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RESEARCH ARTICLE

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Four decades of sustainable tourism research: Trends and future research directions

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Abstract

With the growth of sustainable tourism research and its practical relevance in today's world, it is important to integrate and synthesize the vast amount of intellectual work on this topic. This research applies a novel and robust structural topic modeling technique to analyze textual data from a total of 3289 research articles on sustainable tourism published between 1978 and 2022. The topics identified have been classified into macro, meso, and micro levels. Further, we compared and contrasted research themes across three time periods to provide a coherent, cohesive, and holistic overview of the extant literature in each period and discuss their contributions to knowledge. This article presents the publication trends, research evolution in the last four decades, and identifies emerging topics and future research opportunities to advance knowledge.

KEYWORDS

3M framework, literature review, structural topic modeling, sustainable tourism

1 | INTRODUCTION

The tourism sector contributed to around 4% of the world's GDP (or roughly \$3.4 trillion in 2019). On the negative side, around 5% of carbon dioxide emissions emanates from travel-related activities (UNWTO, 2019). The inherent nature and characteristics of the tourism industry thus may have undesired repercussions on our soil, oceans, and other natural resources (Briassoulis, 2002; UNEP, 2015). Tourism activities such as acquiring natural resources, the production of tourism-related goods, and disposal of used goods continue to impair the environment (Chamarro et al., 2023; Farsari et al., 2011). Furthermore, the proliferation of social media and the Internet has substantially increased global awareness among individuals of the negative impact of uncontrolled tourism on nature (Grilli et al., 2021;

Lee et al., 2023). The concept of "sustainable tourism" emerged as a response to such concerns after multiple academic discussions and deliberations, scientific inquiries, industry insights, and to a certain extent, the politicization of environmental protection, and its intellectual underpinnings continue to dominate academic, economic, policy, and governance debates (Albrecht et al., 2021; Bramwell et al., 2017; Zhang & Chan, 2020).

Tourism has been a vital source of economic survival and sustenance for many countries, including developed (Denstadli & Veisten, 2020) and developing (Nixon, 2020) one. Maintaining economic prosperity without negatively affecting the environment is a dilemma governments and industry face, which has grave consequences for individuals and communities. Sustainable tourism promotes the notion that the tourism industry should consider

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environmental conservation and sustainable development goals (SDGs, Moyle et al., 2020; Weaver, 2007). Research in sustainable tourism has witnessed exponential growth and has covered many topics, such as the conservation of environment and natural resources and the role of multiple stakeholders (Bramwell et al., 2017; Demeter et al., 2023; Mihalic, 2020). Thus, there is an opportunity to conduct a scientific investigation to synthesize the vast body of acquired knowledge with a broad framework for further information distribution (Nunkoo et al., 2020; Sharma, Nunkoo, et al., 2021).

As the field of sustainable tourism has advanced rapidly, researchers are interested in synthesizing and integrating the vast amount of knowledge appearing. In one of the early systematic reviews, Clarke (1997) proposed a framework of the various approaches and a discussion of definitions of sustainable tourism. Recent research has shifted this focus toward UN-mandated SDGs (e.g., Kristjánsdóttir et al., 2018; Rasoolimanesh et al., 2023). Furthermore, as a reflection of the ever-changing technology landscape, Erol et al. (2022) have explored the role of blockchain technology in improving sustainability. However, most reviews have applied different methods and approaches (e.g., narrative reviews, content analysis, bibliometric studies, and meta-analysis), theoretical underpinnings, and varying contexts (e.g., a predefined boundary of reviews limited to a specific journal), and are therefore, characterized by a number of limitations (e.g., Bramwell et al., 2017; Nunkoo et al., 2020; Sharma, Nunkoo, et al., 2021; Wattanacharoensil & La-ornual, 2019). This research follows a similar philosophy and progresses knowledge by using structural topic modeling (STM), an unbiased text-mining method, to track the evolution of the sustainable tourism literature published across the four decades. This study aims to answer the following research questions (RQs) for the sustainable tourism research published from 1978 until 2022:

RQ1. What are the publication trends in terms of research topics and underlying themes?

RQ2. How have the research topics evolved and been distributed across multiple time-periods?

RQ3. What are the mature as well as the new emerging research topics and future research opportunities to promote and advance knowledge?

The current study makes a three-fold contribution to the literature. First, this study discusses the limitations (in terms of number of articles and scope) of existing reviews. Recent research reported in the tourism literature has used STM to examine the huge amount of textual data and to generate comprehensible insights (e.g., Canziani & Nemati, 2021; Loureiro et al., 2022; Stamolampros et al., 2019, 2020). This study also applies the novel yet robust STM to examine text from 3289 research articles to identify research topics. To provide an overarching framework, the extracted twenty-five topics are mapped to the 3M levels of micro, meso, or macro aspects. Second, this review presents a cohesive and holistic overview of extant literature as well as the growth of related research in the last 40+ years. The overall time-period is further divided into three subperiods to compare and contrast evolving research. The subperiods are based on the average number of yearly publications: (1) 1978–2005 (less than 50 yearly

publications), (2) 2006–2015 (between 50 and 150 yearly publications), and (3) 2016–2022 (more than 150 yearly publications). Using topic prevalence analysis, this investigation documents, compares, and contrasts broad research trends across three periods. Third, academic scholars have paid attention to multiple research topics to address the prevalent challenges and issues related to the environment, government, industry practices, and UN mandates. This research synthesizes the vast literature and draws the life cycle of topics to determine the mature, emerging, and pertinent research topics that should be helpful for the academic community, practitioners, and regulatory bodies.

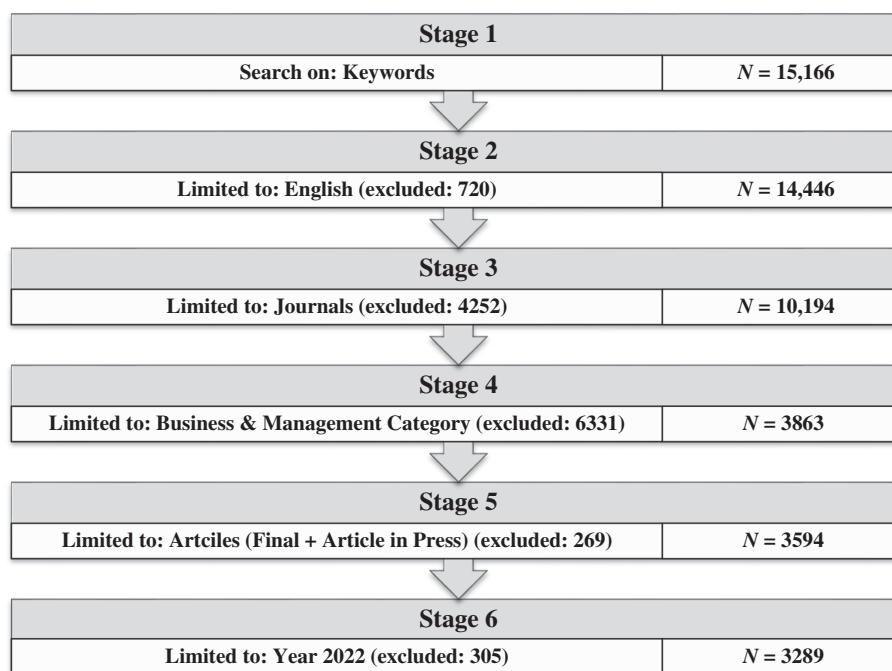
2 | 3M FRAMEWORK AND TOURISM RESEARCH

The 3M framework comprises three levels (micro, meso, and macro) reflecting three distinct layers structured hierarchically to describe and decode a phenomenon or system. Micro represents individual and community-level factors, meso includes intermediaries and processes, and macro reflects broader actors in the given system. The 3M approach is an excellent analytical approach that has been used to critique and analyze existing knowledge across research domains, such as economics (Dopfer et al., 2004), green advertising (Fowler III & Close, 2012), seasonal tourism (Zhang et al., 2021), human capital and firm performance (Crook et al., 2011), and ethical leadership (Hassan et al., 2022). In the context of tourism, Baum et al. (2016) applied the 3M framework to map the identified themes in their review of tourism and hospitality workforce research. Similarly, Duan et al. (2022) categorized the impacts of tourism crises on destinations into three levels. In this article, we follow a similar philosophy to conceptualize and classify various tourism-related research themes identified via the text-mining method into micro (e.g., tourist behavior and communities), meso (e.g., tourism industry, destination marketing, eco-tourism, and responsible tourism), and macro (economic environment, natural environment, and government policies and interventions).

3 | METHODOLOGY

3.1 | Structural topic modeling

Traditional methods (systematic reviews, content analysis, and narrative reviews) are susceptible to researcher bias, whereas STM provides a robust and unbiased method to identify new and emerging research themes and research trends with immaculate accuracy and efficiency (Moro et al., 2017; Nunkoo et al., 2023; Roberts et al., 2019). Recent research has applied STM to analyze a massive amount of textual data (e.g., online hotel reviews and employee reviews) to generate comprehensible insights and to develop theory (Canziani & Nemati, 2021; Serrano et al., 2021; Sharma, Rana, & Nunkoo, 2021). STM allows researchers to

FIGURE 1 Search process.

include an enormous number of metadata to compute the proportion of documents and their relationship with metadata (Roberts et al., 2019). Furthermore, STM calculates exclusivity (uniqueness) and semantic coherence (co-occurrences) to identify the best model and significantly enhances inferences from topic prevalence analysis (Canziani & Nemati, 2021; Park et al., 2021; Stamolampros et al., 2020).

3.2 | Data collection

Since the Scopus database is regarded as a comprehensive collection of academic research data suitable for conducting multidisciplinary research, we used it to extract pertinent documents (Nunkoo et al., 2023). On the basis of the prior literature, we compiled a list of pertinent keywords. Using an “OR” operator, the search string includes terms, such as “environmentally sustainable tourism,” “environment* tour*,” “sustainable* tour*,” “sustainable development tourism,” “tourism sustainability,” “sustainable travel,” “green tour*,” “sustainable transport,” “responsible tourism,” “environmentally responsible tourists,” “sustainable ecotourism,” “environmentally friendly tourists,” “sustainable indigenous tourism,” “environmentally sustainable tourist,” “sustainable mass tourism,” “sustainable community tourism,” “sustainable cruise,” “sustainable cultural tourism,” “sustainable hospitality,” “sustainable visitor,” and “eco* tour*.” The retrieved data were confined to “articles” in English published in journals from the “Business, Management, and Accounting” subject area. The articles under consideration were restricted to the year 2022 in order to retain the reproducibility of the search results. The search yielded a total of 3289 articles for STM analysis (see Figure 1 for more information).

3.3 | Data analysis

The text dataset was created from the abstract and keywords of all the articles to extract the latent key topics (e.g., Nunkoo et al., 2023). We cleaned the data by discarding numbers, punctuations, symbols, URLs, copyright symbols, publisher information, and extra white-spaces. Further, all the terms were converted into lowercase, followed by tokenization and lemmatization of the terms. For example, tourists were lemmatized to tourist and tours to tour. As the documents under study were in English, the standard English stop words were removed to filter out common terms that do not add to the analysis. To remove noise in the data, a document feature matrix was created by trimming the rare words that occurred less than 7.5% of the time (e.g., workgroup or workflow) or were ubiquitous words occurring more than 90% of the time (e.g., tourism) to weed out extremely low-frequency or high-frequency words as they either do not add to the results or skew the results leading to slower processing.

4 | RESULTS

4.1 | Publication trend

The publication trend indicates how academic interest in the field of sustainable tourism has changed over the years (see Figure 2). It may come as a surprise to many, but the first documented academic research that recognized the importance of preserving the natural environment against the risks associated with mass tourism was published about 45 years ago (Cohen, 1978). Afterward, about one to two articles were published every couple of years over the next 13 years.

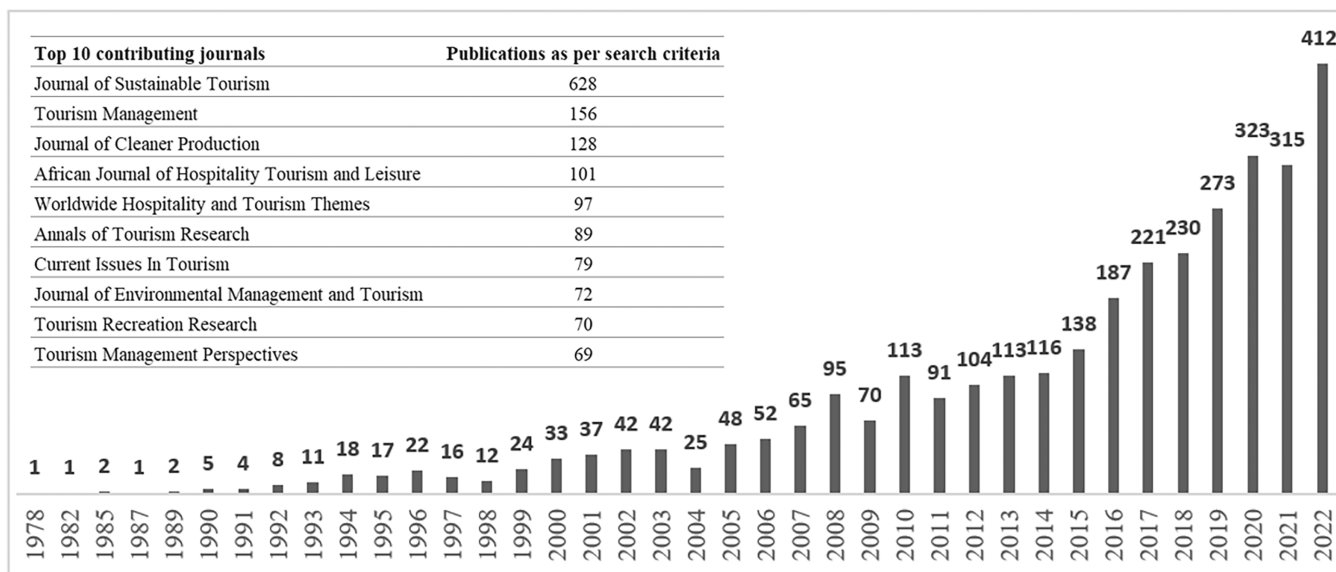


FIGURE 2 Publications over time and the top 10 contributing journals.

But, a slow and steady surge in publications began in 1992, and in 2006, the number of yearly publications reached 50. Another milestone of 150+ yearly publications was reached in 2016. In the last 3 years, annual publications have exceeded 300+ articles, showing the increasing interest and importance given to the domain of sustainable tourism. Figure 2 lists the top 10 contributing journals in the area of our research.

4.2 | Topic extraction

There are many methods and techniques that can help in finalizing the most suitable number of topics. For example, the R package (STM) offers metrics like held-out likelihood, residual analysis, semantic coherence, and average exclusivity to decide the most appropriate number of topics for a given study (Roberts et al., 2019). The held-out measure explains the overall variability in data by selected topics. Exclusivity reflects the uniqueness of words occurring in topics, and semantic coherence measures the similarity of words to each other (quality of topic structure). This study followed an iterative approach using the average held-out likelihood and the trade-off between average semantic coherence and exclusivity scores (Roberts et al., 2019) to narrow the topics for further analysis. The document corpus yielded 25 latent topics, as listed in Table 1, using averaged held-out likelihood with the topic proportions ranging from 0.012 to 0.072. Moreover, the spectral initialization of the topic modeling function was used to make the topic model reproducible.

4.3 | Research trajectories (topic labeling)

STM analysis identifies phrases under latent topics that have semantic coherence while being unique to the given topic (exclusivity metric)

for communicating content. The current study identified five relevant keywords based on the FREX (FRequency and EXclusivity) association with word profiles. The variance in semantic coherence values connected to two topics shows that the top words associated with the two topics are not similar in the documents. Each topic was labeled by analyzing the semantic relationships between its words. For example, Topic 1 was labeled as “public transport support” due to semantically connected words like “transport,” “support,” “public,” “relationship,” “demand,” and so on. Similarly, the remaining 24 topics were also appropriately labeled with the topic labels.

4.4 | Evolving themes in sustainable tourism research

To understand the evolution of tourism research, the 3M framework was used to categorize the twenty-five topics as macro, meso, or micro level factors (see Figure 3). The overall percentage of topics under the three levels was then calculated to understand the distribution of topics (Figure 4).

4.4.1 | Classification of themes (overall period, 1978–2022)

Macro

Out of 25 topics, about 39.1% examined macro-level factors, such as the natural environment, the economic environment, and government-related policy interventions. Researchers have explored the impact of macro factors (e.g., political environment, political stability, economic growth, low and high-income countries, etc.) on tourism (Saha et al., 2022). A consistent increase in the depletion of natural resources calls for balancing economic aspirations while controlling

TABLE 1 Extracted topics and intuitive labeling.

Topic	Topic label	FREX terms
Topic 1	Public transport support	Transport, support, public, relationship, demand
Topic 2	Protecting environment	Ecotourism, nature, conservation, natural, protect
Topic 3	Rural travel	Rural, support, natural, resource, region
Topic 4	Community behavior	Perception, attitude, relationship, resident, support
Topic 5	Conscientious tourism	Adopt, support, responsible, relationship, global
Topic 6	Cultural tourism	Cultural, natural, socio, heritage, conservation
Topic 7	Travel demand management	Travel, world, demand, adopt, tourist
Topic 8	National support	National, support, country, international, demand
Topic 9	Collaborator management	Management, government, support, stakeholder, local
Topic 10	Eco-tourism	Eco, natural, relationship, tourist, demand
Topic 11	City-level support	Local, city, support, strategy, adopt
Topic 12	Policy Interventions	National, policy, government, region, adopt
Topic 13	Community support	Community, support, local, strategy, government
Topic 14	Tourist management	Management, protect, national, visitor, strategy
Topic 15	Destination management	Destination, demand, management, relationship, tourist
Topic 16	Planning	Strategy, plan, management, adopt, support
Topic 17	System management	System, management, support, demand, relationship
Topic 18	Local business management	Small, management, business, support, industry
Topic 19	Environment knowledge management	Knowledge, environment, management, relationship, support
Topic 20	Tourist experience	Tourist, experience, relationship, place, perception
Topic 21	Economic development	Economic, growth, socio, industry, resource
Topic 22	Change management	Change, strategy, industry, support, knowledge
Topic 23	Product strategy	Product, strategy, market, demand, tourist
Topic 24	Social relationship	Relationship, social, economic, support, knowledge
Topic 25	Service quality	Quality, service, support, demand, relationship

the adverse impact on the environment and society. To address such concerns, governments and industry leaders are promoting the new concept of environmental entrepreneurship, which exclusively focuses on sustainable practices (Dudin et al., 2019). Tourism has been a vital source of income for many countries, and the COVID-19 pandemic provides evidence that a reduction in tourism revenues can create havoc for economic growth, as seen in the case of Sri Lanka (Nixon, 2020). Hence, the governments and the industry are caught in a dilemma where they must ensure economic prosperity in turbulent times without severely impacting the natural environment, which has severe repercussions for the natives and communities (Berry & Ladkin, 1997; Rodriguez, 1987). Furthermore, policymakers consistently promote and incentivize sustainable practices (e.g., reducing greenhouse gas emissions due to air transportation) at the industry level with positive results (Debbage & Debbage, 2019). In summary, the concerned stakeholders, including government and industry, have shown interest and will to transform, change, and adapt best practices toward sustainable tourism and achieving the SDGs (Nunkoo et al., 2023).

Meso

Most of the research that examined meso-level parameters ((43.7%) is categorized into two broad categories: destination tourism and tourism industry). Topics such as destination management, eco-tourism, and cultural tourism are examples of destination tourism (e.g., Albrecht et al., 2021; Farsari et al., 2011; Hsu et al., 2022). Heritage or cultural tourism pertains to destinations having a rich cultural history with ancient artifacts of importance. UNESCO lists 1157 properties in its world heritage list (e.g., Chartres Cathedral in France, the Great Barrier Reef in Australia, the Taj Mahal in India, Piazza del Duomo, Pisa, and Vatican City). Heritage tourism became a “magnet” as potential tourists became aware of the UNESCO list on popular online platforms (Yang et al., 2019). Similarly, eco-tourism emerged as a source of recreation and rejuvenation for tourists, but gradually, excessive tourism activities and exploitation of resources by operators had detrimental effects on the environment.

The tourism industry has continued to expand its offerings to fulfill the varying needs of travelers. For example, rural travel and conscientious tourism have been promoted as the industry and local players have devised strategies to generate more revenues following sustainability (Seraphin et al., 2022). Firms from the tourism and hospitality sector embraced predictive technologies and online aggregators for tourist management and planning small businesses in rural destinations (Slabbert & Du Preez, 2022).

Micro

About 17.2% of the topics explored micro-level characteristics. Though the micro-factors form the lowest proportion of the overall topics, researchers' increasing interest in investigating the role of individuals and communities in adopting and driving sustainable practices is noticeable. Visitors display increased awareness of the potentially harmful effects of their actions, which can be attributed to access to

		1978–2005 N: 371	2006–2015 N: 952	2016–2022 N: 2023	1978–2022 N: 3346
M A C R O	Natural Environment	Protecting environment	Environment knowledge management		Protecting environment Environment knowledge management
	Economic Environment	Economic development	Collaborator management	Travel demand management Economic development Collaborator management	Travel demand management Economic development Collaborator management Change management
	Government	Policy interventions Planning	Policy interventions	National support	National support Policy interventions Planning
M E S O	Destination Tourism	Destination Management Eco-tourism Cultural tourism	Cultural tourism	Cultural tourism	Eco-tourism Destination Management Cultural tourism
	Tourism Industry	Social support	City-level support Local business management Transport support Conscientious tourism Product strategy Tourist management	Rural travel	Conscientious tourism City-level support Social support Local business management Transport support Rural travel Tourist management Product strategy System management
M I C R O	Tourists	Tourist experience		Tourist experience Service quality	Tourist experience Service quality
	Community/ Residents	Community support		Community behavior Community support	Community behavior Community support

FIGURE 3 Topic distribution using 3M framework (overall period 1978–2020).

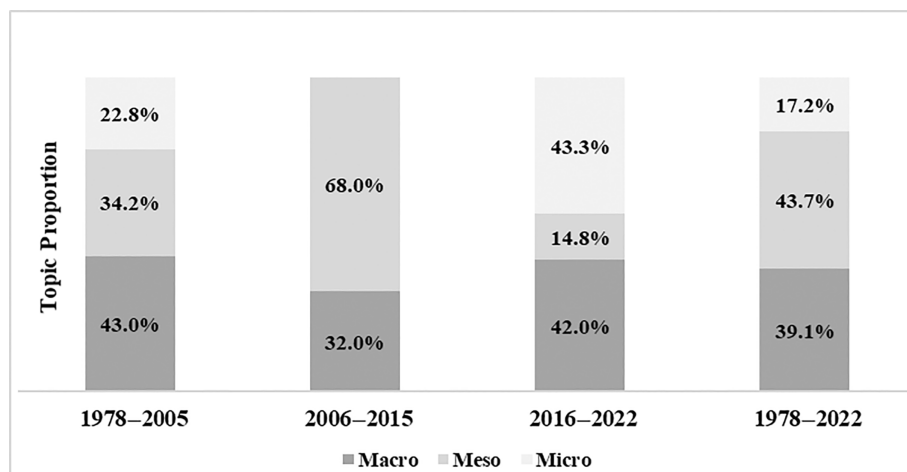


FIGURE 4 Topic distribution (under 3M framework) within three time periods.

online information and social media (Boley & Woosnam, 2021). Moreover, the demand for high-quality tourist services and luxury tourism also increased, which has mixed effects on sustainability (Amatulli et al., 2021). Gradually, residents, community, and the neighborhood became important stakeholders as they consistently faced the challenges of degrading environment and living conditions (Li et al., 2019).

Communities and local residents develop very strong relationships with their environment. They represent a minority compared with big firms and governments and face the complex issues of environmental discrimination, equity, and racism (Rastegar & Ruhanen, 2022). On the positive side, researchers have given a voice to small yet powerful minorities. The research findings affirm that local residents and

visitors play a crucial role in achieving sustainability in the tourism industry (Islam et al., 2023). Further, sustainability-conscious firms promoting sustainable practices like the use of renewable energy sources, recycling waste, adopting the use of reusable and recyclable materials, and incentivizing tourists to adopt sustainable practices also help in increasing sustainability at the micro level (Bressan & Pedrini, 2020; Ruiz-Ortega et al., 2021).

4.4.2 | Evolving themes across the three time periods

To track the evolution of research, we divided the overall time period into three subperiods based on the average number of annual publications. Period 1 is from 1978 to 2005 (having less than 50 annual publications), period 2 is from 2006 to 2015 (between 50 and 150 annual publications), and period 3 is from 2016 to 2022 (more than 150 annual publications). We identified the top 10 topics across the three time periods and mapped them to macro, meso, and micro levels (Figure 4). We notice that research into macro-level issues dominated the first period, then meso factors took over in the second period, and finally, micro-level issues have become more prominent in the last decade.

Macro

The macro-level studies were the highest in the 1978–2005 time period and the lowest for the 2006–2015 time period. During its early days (1978–2005), sustainable tourism research mostly explored the adverse impact of tourism on the environment and stressed the sustainable use of natural resources, balancing the “pursuit of social and economic goals” (Cohen, 1978; Romeril, 1989). Researchers were interested in identifying actionable and feasible strategies, which suggests that encouraging stakeholders to become involved in environmental issues was critical for enhancing sustainable tourism in developing countries. A segment of research used a case-based methodology to reflect the critical role of government policies in promoting and managing rapid growth in tourism across popular destinations (Rodriguez, 1987; Weaver, 2007). Later, researchers shifted their focus toward enhancing and developing environmental knowledge to increase the sustainability of tourism (e.g., Lee, 2013). From 2016 to 2022, most studies did not explicitly mention the natural environment as it had become the assumed foundation and essential underlying element in this discourse (e.g., Mellon & Bramwell, 2016).

Sustainable economic development is another pertinent and fertile research area that has attracted the attention of scholars while investigating the macro-factors related to policy interventions and the political environment. Studies in the time period 1978–2005 highlighted the economic benefits of tourism, such as a stimulus to growth and employment (Hannigan, 1994), whereas the sustainability perspective gained prominence over pure economic benefits during 2016–2022 (e.g., Adeniyi et al., 2023; Rastegar & Ruhanen, 2022).

Stakeholder management and government policies are two important macro-level actors where researchers made conscious

efforts to grasp and decode the function of government policies, programs, and assistance in sustainable tourism. Extant research proclaims that sustainable tourism cannot be achieved without proper government policies and regulations (UNEP, 2015). Institutional initiatives and tourism policies have substantially extended the sustainability paradigm over a period of years, resulting in a deep integration of contemporary tourism with sustainable development (Torres-Delgado & Palomeque, 2012). The adept policymakers have drafted and updated regulations to control the undesired tourism effects on the environment due to changes in the external environment, such as a steep rise in global tourism due to the exponential growth of the aviation industry (Debbage & Debbage, 2019).

Meso

A substantial amount of research is related to the intermediaries (between government and travelers) that affect the tourism industry's operations and performance. Meso-level factors include industry or sector in which an organization operates, degree of industry rivalry, industry structure, various types of tourism, destination image, and suppliers. Many countries anticipated the vast revenue potential from tourism and developed well-planned strategies to position and promote sites, such as ecotourism, rural tourism, and heritage tourism destinations (Thomas, 1994; Weaver, 2005; Zhang & Lee, 2022). Tourism trends in some popular destinations followed the “cycle of evolution” and reached the stagnation phase (Butler, 1980). In such cases, the industry either declined or recovered, depending on the rejuvenation strategies of repositioning destinations and improving infrastructure (Hovinen, 2002). For example, the hugely popular and globally acclaimed TV series on Chernobyl created a “tourism boom” (Hunder, 2019).

Studies on meso-level factors were prominent during 2006–2015, including specific attention on marketing activities, promotions, and increasing use of social and digital media to enhance destination image and build awareness among potential tourists (Camilleri, 2018; Praesri et al., 2022). Prior studies have explored multiple aspects of destination image, such as cultural image, environmental image (natural attractions, pollution, congestion, and greenery), and socioeconomic image (quality of public infrastructure, public transport) and their influence on sustainability (Lee & Xue, 2020; Prayag & Ryan, 2011). Industry has also embraced technology to plan and manage visitors, especially in protected areas, to minimize the resulting damage (Lawson, 2006). At the local level, small businesses need to take responsibility for implementing pragmatic sustainable practices (Berry & Ladkin, 1997). Strategic destination management was also proposed to attain the objectives of sustained value creation (Flagestad & Hope, 2001). Furthermore, businesses (e.g., tour operators and hospitality chains) should promote social tourism by involving economically and socially disadvantaged populations (Kakoudakis & McCabe, 2018).

The availability of good quality infrastructure and means of reliable transport also make a destination more appealing and attractive. The challenges of developing sustainable urban transport were solved by researchers from the domain of decision sciences, who proposed

novel methods to test and improve public transit networks to develop an efficient transport system that can substantially reduce emissions from urban traffic (Liu et al., 2022). Overall, research indicates that understanding the meso environment is critical to promoting sustainable tourism practices, developing strategies to manage the sustainable image of places, and positively impacting the industry's operations and performance.

Micro

Most of the research in the past few years has investigated the influence of micro-level stakeholders and their various characteristics on sustainability. Two micro-level factors that have received particular attention in sustainable tourism research are community/residents and tourists (e.g., Islam et al., 2023; Moayerian et al., 2022). Early research raised ethical concerns related to an individual's responsible tourism and anti-tourism activities (Lea, 1993). Later on, tourists' pro-environmental attitudes and behavior became the center point of research (e.g., Li et al., 2019). Travelers' environmental knowledge and concerns toward environment-friendly practices can instill the desired behavior among tourists (Foroughi et al., 2022). Furthermore, the degree of residents' attachment to the destination and perceived image of the place drives community residents' opinions toward tourism development (Lee, 2013; Pai et al., 2023). Recent research also documents the enormous challenges associated with including community-based tourism (CBT) in planning and development, which fosters community support in implementing sustainable tourism practices (Moayerian et al., 2022).

Destination type and destination image have received sufficient attention as meso-factors; however, travelers' attitudes and perceptions became key antecedents to drive ecotourism, heritage tourism, medical tourism, and rural tourism (Chamarro et al., 2023; Lee et al., 2020; Megeirhi et al., 2020). The number of global tourists witnessed exponential growth in the decade before the pandemic arrived. Some of the dominating reasons that fueled the tourism industry belong to technological interventions, such as social media, the proliferation of the Internet, and the mobile revolution that gave "information" power to consumers to search, review, finalize, and book online from the comfort of their homes (Ghimire et al., 2022). Industry and hotels paid great attention to what customers were saying (online feedback) as positive reviews (word-of-mouth) became a catalyst to drive future revenues (Nowacki & Kowalczyk-Anioł, 2022).

Research during the last decade has appropriately captured tourists' behavior and attitude toward natural and recreational tourism, leisure travel, and tourists' growing expectations of the quality of services and facilities available at the destination (Amatulli et al., 2021; Boley & Woosnam, 2021; White et al., 2019). Tourism growth was temporarily halted by the COVID-19 pandemic in the last few years, but it has rebounded with "revenge" tourism and "over-tourism" (Vogler, 2022). The COVID-19 pandemic had unprecedented adverse effects on the global tourism industry, wherein the pandemic had a mixed impact on sustainable practices (Mayer et al., 2021). A substantial increase in disposable products reduced the reuse or recycle options but increased costs. To manage costs, the tourism industry

was forced to innovate to develop products that are economically viable and sustainable (Nixon, 2020; Sharma, Thomas, & Paul, 2021). The use of technology such as remote check-in and contactless payments has significantly reduced paperwork and wastage (Vogler, 2022). The potential impact of emerging technologies like blockchain, the sharing economy, and consumers' response to sharing rooms and transport toward sustainable tourism are also well-researched (Erol et al., 2022; Huang et al., 2022).

4.5 | Emerging research trends (topic prevalence)

Topic prevalence analysis computes the probability of topic occurrence against the metadata. For example, Park et al. (2021) used topic prevalence to map the themes that emerged from online employee reviews against various industries. In this study, we evaluated emerging themes (topics) with respect to the year of publication to understand the patterns of topics over time from 1978 to 2022 (Figure 5). Topics such as support related to transport, national support for managing domestic and international demand, and eco-conscious tourists (Topics 1, 8, and 10) have found regular attention in the study. Increasing public transport access and usage among tourists (domestic and international) promotes and enhances sustainable tourism practices (Denstadli & Veisten, 2020; Luo et al., 2018).

A few topics, for example, eco-tourism, rural tourism, tourist management and planning, and marketing strategies for sustainable tourism (Topics 2, 3, 14, 16, and 23) have followed a declining trend, which suggests that academic research in these areas may have reached a maturity level and researchers' attention has shifted toward more novel ideas. Exhaustive reviews on rural tourism signify the extensive amount of research already done on the topic (Lane & Kastenholtz, 2015). A substantial amount of research has already examined the outcomes and challenges in implementing sustainability-oriented development works for rural tourism development and issues related to income inequality (Mwesiumo et al., 2022; Zhang, 2023).

Studies on community behavior, conscientious tourism, the role of multi-stakeholder participation, service quality, tourism experience, and economic growth (Topics 4, 5, 7, 9, 11, 15, 20, 21, 22, 24, and 25) have on the other hand shown a consistent growth (e.g., Dickinson & Peeters, 2014). Firms' CSR activities influence residents' and visitors' attitudes, which further drives the adoption and usage of accommodation-sharing platforms (Chamarro et al., 2023; Li et al., 2019). Emerging technologies, such as blockchain, artificial intelligence, and text mining, can help resolve complex problems and create the framework for worldwide sustainable tourism (Erol et al., 2022).

4.6 | Future research avenues

Topic prevalence analysis in STM was performed to understand the publishing patterns and reviews of the latest research articles to

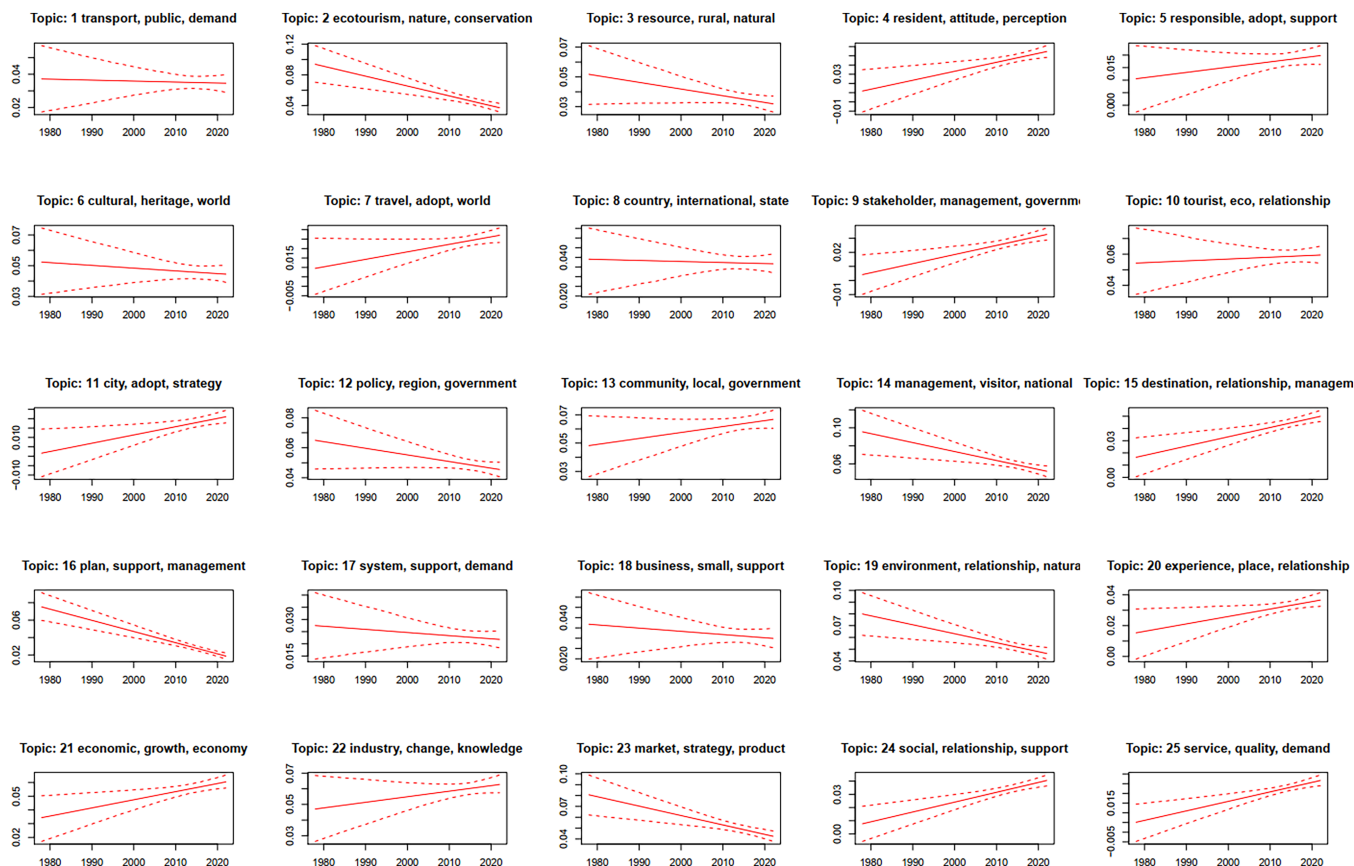


FIGURE 5 Topic prevalence from 1978 to 2020 (Y-axis represents expected topic proportion).

identify potential areas for future research. For example, many opportunities exist to identify the influence of multiple stakeholders, such as businesses, communities, individuals, and governments, to promote and achieve sustainability with fixed accountability. Though extant research has explored the importance of stakeholders at individual levels, a shift in recent research toward adopting multi-stakeholder perspectives signifying the importance of each stakeholder is noticeable (e.g., Mwesiuno et al., 2022; Spencer & Sargeant, 2022). Destination managers must discuss and practice ideas, plans, and projects as part of a commitment to sustainability. Local residents and communities must be involved in management, planning, and promotion to achieve sustainable goals (Rastegar & Ruhanen, 2022).

One of the most crucial steps toward making tourism more sustainable is to concentrate on sustainable transportation, in which case multimode transport resilience becomes essential (Liu et al., 2022). Cooperative and flexible travel decisions can advance travel and transportation sustainability, improving tourist sustainability.

Technological intervention and the new age consumer behavior are also fertile areas for further research (e.g., Mkono, 2020). The proliferation of global media in the form of over-the-top (OTT) platforms will ensure that content reaches a global audience. For example, a popular TV series has increased tourism at Chernobyl, termed as dark tourism (Hunder, 2019; Yankovska & Hannam, 2014). Similarly, many dedicated online websites offer information on exploring

New Zealand based on the filming of locations of the hugely popular (and one of the highest-grossing films of all time) movie trilogy “Lord of the Rings” (Meneguzzi, 2022). Hence, further research can explore specific instances with sustainability context, where a popular media series or online content (promoted by social media influencers) increases tourism activities. It is also recommended that multidisciplinary research using theories from psychology, marketing, sociology, and so on, be used to understand the behavioral responses of individuals and community and to devise effective nudges toward promoting sustainability (e.g., Chen et al., 2022). We have categorized the literature into three time periods. Further research can explore other parameters, such as geography and economy. Additionally, the authors may explore other frameworks to identify diverse and pertinent themes and patterns in the existing literature. A list of possible future research questions is presented in Table 2.

5 | DISCUSSION AND CONCLUSIONS

Since the first documented research publication in the year 1978, research on sustainable tourism has grown substantially, which calls for the integration and synthesis of a vast amount of existing research data (Ivanka et al., 2023; Nunkoo et al., 2023; Rasoolimanesh et al., 2023) to establish clear trends. We noticed an opportunity to

TABLE 2 Future research directions in sustainable tourism.

Macro-level RQs
<ul style="list-style-type: none"> • How to integrate issues of environmental equity, distributive justice, environmental degradation (e.g., water and air quality), and unequal consumption of natural resources in planning and predicting economic growth? • How can voluntary carbon offsetting schemes be established to encourage sustainable tourism practices? • How to change the polarized conversations into pragmatic government regulations and policies? • How to persuade industry and business stakeholders to shift their mindset from immediate revenues to long-term sustainable profit maximization? • How does short-term demand management (e.g., spike post-COVID19) affect the environment in the long term? • Do government regulations, rules, or laws (e.g., banning polythene or single plastic usage, restricting the number of tourists) really work? • What are the effects of economic status (e.g., developing vs. developed countries) and potential growth in promoting and implementing sustainable practices in the tourism industry? • How do micro-businesses and tourism services industry contribute to the economy in countries with different sociocultural, economic, and political-legal settings, including different ecological conditions?
Meso-level RQs
<ul style="list-style-type: none"> • What are the effective sustainable approaches used to reconcile the tensions between the contradictory motives of rural development and conservation? • How can technology (e.g., data mining) be used to predict the impact of short-term growth on long-term environmental degradation and natural disasters? • How can carefully planned improvements in urban mobility contribute to sustainable tourism? • What is the potential market for voluntary offsetting and obligatory compensation schemes for encouraging sustainable tourism practices? • What is the impact of CSR in shaping attitudes toward developing large-scale tourism projects? • Which regional and local perspectives should be included to build effective sustainable policies? • How do performance-based incentives to tour operators influence their motivation and engagement toward sustainable tourism? • How do services offered by tourism providers (e.g., accommodation vs. catering) contribute toward growth?
Micro-level RQs
<ul style="list-style-type: none"> • How do we utilize individuals' belief systems and values toward sustainable tourism? • How do we convert eco-hypocrisy and inauthenticity into a more responsible travel behavior? • How can technology (smartphone apps, VR, AR, AI, and blockchain) influence consumers by tracking and visualizing their travel traces? • How do community leadership, hierarchical structures, and social groups impact endorsing or discouraging sustainable tourism? • How do we nudge local residents and travelers to make the trade-off between sustainable ecotourism and immediate revenue generation? • How do social responsibility, ethics, and ideologies impact tourism sustainability? • How to persuade people to implement strategies (e.g., reward vs. punishment) and adopt behavior to reverse the damage done to ecological resources? • What is the role of sociodemographic or other psychographic factors (i.e., personality, materialism, culture, and altruism) in people's emotional responses and sustainable behavior? • How do behavior and attitudes of native residents differ from those of temporary residents (e.g., people temporarily relocated to the destination)? • How can content marketing be used for interactive communication to promote social and environmental responsibility in tourism? • How do leisure travelers differ from business travelers in terms of eco-friendly attitudes? • What are the effective strategies to target consumers (e.g., children or festival tourists) to promote and build awareness of responsible tourism? • How to utilize popular media content to promote sustainability with increasing tourism?

apply robust text-mining and analytics methods to unearth the intellectual underpinnings and conceptual structures of scientific knowledge produced in the last four decades. The outcomes of this rigorous analysis answered the research objectives and provided useful insights to illustrate publication trends, the evolution of research, and most importantly, the “publication life cycle” of various topics and themes. We used STM to analyze 3289 research articles (published from 1978 to 2022), which identified 25 broad topics that were mapped to the 3M (macro, meso, and micro level) framework.

The publication trend shows two spikes in the number of yearly research publications. The first significant milestone of 50+ annual publications was reached in 2006, followed by a second milestone of 150+ annual publications in 2016. This substantial increase in research publications related to sustainable tourism may be partly attributed to the SDGs formulated and widely circulated by the United Nations (UNEP, 2015). The journal *Annals of Tourism Research*

pioneered the early research, followed by other outlets like *Tourism Management*, *Journal of Sustainable Tourism (JST)*, and *Tourism Recreation Research*. The introduction of JST, a sustainability-specific journal, also acted as a catalyst to advance knowledge (Bramwell et al., 2017; Mooney et al., 2022). Furthermore, at the dawn of the century, topics like climate change, global warming, and the agreement of the Kyoto Protocol generated a lot of buzz and interest in popular media (Gössling et al., 2007; Sharma et al., 2023). The introduction of the Internet and the rise of social media fueled the discussions and dissemination of issues and challenges across a global audience. Youth activism and political populist approaches became reckoning forces to force government and policymakers to implement strategies with visible effects (El Barachi et al., 2021).

Research themes and distinct thought processes of scientific inquiries vary across the three time periods, reflecting the true nature of research evolution. In the initial phase, as expected, scholars

discussed and debated the definition of “sustainability” and sustainable tourism and the broad impact of tourism on the environment and economic growth (Clarke, 1997; Cohen, 1978). At that point, international tourism was almost negligible, and most tourism was restricted to within states, thereby having an impact on local revenues and growth (Briassoulis, 2002) but not on the external balance of trade. In this early period, only a few researchers explored the ethics of sustainable tourism development (Lea, 1993).

Subsequently, globalization and industrialization substantially improved the availability and quality of infrastructure. Moreover, countries recognized the considerable potential of tourism and its contribution to economic growth, which resulted in the development and promotion of specific forms of tourism (e.g., ecotourism, rural tourism, and recreational tourism) to the masses (Lane & Kastenholz, 2015; Prayag & Ryan, 2011). At this time, governments and policymakers were tinkering with the regulations and frameworks to promote environmental conservation and responsible usage of natural resources (Farsari et al., 2011). Small tourist operators and businesses benefitted from the increase in tourists and sometimes overlooked the harmful impacts of “over-tourism.” The positive effects of tourism on GDP and employment were empirically acknowledged, which further encouraged countries (including developing and third-world countries) to make significant investments to support industry growth (Goffi et al., 2019). However, uncontrolled growth has its own repercussions in terms of serious damage to environmental resources and resistance from native residents and communities (Rastegar & Ruhanen, 2022). The third period witnessed impressive growth in research involving multidisciplinary approaches. Concepts and theories from psychology and marketing were adopted to comprehend individual behavior, idiosyncrasies, service quality and perceptions, and attitudes toward sustainability (Chamarro et al., 2023; Moyle et al., 2020).

Furthermore, topic prevalence outcome reaffirms the growing research interest in individual behavior and the importance of technology to ensure sustainable behavior. Research avenues for macro, meso, and micro topics are documented in the discussion of future research avenues. There are, for example, substantial research opportunities in the domain of cutting-edge technology, individual and community behavior, the effects of online and offline media on sustainable tourism, and multidisciplinary research. Emerging technological advances can significantly improve supply chains and optimize transport networks to help reduce emissions and pollution levels (Denstadli & Veisten, 2020). The recent COVID-19 pandemic is now at the endemic stage, but it has profoundly impacted the tourism industry and tourists' behavior. Despite this minor setback, the future research discourse looks promising, especially with integrating technology into consumer behavior. Many mobile apps are now available, which allow people to check the sustainability of fashion brands and tourism before they buy (travel) (Balińska et al., 2021). Similarly, smart technologies (e.g., smart wearables) and smartphone apps provide a personalized schedule to help individuals reduce their carbon footprints and electricity consumption (Hoffmann et al., 2022). Industry and practitioners are experimenting with nudges and interventions to

change user habits to build a sustainable world. For example, Zomato, the largest food delivery app in India, has introduced “climate conscious delivery,” environment-friendly packaging, plastic neutral deliveries, and has made “no cutlery required” a default option, which helped Zomato to save 5000 kilos of plastic every day (Zee Business, 2021). We believe that our research can be a good starting point for scholars to continue producing significant, rigorous, exciting, and impactful research to enrich and progress diversified knowledge in the field of sustainable tourism.

6 | LIMITATIONS

The article contributes to the body of knowledge on sustainable tourism. However, it is not devoid of limitations. First, the research articles studied in the article were limited to the Scopus database. The researchers may explore other databases like Web of Science in combination with Scopus to draw results from more enriched data. Another drawback of the current article is that we have limited our analysis to keywords and abstracts of the articles. Though this is a standard practice in text mining-based reviews, it may lead to a restricted understanding of the existing research. We recommend that further research explore categorizing articles on aspects, such as geographical area, economy, and stages of development, amongst others. We suggest that future authors may explore approaches other than 3M approach to categorize the results and compare the findings with those resulting from our use of this approach. Since COVID-19 has disrupted and changed the strategies of many industries, future studies may also investigate if there is any paradigm shift in the sustainable tourism post-pandemic era, offering their readers a holistic pre and post-pandemic comparative perspective.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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