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A bibliometric-systematic review of digital transformation and circular economy in sustainable tourism across Asia

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ABSTRACT

Combining digital transformation and circular economy principles is increasingly vital to advancing sustainable tourism, especially within Asia's evolving economic and technological landscape. This study conducts a Bibliometric-Systematic Literature Review (B-SLR) of 101 peer-reviewed articles published between 2013 and 2024, focusing on the intersection of digital innovation and circular economy within the tourism sectors of key Asian countries, including China, Indonesia, South Korea, Thailand and Malaysia. The findings reveal substantial scholarly interest in technologies such as artificial intelligence (AI), blockchain and innovative tourism platforms. However, the review also exposes empirical gaps – particularly in real-world validation of digital solutions and the uneven application of circular economic principles across different governance contexts. China and South Korea have emerged as leading contributors to the research domain. Conversely, Southeast Asian nations demonstrate growing but fragmented scholarly output. This study introduces a new approach by combining bibliometric mapping and qualitative synthesis. This method provides a complete overview of both theoretical and practical developments. The results provide actionable insights for policymakers to align digital innovation with sustainability goals and guide industry practitioners in adopting regenerative and tech-enabled tourism strategies. These findings also highlight the need for more context-specific, empirical research across diverse Asian tourism ecosystems.

IMPACT STATEMENT

This study highlights how digital transformation and circular economy can jointly drive sustainable tourism in Asia, offering fresh insights for research, policy, and practice.

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Smart tourism; digital transformation; circular economy; sustainable tourism; artificial intelligence; blockchain in tourism

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Introduction

Asia has emerged as one of the most dynamic regions for global tourism, hosting diverse destinations such as China, Thailand, Indonesia, Malaysia, South Korea and the United Arab Emirates. These countries are known not only for their cultural richness and natural landscapes but also for increasing efforts to integrate innovative technologies into tourism ecosystems (Chang et al., 2022; Han & Ji, 2020; Liu et al., 2024; Sutarman et al., 2023).

The surge in digital tourism infrastructure, the adoption of smart city principles and the application of emerging technologies like artificial intelligence (AI), blockchain and the Internet of Things (IoT) have significantly shaped how tourism is developed, marketed and managed across Asia (Shafiee et al., 2019; Wang, 2024; Xiao et al., 2023). Simultaneously, sustainable tourism agendas are gaining prominence as policymakers and industry stakeholders face mounting pressures related to over-tourism, environmental degradation and socio-economic imbalances (Lu et al., 2021; Muthuswamy & Sharma, 2023).

Nevertheless, the application of circular economy models in Asia remains inconsistent and uneven. While countries like China and Japan demonstrate leadership in digital tourism innovation and green

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policy experimentation, others face significant barriers due to fragmented policy environments, economic disparities and infrastructural limitations (Amadu et al., 2025; Pranita et al., 2023; Sulistyadi et al., 2024). Real-world examples illustrate this divide: excessive plastic waste in Bali, unregulated tourist overcrowding in Thailand, and air pollution impacts in China underscore the sustainability crisis within Asia's tourism sector (Huang et al., 2017; M. Li et al., 2023). Despite innovative tourism pilot programs and green initiatives, the adoption of circular models is hindered by a lack of intergovernmental policy coherence and limited stakeholder coordination across sectors (Y. Zhang, 2023; M. Yang & Tang, 2025). Furthermore, although emerging technologies such as AI, blockchain and VR are increasingly discussed in academic literature, their empirical application to real-world tourism challenges remains underdeveloped (Erol et al., 2022; Chiwaridzo & Chiwaridzo, 2024). This tension between technological potential and operational implementation reflects a broader regional gap in aligning innovation with sustainability.

Previous studies have examined digital transformation or sustainable tourism independently, yet relatively few have explored their intersection, especially from the circular economy perspective (Louati et al., 2024; Sigala et al., 2024). In recent years, scholarly attention has grown to the role of AI in resource efficiency, blockchain for traceability and trust and IoT in environmental monitoring (X. Li, 2024; Gong & Chen, 2023; Rosa et al., 2024). However, this body of literature is often fragmented, lacks empirical validation and rarely incorporates comparative perspectives across diverse Asian contexts. Many contributions emphasize theoretical potential rather than practical adoption. This contribution will lead to a knowledge gap between conceptual frameworks and policy or industry implementation. The need for a more integrated, evidence-based understanding of how digital transformation and circular economic principles co-evolve in Asia's tourism sector remains critical.

This study adopts a Bibliometric-Systematic Literature Review (B-SLR) approach to address these gaps, combining quantitative bibliometric mapping with qualitative synthesis. This methodology allows for structured analysis of knowledge production in the mapping patterns, identifying emerging clusters and evaluating the thematic evolution of research over time (Marzi et al., 2024; Van Eck & Waltman, 2010). By focusing specifically on Asia, the study examines scholarly output related to sustainable tourism, digital innovation and circular economy across countries with varied levels of economic development, technological capacity and environmental policy maturity. Such a regional lens enables the identification of high-performing innovation hubs (e.g. China, South Korea) and underrepresented regions with growing relevance (e.g. Indonesia, Thailand, Malaysia).

The literature reviewed in this study spans multiple domains – smart tourism, green technology, digital governance and sustainability transitions. Within this corpus, the analysis identifies dominant themes such as AI-enabled predictive systems for waste reduction, blockchain's role in supply chain transparency and IoT applications in monitoring ecological footprints (Erol et al., 2022; Shen et al., 2020; Suanpang et al., 2022).

Nevertheless, despite the conceptual richness of the field, several limitations persist: a strong Western-centric bias in existing reviews, a lack of regionally grounded empirical studies in Asia, and minimal engagement with circular economy theory in tourism-specific contexts. Furthermore, few studies have systematically explored the multi-level interplay between technology adoption, institutional readiness and policy alignment in Asian countries. As a result, there is a need to clarify how existing research responds to the complex realities of tourism development and environmental governance in Asia.

This study aims to fill that void by conducting an integrative review of academic literature at the intersection of digital transformation, circular economy, and sustainable tourism within Asia. The primary objective is to uncover how these concepts have been studied collectively, what theoretical and methodological patterns emerge, and where the field still lacks empirical depth and regional nuance. By synthesizing trends across 101 peer-reviewed journal articles from 2013 to 2024, this research identifies the key countries, institutions, and authors contributing to this body of knowledge. It also explores how themes have shifted over time and which technologies are most prominently linked to sustainable tourism goals in the region. Most importantly, the study highlights gaps in empirical validation and proposes a future research agenda oriented toward practical, context-sensitive applications.

The novelty of this research lies in its methodological contribution using bibliometric mapping to quantify trends and systematic review to interpret findings and in its regional focus on Asia. Asia was also chosen due to a landscape marked by technological advancement and environmental urgency. This

study explicitly addresses how the convergence of digital tools and circular models can reshape sustainability outcomes in tourism, unlike prior reviews that often focus globally or on single technologies. The insights generated are intended for academics and policymakers, industry actors and development agencies seeking to implement data-driven, resilient, and inclusive strategies in the Asian tourism sector. Ultimately, the study bridges innovation theory and actionable sustainability practices, aligning technological potential with real-world environmental and socio-economic needs.

Methodology

This study employs a B-SLR approach to analyze the intersection of digital transformation, circular economy, and sustainable tourism in Asia. The B-SLR method integrates quantitative bibliometric techniques with qualitative systematic review strategies, offering breadth and depth in analyzing academic knowledge production (Marzi et al., 2024). Bibliometric analysis identifies the field's citation networks, thematic clusters, and intellectual structures. At the same time, the systematic literature review component allows for detailed synthesis and interpretation of key themes, theoretical gaps and methodological patterns (Waltman et al., 2010). This approach ensures understanding how digital innovation and circular economy principles are conceptualized and applied in tourism research. The following research questions guide the study:

1. What are the key research trends in digital transformation, circular economy, and sustainable tourism?
2. How has academic interest evolved in integrating digital transformation with circular economy principles in tourism?
3. What are the research gaps and future research directions in this domain?

The primary data for this study were collected from Scopus, a widely used academic database known for its comprehensive indexing of peer-reviewed journal articles and strong bibliometric capabilities (Baas et al., 2020). Scopus was selected because it can track publication trends, citation networks, and co-citation patterns, making it a reliable source for bibliometric analysis.

Primary data for this review were collected from the Scopus database, selected for its rigorous peer-reviewed coverage and advanced bibliometric tracking capabilities (Baas et al., 2020). The Scopus search was conducted in January 2025 using the following string to ensure reproducibility: (TITLE-ABS-KEY ('digital transformation' OR 'artificial intelligence' OR 'AI' OR 'Internet of Things' OR 'IoT' OR 'blockchain' OR 'cloud computing' OR 'big data' OR 'smart tourism' OR 'smart destinations' OR 'digital innovation') AND TITLE-ABS-KEY ('circular economy' OR 'waste reduction' OR 'resource efficiency' OR 'regenerative tourism' OR 'green tourism' OR 'low-carbon tourism' OR 'sustainable tourism' OR 'eco-certifications' OR 'sustainable development in tourism' OR 'sustainable hospitality' OR 'waste management') AND TITLE-ABS-KEY ('tourism' OR 'hospitality' OR 'hotel industry' OR 'travel industry' OR 'eco-tourism' OR 'sustainable tourism')) AND (LIMIT-TO (DOCTYPE, 'ar')) AND (LIMIT-TO (LANGUAGE, 'English')) AND PUBYEAR > 2009 AND PUBYEAR < 2025.

This search initially yielded 6483 documents. After applying thematic filters specific to tourism, publication type (journal articles), language (English) and geographical focus (Asia), the dataset was reduced to 101 documents. The document screening and selection process followed the PRISMA 2020 framework (Page et al., 2021), and the flow of article inclusion is detailed in Figure 1, Tables 1 and 2. This structured filtering ensured a transparent and replicable methodology for identifying the most relevant academic literature in the domain.

Bibliometric analysis was conducted using VOSviewer version 1.6.19, which allowed for keyword co-occurrence mapping, citation clustering and author collaboration networks. The clustering of documents was based on bibliographic coupling, and themes were identified using VOSviewer's built-in clustering algorithm. To ensure conceptual clarity and accuracy, these automatically generated clusters were reviewed manually and labeled based on a close reading of the titles and abstracts of the most central documents in each cluster. This manual validation step strengthened the interpretive rigor of the analysis. Additionally, the Bibliometrix R package version 4.1.0 was employed to calculate performance

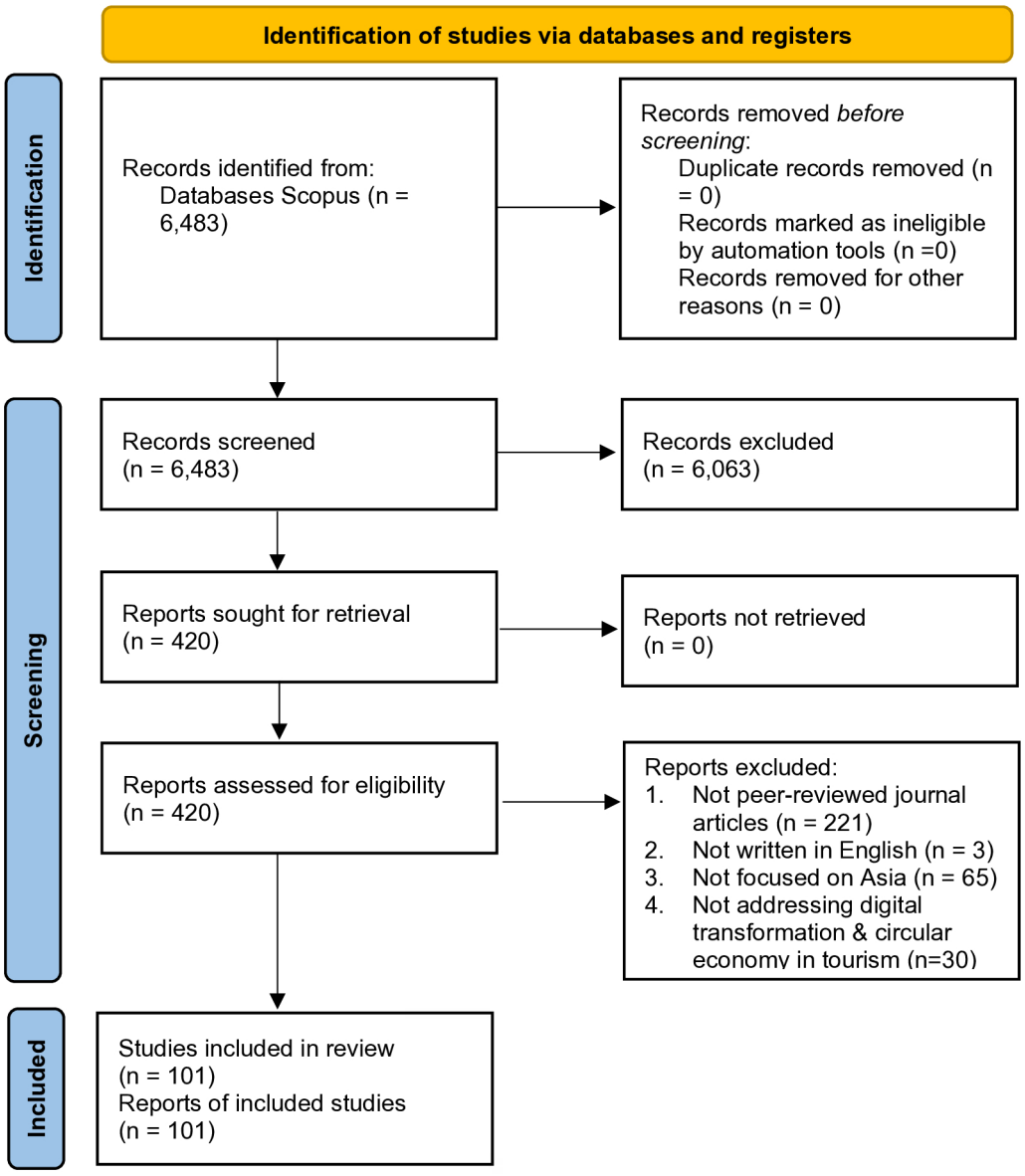

Figure 1. PRISMA flowchart.

Table 1. Inclusion and exclusion criteria.

Criteria	Details
Inclusion	1. Peer-reviewed journal articles published between 2010 and 2024.
	2. Articles written in English.
	3. Studies focused on digital transformation, circular economy and Asian sustainable tourism.
Exclusion	1. Conference papers, book chapters, editorials and gray literature.
	2. Articles that do not address the integration of digital transformation and circular economy in tourism.

metrics such as citation counts, country-level contributions, and thematic evolution over time (Aria & Cuccurullo, 2017).

Inter-rater reliability was assessed using Krippendorff's Alpha to ensure consistency in inclusion decisions during screening and thematic classification. Three researchers independently screened a sample of 30 documents, and the resulting Krippendorff's Alpha score was 0.82, indicating substantial agreement and high coding reliability (Hughes, 2021). This quantitative check ensures that individual bias is prevented.

While Scopus offers extensive journal coverage and reliable citation metrics, the exclusive use of a single database introduces limitations. Studies indexed only in Web of Science, Google Scholar or regional

Table 2. PRISMA flowchart – study selection process.

Phase	Step	Records (*n*)
Identification	Records identified from Scopus databases (digital transformation + circular economy)	6483
	Records identified from thematic filters (tourism)	420
	Records after applying year filter (<2025)	390
	Records after filtering article type (only journals)	169
	Records after filtering language (only English)	166
	Records after filtering by country (Asia only)	101
Screening	Records screened	166
	Records excluded (not relevant based on abstract/title)	61
	Reports sought for retrieval	101
	Reports not retrieved (full texts not accessible)	0
Eligibility	Reports assessed for eligibility	101
	Reports excluded (based on full-text analysis)	0
Included	Studies included in the final review	101

Source: modified from Page et al. 2021.

Table 3. Summary of bibliometric data.

Description	Results
Timespan	2013–2024
Documents	101
Annual growth rate (%)	38.86
Average citations per document	17.21
Document contents	
Keywords Plus (ID)	492
Author's keywords (DE)	436
Authors and collaboration	
Authors	375
Co-Authors per Document	3.89
DOCUMENT TYPES	
Article	101

databases such as the ASEAN Citation Index may have been overlooked. This index could also result in the underrepresentation of emerging research communities or gray literature that is less visible in global academic networks. Limiting the language to English is necessary for consistency but may exclude regionally significant publications in local languages, such as Chinese, Korean or Bahasa Indonesia. These limitations are acknowledged in generalizing findings beyond the scope of indexed and English-language academic discourse.

The data collection and analysis were designed to ensure transparency and replicability. Combining bibliometric and systematic techniques allowed for identifying research trends, mapping structures, and discovering underexplored areas. The B-SLR approach employed in this study thus offers a rigorous methodological foundation for advancing theory and informing policy in sustainable tourism in Asia.

Results

Asia's contribution to smart and sustainable tourism: bibliometric trends and research overview

Before diving into trends, Table 3 summarizes key bibliometric statistics from the dataset. The bibliometric analysis is based on 101 documents published between 2013 and 2024, focusing on digital transformation, circular economy, and sustainable tourism in selected Asian and Middle Eastern countries. The annual growth rate of 38.86% reflects the increasing academic interest in this field. Each document receives an average of 17.21 citations, indicating a moderate to high impact within the research community. The dataset includes 492 Keywords Plus (ID) and 436 Author Keywords (DE), showcasing diverse research topics.

The study involves contributions from 375 unique authors, with an average of 3.89 co-authors per paper, highlighting the collaborative nature of this research domain. All documents are peer-reviewed journal articles (101), ensuring high academic rigor. This data provides a strong foundation for analyzing publication trends, key contributors and thematic research directions in the following sections.

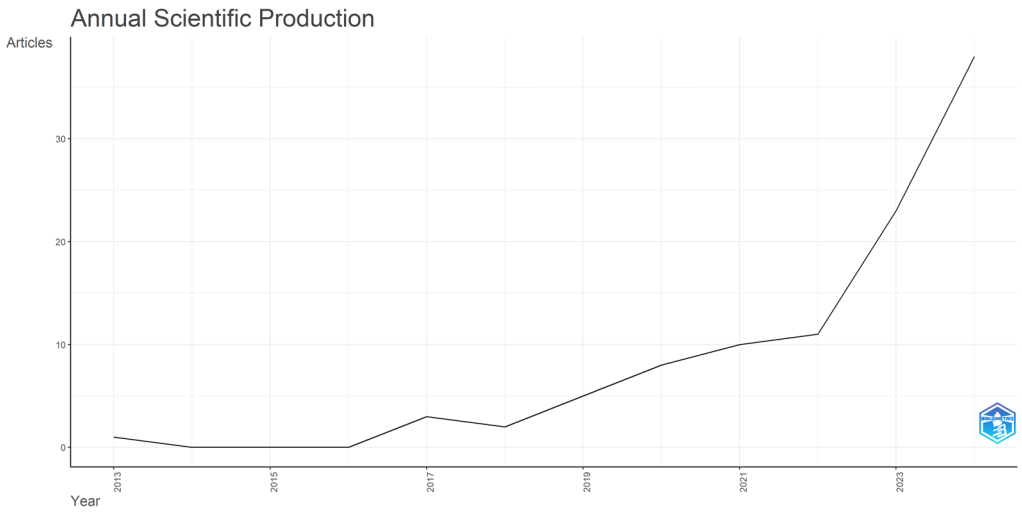

Figure 2. Annual scientific production graph.

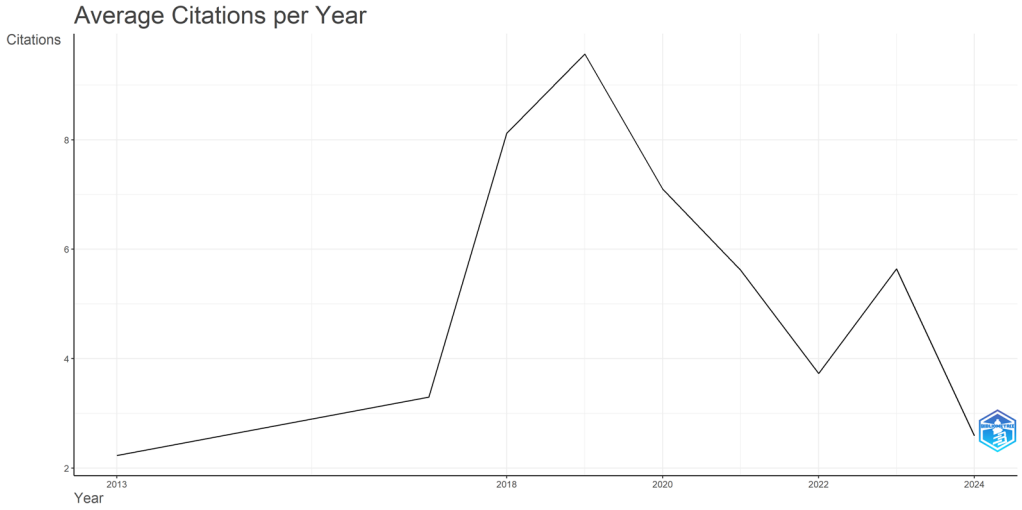

Figure 3. Average article citations per year.

Publication trends

The Annual Scientific Production Graph shows on digital transformation, circular economy and sustainable tourism show a markedly upward trajectory (Figure 2). After a solitary publication in 2013 and complete dormancy through 2016, interest gained traction with three papers in 2017, two in 2018, and five in 2019, the field then entered an acceleration phase, rising to eight publications in 2020, ten in 2021 and eleven in 2022 – momentum widely attributed to COVID-19–driven digital adoption and policy pushes for greener recovery; finally, a rapid expansion is evident as publications more than doubled to twenty-three in 2023 and surged to 38 in 2024, underscoring the mainstream integration of digital and circular-economy principles within tourism research and signaling robust prospects for continued growth.

Citation impact

The citation impact of research in digital transformation, circular economy, and sustainable tourism peaked between 2017 and 2019, as shown in the Average Article Citations per Year and Average Total Citations per Year graphs (Figure 3). Key studies from this period were famous, attracting significant academic attention. However, post-2020, despite increasing publications, citation rates declined slightly,

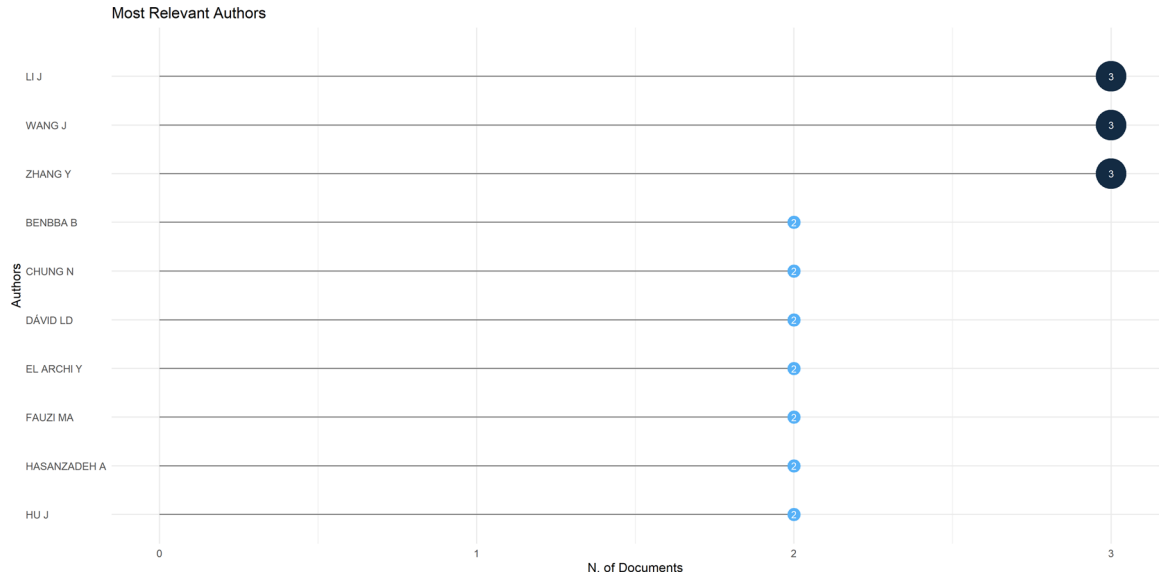

Figure 4. Most productive authors.

indicating that newer studies are still gaining recognition. This trend aligns with the natural citation cycle, where older studies accumulate more citations over time.

Geographic patterns and country-level insights

Most productive authors

The most productive authors analysis highlights key contributors in the field, with Zhang Y, Wang J and Li J leading in publication count (Figure 4). Other notable contributors, including Benbba B, Chung N and Hasanzadeh A, have also made significant contributions. While no single author dominates, multiple researchers with multiple publications suggest a diverse and collaborative research landscape in digital transformation, circular economy and sustainable tourism.

Main research themes and conceptual network

Keyword co-occurrence analysis

The co-occurrence network reveals three main thematic clusters (Figure 5). The red cluster centers on *sustainable tourism*, *sustainable development*, and *tourism*, which are strongly interconnected with digital technologies such as *big data*, *AI*, *machine learning* and *decision-making*, reflecting the integration of advanced analytics into sustainability strategies. The green cluster includes *smart tourism*, *ecotourism*, *tourist destinations*, *tourism economics* and *innovation*, emphasizing the role of smart destinations and policy instruments in achieving sustainability goals. Meanwhile, the blue cluster groups terms such as *tourism management*, *marketing*, *social media* and *the tourism industry*, focusing on the influence of digital communication and managerial practices in shaping sustainable tourism behavior. The dense links among clusters – particularly through the bridging terms *sustainable tourism* and *sustainable development*, underscore the interdisciplinary and integrative nature of this research domain.

Density visualization

The density visualization highlights the most intensively studied areas in the literature (Figure 6). The brightest spots – *sustainable tourism*, *sustainable development*, *tourism*, and *ecotourism* – represent core research concentrations. Moderate intensity around terms such as *smart tourism*, *tourist destination*, and AI indicates emerging yet increasingly relevant topics, while less intense areas like *machine learning* reflect newer, niche themes with future research potential. Overall, the map confirms that sustainability

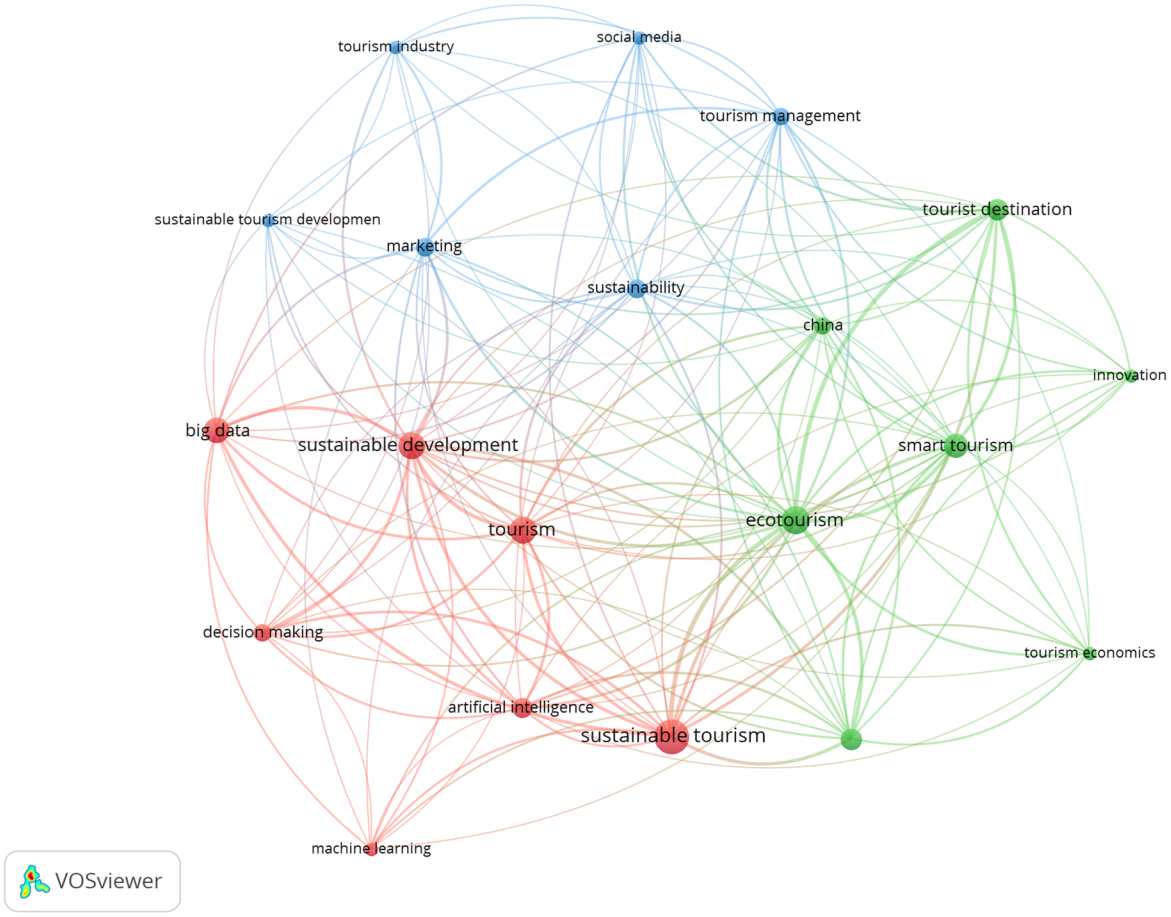

Figure 5. Co-occurrence network visualization.

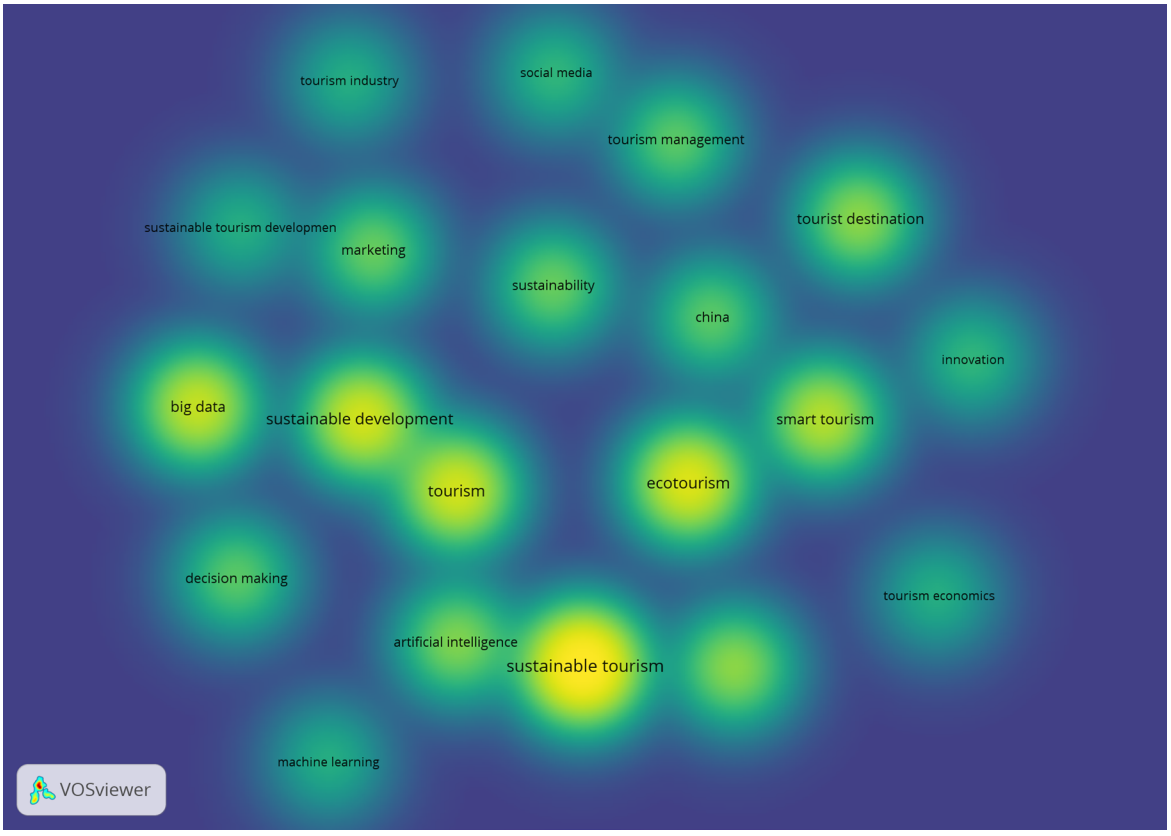

Figure 6. Co-occurrence density map.

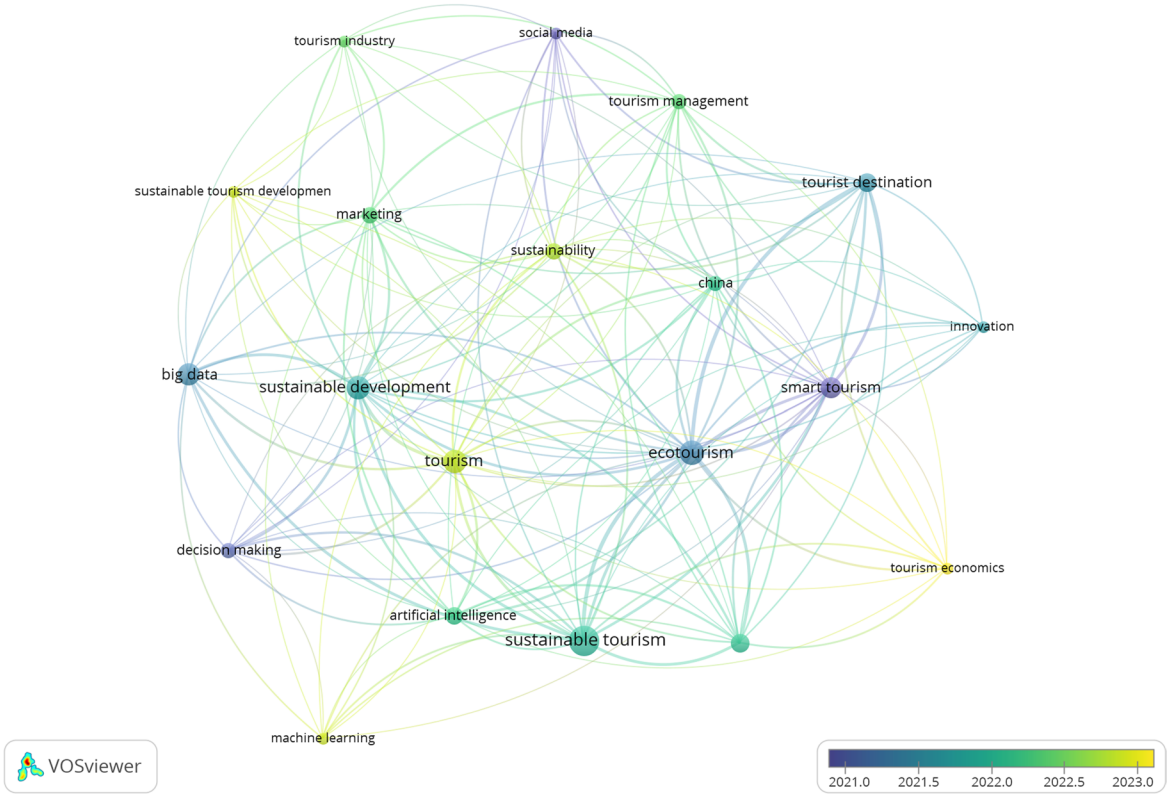

Figure 7. Co-occurrence overlay visualization.

and digital innovation are central pillars shaping the knowledge structure of contemporary tourism studies.

Thematic evolution and research progression

The overlay visualization illustrates the temporal evolution of research themes based on the average publication year (Figure 7). Earlier themes, such as *sustainability*, *decision-making* and *social media*, are depicted in darker blue tones (≈2021), indicating more established topics. In contrast, terms such as *machine learning*, *tourism economics*, *innovation*, and *smart tourism* appear in lighter yellow hues (≈2023), indicating more recent scholarly attention. This visual progression suggests a shift in thematic focus from general sustainability discourse to more data-driven, technology-enhanced tourism research, in line with the post-pandemic digital transformation observed in the field.

Word cloud representation

The word cloud highlights key research themes in sustainable tourism, ecotourism, and tourism development (Figure 8). Prominent keywords like 'sustainable development', 'ecotourism' and 'tourism destination' reflect core discussions. The technological shift is evident through terms like 'artificial intelligence', 'machine learning' and 'smart city', showing the role of digital transformation in tourism. The circular economy perspective appears from terms such as 'environmental protection' and 'economic development', indicating a focus on resource efficiency and sustainability.

Discussion

The findings of this study offer a multidimensional view of how digital transformation technologies – particularly AI, blockchain and IoT – are positioned within the academic discourse on sustainable tourism and circular economy. The bibliometric trends reveal a steady increase in scholarly interest, particularly after 2020. This post-pandemic surge reflects the accelerated adoption of digital solutions to address tourism disruption toward resilience and sustainability (Tang, 2024; Vu et al., 2022).

Figure 8. Word cloud representation.

The thematic analysis further illuminates technology integration with circular economic principles. AI, for instance, has become a cornerstone of smart tourism innovation. It supports energy-efficient operations and personalized services through machine learning and predictive analytics (Cheng et al., 2024; Stephenson & Dobson, 2020). These functions correspond with circular economic objectives such as resource efficiency, waste minimization and regenerative value creation. Nevertheless, Alsahafi et al. (2023) and Jiang et al. (2023) note that real-world validations are rare, indicating a gap between theoretical models and practical deployment.

Blockchain technology offers unique opportunities for enhancing traceability, transparency, trust and critical components of sustainable supply chains. Its potential to track carbon footprints and facilitate decentralized sustainability governance aligns directly with circular economy mechanisms focused on accountability and ethical sourcing (Erol et al., 2022; Pranita et al., 2023). The field lacks empirical evidence on scalability and effectiveness in varied Asian regions. Regulatory inconsistencies remain a significant barrier across developing tourism economies such as Vietnam, Malaysia and Indonesia. Comparative research examining policy frameworks and regional interoperability is essential for blockchain adoption in diverse governance environments (Jausmin et al., 2021; Omar et al., 2024).

The rise of smart cities and IoT-based tourism services also supports circular practices by enabling real-time monitoring of environmental indicators, such as water usage, waste output and carbon emissions (Nilashi et al., 2019; Sutarman et al., 2023). This data-driven infrastructure allows destinations to implement adaptive policies and promote efficient urban mobility – which is foundational to sustainable tourism development. Nevertheless, current literature pays little attention to integrating such data into actionable sustainability governance. Moreover, innovations like metaverse tourism and VR-enhanced experiences can potentially dematerialize travel, which could reduce physical tourism footprints (Suanpang et al., 2022). However, empirical exploration of their environmental benefits remains minimal.

A major contextual factor influencing these technological shifts is the post-pandemic digital transformation. As seen in the bibliometric trajectory, scholarly activity intensified during and after COVID-19, aligning with the global tourism sector's pivot to digital recovery strategies. Contactless technologies, AI-based safety protocols, and digital passports enabled continuity during lockdowns and transformed visitor expectations (Van et al., 2020; Wang, 2024).

Nevertheless, the long-term resilience potential of these innovations is understudied. There is a need to assess operational efficiency and how digital tools support systemic resilience – enabling tourism systems to respond to future health, environmental, or geopolitical shocks (Cloete & Ndlovu, 2023).

The discussion also surfaces important regional disparities. While China and South Korea lead in research volume and collaborative networks, thanks to robust digital infrastructure and policy alignment, other countries show fragmented scholarly output. For example, Indonesia and the Philippines contribute to growing but largely domestic-focused studies, reflecting challenges in research funding, policy coherence, and infrastructure readiness. These disparities reinforce the necessity of policy reforms, public-private partnerships, and digital capacity building to support smart tourism across Asia.

Table 4. Research gaps in digital transformation and sustainability within tourism.

Research gap	Existing findings	Future research direction
Lack of empirical validation in AI-driven tourism	AI-based recommendation systems and sentiment analysis are widely studied, but real-world applications are scarce (Rosa et al., 2024; Y. Zhang, 2023).	Conduct field experiments and case studies to validate AI applications.
Blockchain's potential in sustainable tourism is underexplored	Studies discuss blockchain's role in food waste reduction and financial transparency, but practical implementations are lacking (Erol et al., 2022; Muthuswamy & Sharma, 2023; Omar et al., 2024; Pranita et al., 2023).	Empirical research on blockchain adoption in tourism businesses.
Regulatory inconsistencies in smart tourism policies	Varying policy frameworks across Asia create barriers to implementing digital solutions (Shi et al., 2024; Shokri Garjan et al., 2023; M. Yang & Tang, 2025; W. Yang & Lin, 2022).	Comparative studies on best practices in smart tourism governance.

Research gaps and future directions

The bibliometric and thematic analysis reveals three key research gaps in digital transformation and sustainability within tourism (Table 4). While AI and blockchain are increasingly studied, empirical validation remains limited, with most research being conceptual. Additionally, regulatory inconsistencies hinder the large-scale implementation of innovative tourism solutions across Asian countries. Table 4 summarizes the primary research gaps and potential directions:

Conclusion

This study provides a comprehensive synthesis of how digital transformation intersects with circular economic principles in sustainable tourism across Asia. It identifies key research trends, conceptual shifts and critical gaps by employing a B-SLR of 101 peer-reviewed articles (2013–2024). The study's novelty lies in its dual-method approach – merging quantitative bibliometric mapping with thematic synthesis – to bridge conceptual understanding and real-world application. Unlike previous reviews, this research offers region-specific insights into how technologies, such as AI, blockchain and IoT are (and are not) being integrated into tourism sustainability frameworks.

The results highlight an accelerating discourse around smart tourism and digital sustainability, particularly in high-capacity innovation hubs like China, South Korea and Singapore. However, integration with circular economy principles remains fragmented, with limited empirical validation and weak policy harmonization. This underscores the urgent need for context-sensitive and scalable digital sustainability models.

Practically, the study offers targeted insights: policymakers must develop coherent regulatory frameworks and support public-private partnerships to scale innovation; industry practitioners can adopt AI and blockchain to optimize resource use and improve supply chain accountability; academics can build on this foundation to design evaluative and interventionist research.

Future research should prioritize three directions: (1) conduct pilot studies and field experiments validating AI and blockchain in tourism operations; (2) initiate comparative policy studies across Asian subregions; and (3) advance interdisciplinary research on how digital tools shape sustainability behavior and governance. Addressing these areas is essential to move from conceptual promise to measurable impact in technology-enabled sustainable tourism.

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Author contributions

CRediT: **Muhammad Fikry Aransyah**: Conceptualization, Investigation, Methodology, Visualization, Writing – original draft; **Bambang Hermanto**: Funding acquisition, Project administration, Supervision; **Anang Muftiadi**: Supervision, Validation, Writing – review & editing; **Hera Oktadiana**: Methodology, Supervision, Writing – review & editing.

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Data availability statement

The data supporting this study's findings are available from the corresponding author upon reasonable request.

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