external to the cluster would be "myopic" in the analysis and would make it difficult to understand the state of the art. The term eco-efficiency stands out as this process affects the entire production chain of the service to reduce the environmental impact. Hence, it establishes relationships with terms from other clusters such as waste management, challenges or patterns, that affect the process and with rural tourism as the final service.

Ultimately, all these aspects can be useful for scholars, researchers and journals. Most bibliometric studies carry out a study of the relationships of the terms in each cluster, so the present study enriches this study by completing the analysis of all the relationships that are established. This presumes foundational knowledge in the field studied and can inspire to other academics to carry out further research.

6.2 Practical implications

Regarding practical implications, this paper provides valuable information about circular tourism for governments, organisations and managers, practitioners and tourists.

Findings reveal to governments the need to establish a legislative and measurement framework. Which makes it easier for companies and managers to carry out certain actions and to be able to establish a reliable comparison of results or progress. The existence of action plans at European level, such as those developed on the circular economy and waste management (European Commission 2019), facilitate the achievement of Agenda 2030 (Tomassini and Cavagnaro 2022). However, the specific characteristics of the tourism sector require specific regulations to guide this new economic paradigm, which requires new rules of the game. Leaving the implementation of circular initiatives to the willingness of companies or consumers would slow down the process and generate confusion. The challenge of achieving internationally enforceable legislation in the tourism sector must be recognised, considering the great differences in sustainable development between countries. Nevertheless, this process can be favoured by demonstrating the benefits of circular practices in the tourism economy and by achieving informed and educated clients. Validation procedures for sustainability or SDG achievement measurements (yellow cluster) should ensure that the social, environmental and economic dimensions of sustainable development are reflected (Lorgnier et al. 2022). Even considering the difficulty of measuring the social dimension—as opposed to the environmental and economic dimensions-, its significant impact on tourism activities makes it an imperative factor. Despite this, research on this social dimension in tourism "remains inconsistent and needs to be refined" (Qiu Zhang et al. 2016: p. 64). It requires measurement tools that are standard enough to establish comparisons, and flexible enough to adapt to the particularities of each destination or type of tourism service.

This paper enhances managers to implement education and training programs, which play a key role in circularity implementation (Machado-Toffolo et al. 2022). This requires public–private initiatives and cooperation, which involves governments. There is also a need for inter-organisational tools at both the educational and communication levels, facilitated by new technologies, an aspect that has not yet been sufficiently researched. Smart tourism based on Industry 4.0 technologies is needed in the transition towards circular practices in this industry (Vecchio et al. 2021). Investment in innovation is an essential aspect that tourism professionals and organisations need to consider.

This innovation (red cluster) will encourage a change in waste management strategies or a shift towards renewable energy sources. But this requires awareness-raising plans. The implementation of tourist-centred socialisation programmes allows for the education of tourists with standardised and personalised tactics to understand their roles towards sustainable models—blue cluster (Yen et al. 2021). Results encourage to develop new consumption habits to minimise waste management after COVID-19 pandemic—red and green clusters-. Accordingly, a main aspect to address is transportation and its harmful effect on the environment (green and purple clusters). Concerning to governments, this requires of new policies to minimise car dependency creating more eco-friendly urban transportation system, focused on public transport (Diao 2019). Although at the same time is a necessity new tourists' consumption patterns regarding to the use of public transport for tourism leisure (Davies and Weston 2015).

6.3 Limitations and future research lines

This bibliometric study holds certain limitations. Firstly, interpretation of documents retrieved may have limited the interpretability of some findings. The document search was based only on keywords which implies no guarantees of exhaustiveness. Secondly, only articles written in English have been analysed, excluding potential interesting papers to analyse in other languages such as Chinese or Spanish. Thirdly, papers from other databases are excluded because we only consider articles published in sources indexed in WoS—based on its quality (Birkle et al. 2020) to retrieve the data collection. Thus, other studies may not be included, which assumes the main limitation of our work.

Fourthly and fifthly refer to the methodological process. The interpretation of the co-occurrence analysis is somewhat subjective in explaining the results obtained. And the citation analysis used represents the influence of the papers, but it has some limitations, for instance on the reputation of the journals included (Jeong and Yoo 2022).

Sixthly, other databases such as Scopus, or Google Scholar may be of interest to retrieve a larger sample of articles that could shed light about hotspots in the field. Which could be of interest is to incorporate scholar documents such as participation in international conferences, doctoral thesis and books in future research. Likewise, the use of other bibliometric software, for instance, SciVal, SciMat, Histcite, BibExcel or CiteSpace can bring new information to our study. It would be interesting to repeat the bibliometric analysis in the future to visualise the evolution of the research topic studied, bearing in mind the interest that circular tourism has received in recent years.

To extend and validate the results obtained in this article, further research could complement it with other techniques. For instance, content analysis using software such as Atlas.ti and Nvivo. Conducting in-depth interviews—to tourists and tourism firms—about the implementation of circularity in tourism could be addressed.

Additionally,—based on the most influential papers—further empirical analysis about collaboration between citizens and firms towards circularity (Zorpas 2020) and expand the scope to other geographical areas (Pilving et al. (2019)) are required.

It is true that, following review of the literature, we can affirm that there is no solid theoretical basis to better understand what the circular economy consists of. Although we do detect a clear intention to contribute to generating ideas, strategies, and policies to confront the future challenges set by the SDGs and climate change, through the circular economy and tourism. To sum up, circular tourism should not be considered a typology, but as an enabling tool to reach the necessary levels of sustainability, considering that this cannot be postponed.

Annex 1

See Table 3.

Table 3 Major research hotspots in circular tourism

Keyword	Occurrences	APY	AC	Links	TLS	Most co-occurring keywords
Cluster 1. Innovation and eco-efficiency in the circular tourism industry (red)						
Innovation	9	2019.00	33.22	18	28	Circular tourism (5); tourism industry (2); performance (2); sustainability (2); management (2)
Performance	8	2018.71	13.88	17	30	Circular tourism (4); tourism industry (4); sustainable tourism (2); COVID-19 (1); innovation (2)
Eco-efficiency	7	2020.71	6.29	14	21	Circular tourism (3); challenges (2); performance (2); tourism industry (1); waste management (1)
COVID-19	6	2020.33	15.67	14	17	Circular tourism (3); tourism industry (2); innovation (1); patterns (1); policies (1)
China	5	2020.60	0.80	12	17	Eco-efficiency (4); circular tourism (2); tourism industry (2); COVID-19 (1); challenges (2)
Industry	5	2018.20	8.60	13	17	Innovation (3); circular tourism (2); sustainable tourism (1); policies (1); strategies (1)
Indicators	4	2019.25	14.25	12	16	Circular tourism (2); tourism industry (2); challenges (1); performance (1); innovation (1)
Data envelopment analysis	4	2019.75	2.75	9	12	Circular tourism (2); eco-efficiency (2); performance (2); indicators (1); tourism industry (1)
Cluster 2. Circular waste management in tourism practices (green)						
Impacts	13	2018.92	5.54	15	29	Tourism industry (6); circular tourism (3) solid-waste (3); management (3); policies (3)
Policies	7	2018.71	26.00	17	22	Circular tourism (3); impacts (3); strategies (2); innovation (1); waste management (1)
Waste management	7	2019.43	12.29	13	19	Circular tourism (3); management (3); sustainability (3); challenges (1); policies (1)
Challenges	6	2020.17	10.17	15	23	Tourism industry (2); sustainable tourism (2); eco-efficiency (2); solid-waste (2); COVID-19 (1)
Patterns	5	2017.00	5.20	10	10	Tourism industry (1); COVID-19 (1); eco-efficiency (1); impacts (1); policies (1)
Strategies	4	2017.75	11.00	13	15	Transport (2); circular tourism (1); sustainable tourism (1); innovation (1); sustainable development goals (1)
Transport	4	2016.50	12.75	12	13	Management (1); policies (1); experience (1); destination (1); mobility (1)
Solid-waste	4	2020.00	11.00	7	11	Impacts (3); challenges (2); tourism industry (2); waste management (1); policies (1)
Cluster 3. Sustainable tourism model management towards circularity (blue)						

Table 3 (continued)

Keyword	Occurrences	APY	AC	Links	TLS	Most co-occurring keywords
Management	16	2020.06	3.94	23	50	Sustainability (5); tourism industry (4); impacts (3); waste management (3); sustainable tourism (2)
Sustainable tourism	8	2019.75	15.75	17	27	Circular tourism (5); sustainability (2); challenges (2); performance (2); management (2)
Rural tourism	5	2019.20	11.40	13	18	Circular tourism (3); sustainable tourism (2); challenges (1); indicators (2); eco-efficiency (1)
MODEL	4	2018.75	39.00	13	16	Circular tourism (2); sustainable tourism (2); sustainability (2); performance (1); strategies (1)
Experience	4	2019.25	5.00	7	8	Circular tourism (2); sustainability (1); evolution (1); model (1); management (1)
Evolution	4	2018.00	4.75	6	6	Tourism industry (1); sustainable tourism (1); management (1); model (1); experience (1)
Cluster 4. Circular tourism towards SDGs achievement (yellow)						
Circular tourism	43	2019.72	14.95	27	102	Sustainability (16); management (10); tourism industry (9); innovation (5); sustainable development goals (4)
Sustainability	21	2019.68	23.14	20	51	Circular tourism (16); management (5); waste management (3); model (2); destination (2)
Sustainable development goals	9	2016.38	11.56	12	18	Circular tourism (4); tourism industry (3); framework (2); policies (1); strategies (1)
Systems	6	2019.33	5.50	11	19	Circular tourism (3); sustainability (2); hospitality (2); challenges (1); eco-efficiency (1)
Hospitality	5	2020.20	3.40	6	10	Circular tourism (3); systems (2); sustainable development goals (1); performance (1); sustainability (1)
Framework	4	2020.33	3.75	6	12	Circular tourism (4); sustainable development goals (2); management (2); sustainability (2); innovation (1)
Cluster 5. Circular mobility to destinations in the tourism industry (purple)						
Tourism industry	37	2017.25	8.62	29	69	Circular tourism (9); impacts (6); systems (5); management (4); performance (4)
Circular migration	6	2016.20	6.17	3	7	Tourism industry (4); mobility (2); systems (1)
Mobility	5	2015.50	5.20	7	10	Tourism industry (3); circular migration (2); circular tourism (1); sustainability (1); destination (1)
Destination	4	2017.00	13.25	7	9	Circular tourism (2); sustainability (2); mobility (1); rural tourism (1); transport (1)

APY average publication year; *AC* average citation; *TLS* total link strength

Annex 2

See Fig. 5.

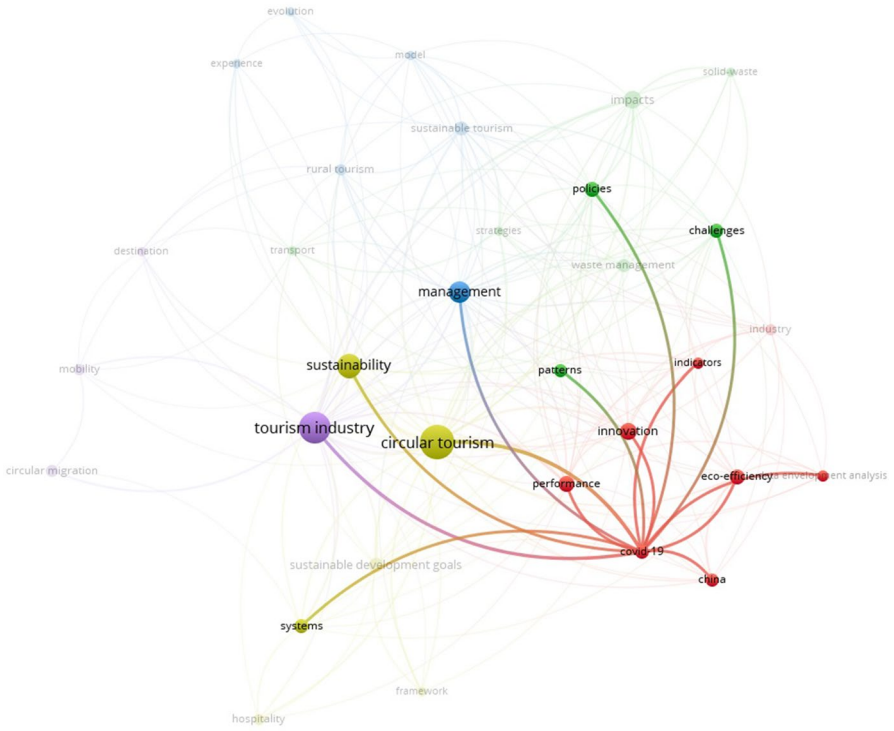

Fig. 5 COVID-19 relationships

Annex 3

See Fig. 6.

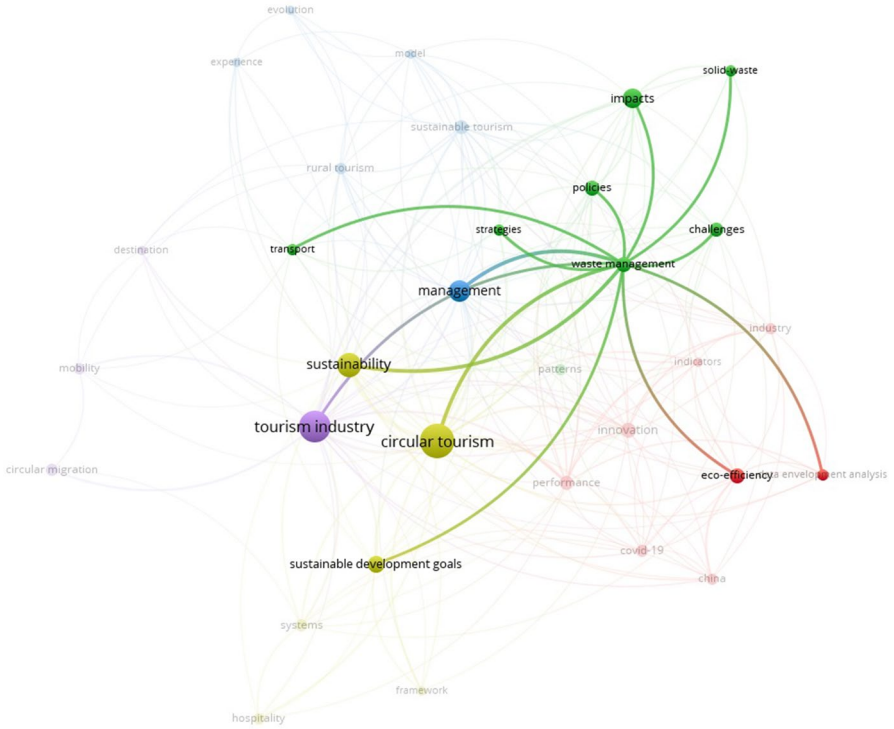

Fig. 6 Waste management relationships

Annex 4

See Fig. 7.

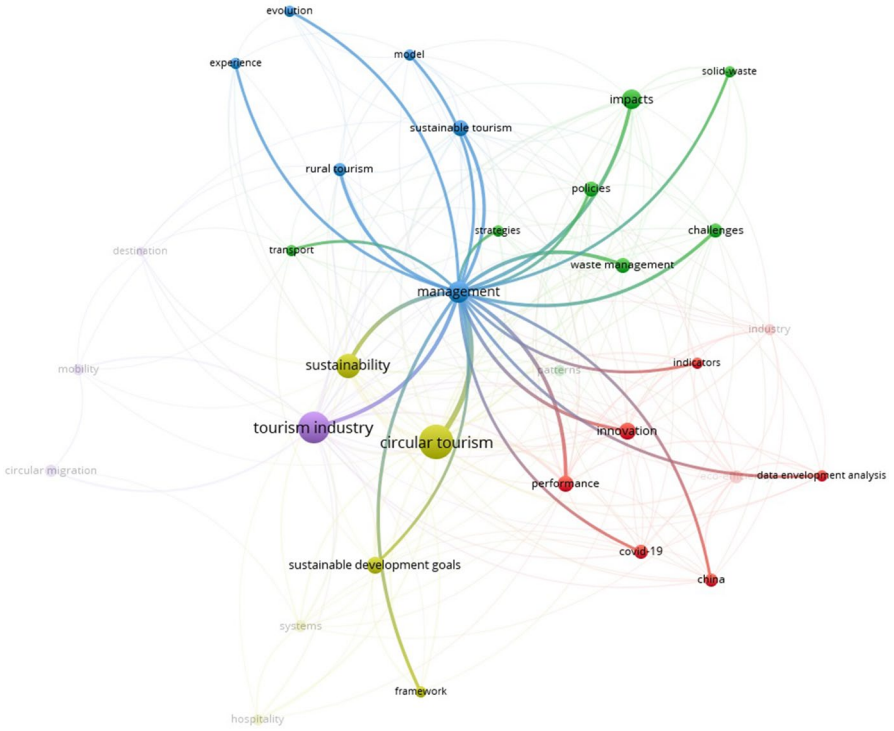

Fig. 7 Management relationships

Annex 5

See Fig. 8.

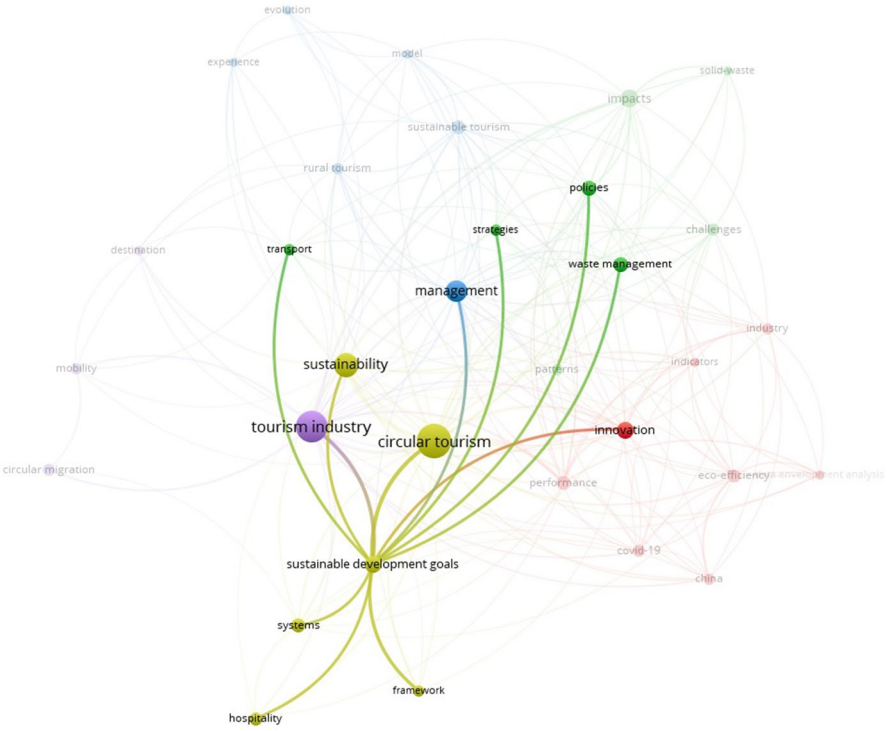

Fig. 8 SDGs relationships

Annex 6

See Fig. 9.

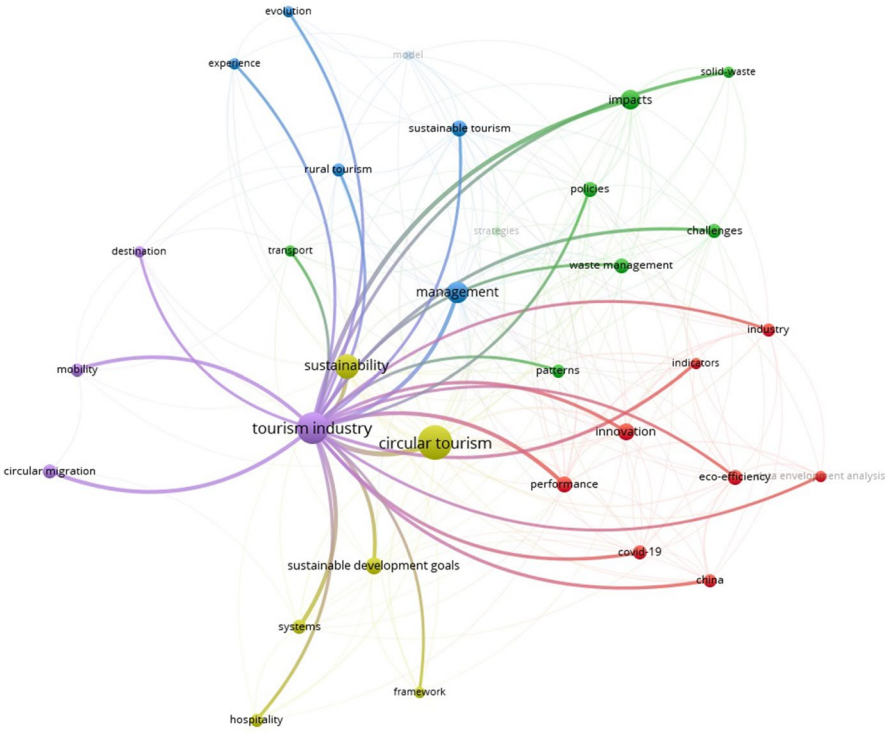

Fig. 9 Tourism industry relationships

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Data availability Data was retrieved from Web of Sciences database.

Declarations

Conflict of interest The author(s) report there are no competing interest to declare.

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