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BIBLIOMETRIC AND CONTENT ANALYSIS OF GLOBAL TRENDS IN DIGITAL TRANSFORMATION AND RURAL TOURISM

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Abstract: This article comprehensively reviews recent advancements in digital transformation in rural tourism research. It analyzes prominent studies, key authors, and influential journals while identifying potential future research directions. From a bibliographic perspective, the study used data extracted from the Scopus database. Analytical methods, such as co-citation and co-occurrence keyword analyses, were employed to evaluate the content and assess research performance. These techniques revealed discernible patterns of international collaboration. Research on digital transformation in rural tourism has grown significantly since 2017, with the first papers published in Malaysia and China. The number of articles increased sharply in 2021–2023. China leads with nine papers, followed by Malaysia, Spain, Poland and the United States. During the analysis period, 36 journals published articles on digital transformation in rural tourism. Some journals that published only one article but received the most citations included Journal of Tourism Futures, Cogent Social Sciences and Environment, Development and Sustainability. With a minimum co-citation threshold of two, the paper identified a cluster with 31 prominent authors. The study identified five key clusters of digital transformation in rural tourism: (1)-Digital Folklore and Smart Travel Technology Before and After the Pandemic, examining shifts in traveller behaviour and folklore digitization driven by COVID-19 disruptions; (2)-Digital Technology Solutions Supporting Green and Sustainable Tourism Development, highlighting eco-friendly innovations enabled by digital tools; (3)-Applying Information Technology in Developing Community-Based Rural Tourism, exploring IT's role in empowering local communities; (4)-Digital Communications and Marketing for Rural Tourism, understanding the impact of digital marketing strategies on rural destinations; and (5)-Geographic Information System (GIS) and Scanning Technology in Rural Tourism, investigating the use of spatial and scanning technologies for rural tourism management. Researchers should consider incorporating data from additional databases, such as Web of Science (WOS), Dimensions, and PubMed, to enhance the depth and comprehensiveness of future studies. Expanding the scope of bibliographic analysis to emerging digitalization areas within tourism could further strengthen the field's relevance and scholarly value.

Keywords: digital transformation, rural tourism, bibliometric, content analysis

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INTRODUCTION

Digital transformation (DT) has become increasingly significant in academic research, catalyzing profound changes through integrating digital echnologies (Rêgo et al., 2022). DT primarily aims to improve organizational performance by strategically utilizing technologies, including social networking platforms, smartphones, and advanced analytics (Gusakov et al., 2020). Formulating robust DT strategies is essential for successfully navigating the transformation process and maintaining operational continuity business (Chamboko & Tembi, 2021). The ongoing evolution of digital technology has profoundly impacted various industries, including tourism, facilitating transformative changes in processes, mechanisms, and revenue models (Ancillai et al., 2023). Adopting new technologies is crucial for achieving objectives such as enhancing user satisfaction, reducing costs, improving efficiency, and increasing sales (Mattila et al., 2021).

Information and communication technologies (ICT) have significantly influenced the industry's communication strategies, strategic planning, financial management, market research, and pricing. The advent of smart tourism underscores the importance of leveraging real-time data to co-create value, driven by advancements in real-time consumer intelligence, artificial intelligence, and data analytics (Jingjing et al., 2018).

In the 1970s, 1980s, and 1990s, rural tourism (RT) emerged as a novel and distinctive option (OECD, 1994). RT helps protect the environment, promote local economic growth, reduce regional disparities, and encourage development in developing countries (Litheko & Potgieter, 2021). The United Nations World Tourism Organization (UNWTO) defines RT

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as a form of tourism activity where the visitor's experience is associated with a diverse array of products, typically connected to nature-based activities, agriculture, rural lifestyles, culture, angling, and sightseeing (UNWTO, 2021). Similarly, the Organisation for Economic Co-operation and Development (OECD) offers a widely accepted definition, describing RT as traditionally sustainable tourism intricately linked to the local economy, history, and environmental landscape. RT is characterized by experiences in rural settings, such as open spaces and interactions with nature and local communities. It encompasses small-scale physical activities within nature, typically in villages and towns. OECD research refers to settlements of less than 10,000 inhabitants, involving many private sectors, often micro-enterprises, owned by families. This has given rise to various niche types of RT, including wellness tourism, activity tourism (e.g., cycling, walking, climbing, skiing), and cultural and heritage tourism, such as food and wine tourism. RT is linked to sustainable tourism development, as RT is associated with environmentally friendly forms of tourism (Naidoo & Sharpley, 2016).

Researchers have observed that farmers increasingly use RT to enhance and diversify their income sources (Tew & Barbieri, 2012). The Eurobarometer survey on Europeans' attitudes to travel shows that COVID-19 has impacted European Union (EU) citizens' travel behaviour and demonstrates the importance of sustainable tourism services for the tourism industry's recovery. The survey shows that a majority of EU citizens (82%) are willing to change some of their habits, for example, consuming local products (55%), choosing eco-friendly transport (36%), paying more for the protection of the natural environment (35%) or travelling that benefits the local community (33%) (European Union, 11.2021b, 24).

Over the past decade, the substantial disparity in broadband internet connectivity between urban and rural areas has diminished. By 2021, 93% of households in metropolitan areas within the EU had broadband access, compared to 86% of households in rural regions. Thirty-one percent of respondents regularly utilize online platforms to search for accommodation, car rentals, and flights, while 19% book rooms and apartments through these platforms. Additionally, 24% of respondents use hotel or airline company websites to make bookings (European Union, 11.2021a, 13). The European Tourism Agenda 2030 designates tourism as one of the 14 industrial ecosystems targeted for acceleration through green and DT (European Union, 12.01.2022, 12-17). Stakeholder consultations have underscored inadequate transport links and limited digital connectivity as critical challenges hindering the progress of green and digital transitions in RT. These consultations also emphasized the necessity of tailoring actions and monitoring efforts to each region's specific characteristics. The EU has introduced a new tourism dashboard to assist national and regional policymakers formulate DT strategies and enhance tourism resilience (European Union, 12.01.2022, 12-17). Rural communities can also directly showcase their culture and heritage to prospective tourists via platforms like Facebook, Instagram, and Twitter, reducing reliance on traditional tourism intermediaries. In the digital age, digitalization enhances accessibility and reshapes conventional tourism models (Lim, 2023). This shift encourages a comprehensive approach, weaving sustainability and ethical responsibilities into business operations that align with the evolving values of global tourists and industry stakeholders. Recent studies on DT in tourism have also contributed to identifying modern technological trends and their potential applications in the tourism industry. Technologies such as artificial intelligence (AI), big data, and the Internet of Things (IoT) are being widely applied to enhance customer experience and optimize tourism destination management (Madzík et al., 2023). Through online travel platforms and digital technology, DT is changing how businesses and destinations communicate with customers, increasing convenience and efficiency in the booking and experience (Asif & Fazel, 2024). DT is essential in promoting sustainable tourism development and suggests that new technologies can help better manage tourism resources, minimizing environmental negative impacts (Bekele & Raj, 2024).

In addition, digital technologies have great potential in creating sustainable tourism destinations, helping to collect real-time data and analyze information to support decision-making (El Archi et al., 2023). Smart tourism, with the support of digital technology, helps to enhance the tourist experience and improve interactions between stakeholders in the tourism ecosystem (Kumar et al., 2023). Digital technologies such as virtual reality (VR) and augmented reality (AR) have opened up innovative possibilities for preserving and showcasing local culture. They enable visitors to experience destinations from afar, which helps conserve cultural sites and lessens the strain on local resources (Beck et al., 2019). Furthermore, highlighting cultural heritage as an essential element of RT through tourism education bolsters residents' cultural pride in implementing sustainable tourism practices, emphasising environmental responsibility and cultural preservation (Strickland & Ratten, 2024). Overall, these studies agree that DT not only creates development opportunities but also supports more sustainable and efficient tourism management and operation, especially in the context of rapidly developing technology.

Despite the achievements, recent research on DT still has some significant limitations, especially when considered in the specific context of RT. Most studies using bibliometric analysis focus mainly on DT in the tourism industry in general and have not delved into RT. Studies lack specific analysis of RT's context and challenges (Madzík et al., 2023). This leads to general conclusions that are difficult to apply to practice in rural areas with limited technical infrastructure and lower digital participation than in urban areas. The lack of focus on RT results in research findings that do not fully reflect the specificities of the field, such as the problems of limited internet connectivity and difficulties in accessing technology for rural residents (Asif & Fazel, 2024; Bekele & Raj, 2024; El Archi et al., 2023;Raman & Aashish, 2023).

The lack of research on the applicability of technology in rural destinations creates a significant gap in promoting sustainable tourism in these areas, not fully reflecting the unique nature and needs of rural communities in the DT process. Recently, bibliometric studies on DT and RT have highlighted major trends and suggested future research directions, but they still have many limitations. Some studies identified major topics but lacked detailed analysis of the relationships between issues and their development over time (Rauniyar et al., 2021), only considered articles in leading journals, which may have overlooked essential studies from regional or lesser-known journals (Saravanan & Rajan, 2024), and only used the Web of Science database, which limited the scope of the literature and overlooked studies in other databases such as Scopus or Google

Scholar (Răcăsan et al., 2023). These limitations suggest that current bibliometric studies on DT and RT need to expand the scope of databases, enhance the analysis of relationships between topics, and consider local contexts. This will help to draw more comprehensive conclusions and support the sustainable development of DT and RT in different contexts. The research gap concerning technology's applicability in rural destinations significantly hampers efforts to promote sustainable tourism in these areas. It fails to address rural communities' unique characteristics and needs within the DT process.

These limitations make it evident that bibliographic research on DT in RT must prioritize rural destinations' specific characteristics and challenges. This study addresses the limitations in bibliometric research on DT in RT by prioritizing rural destinations' unique characteristics and challenges. In addition, the study aims to conduct a comprehensive analysis at the global level, using diverse data sources to assess the feasibility of technologies in different contexts. Through bibliometric analysis, this study mines data from scientific publications to examine multiple aspects of DT in RT. By analyzing research articles, citation patterns, collaboration networks, and other bibliometric indicators, the study helps to clarify the intellectual structure and impact of DT on the field of RT. Furthermore, the study identifies critical topics, prominent researchers, leading institutions, and emerging trends in DT in RT. The results will provide valuable information to researchers, industry experts, and policymakers on DT's current status and future direction in the RT field. The article is organized into several sections. The initial section examines the interest in DT within RT. The subsequent section details the data, specifying the sources and methodologies employed in the research. The third section presents the findings and analyses the data, including thematic analysis to identify critical topics, leading authors, and the most influential contributors. The final section discusses the results, draws conclusions, and provides recommendations for future research.

METHODOLOGY

Review articles are widely recognized as valuable academic works for presenting the current state of knowledge in DT, RT, and related studies (Saravanan & Rajan, 2024), (Ayaviri-Nina et al., 2023), (Madzík et al., 2023) proposed a comprehensive framework for categorizing review articles, encompassing four key elements: search, evaluation, synthesis, and analysis. As suggested by them, systematic reviews play a crucial role in scientific exploration, as they not only enable a thorough investigation of relevant sources but also assist in identifying existing knowledge and uncovering research gaps within a specific field of study. Bibliometric analysis involves the application of statistical methods to examine the development of scientific disciplines by assessing publication performance, mapping the structure and dynamics of the field, and utilizing data obtained from various written publications such as books, journals, proceedings, and articles (Köseoglu et al., 2015). This study was conducted in two main phases: document selection and bibliographic analysis (Figure 1).

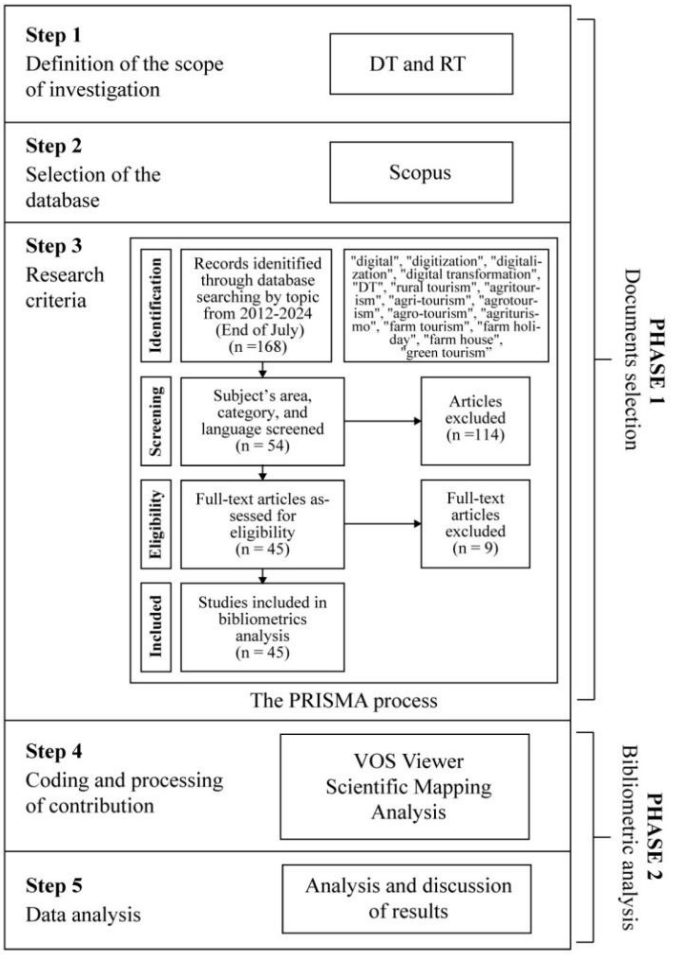

Figure 1. Research process developing the PRISMA diagram adapted from Moher et al. (2010)

In the first phase, there were three main steps: defining the scope of the investigation, selecting the database, and establishing research criteria. The first step was to define the scope of the study as the topic of DT and RT. The next step was to select the database as the primary source of documents. Information science and documentation advancements have generated numerous databases that users can easily access. However, it has been identified that these databases contain vast and fragmented amounts of information and scientific documents across various disciplines (Saravanan & Rajan, 2024).

Therefore, it is essential to utilize appropriate tools to manage data and facilitate the comparison and organization of research documents. To obtain bibliographic data, the authors chose to use the Scopus Database (Elsevier) as the primary source of information. This study selected Scopus as its primary data source due to its extensive and comprehensive coverage. Scopus is recognized as one of the two largest scientific indexing systems globally, encompassing a vast database that includes 57 million abstracts and nearly 22,000 journal titles from more than 5,000 publishers, with regular updates to ensure the inclusion of the latest research (Hallinger & Kovačević, 2019). Notably, Scopus has a broader scope in the social sciences and humanities than WoS, making it particularly valuable for research in DT with RT (Guz & Rushchitsky, 2009; Tabacaru, 2019; Pham et al., 2024). Furthermore, Scopus offers an array of advanced search functionalities that cater to various research needs, including document retrieval, citation analysis, and the evaluation of scientific impact (Falagas et al., 2008). Scopus's user-friendly interface and analytical tools facilitate efficient literature reviews and meta-analyses, making it a preferred choice for researchers conducting systematic reviews.

The third step of phase 1 is research criteria. To ensure a rigorous and systematic approach to the study, the authors followed a three-phase methodology aligned with the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines (Moher et al., 2010; Haddaway et al., 2022). PRISMA is a reputable framework initially utilized in the medical sciences. In recent years, scholars from various fields have increasingly favored its use for conducting systematic literature reviews (Bertoglio et al., 2021; Krittayaruangroj et al., 2023). PRISMA ensures transparency, replicability, and comprehensiveness in the research process (Moher et al., 2009). By adhering to PRISMA, the study protocol is designed to minimize bias, enhance methodological rigor, and provide a clear framework for synthesizing existing literature, contributing to the reliability and validity of the research findings (Page et al., 2021). We combined relevant search phrases for all articles in English, including in the title, abstract, and keywords: digital OR digitization OR digitalization OR digital transformation OR DT AND rural tourism OR agritourism OR agri-tourism OR agrotourism OR agro-tourism OR agriturismo OR farm tourism OR farm holiday OR farmhouse OR green tourism. The search query mentioned in previous studies (Verhoef et al., 2021; Rauniyar et al., 2021; Madzík et al., 2023; Roziqin et al., 2023).

The initial screening process revealed 168 documents obtained by searching the Scopus website on 15 July 2024. Scopus filters were used to screen the documents based on broad categories. The authors filtered the documents by discipline, selecting only disciplines such as ‘Social Sciences,’ ‘Business, Management and Accounting,’ ‘Environmental Science,’ ‘Agricultural and Biological Sciences,’ ‘Economics, Econometrics, and Finance,’ and ‘Decision Sciences.’The studies that did not fall under the category of 'article' were excluded from the analysis. Additionally, non-English articles were also excluded. To maintain consistency across data sources, the Scopus database allows data to be exported in a widely recognized format, namely the CSV format. The obtained data were managed using the guidelines outlined in the reference documents. After this action, the database was reduced to 54 articles. The titles and abstracts of the documents were reviewed to determine their relevance to the subject in the next step. Several articles were excluded due to their focus on topics such as agricultural supply chains, biodiversity conservation, drought solutions, and carbon transition without addressing the role of digital technologies in these issues (9 articles excluded). Therefore, the final database included 45 articles for the final review. To improve data accuracy, the authors performed data synchronization, following the instructions of Van Eck and Waltman (Van Eck & Waltman Ludo, 2013). Before analysis, the process of standardizing synonymous keywords, abbreviations, complete forms, plurals, and singulars such as promotion of RT/RT promotion, Covid-19 pandemic/Covid-19, Rural tourisms/ RT/Rural tourism, Digital artefacts/Digital artefact, GIS/Geographic Information System, Digitalisation/Digitalization was conducted. In the second phase, two main steps were coding and processing of contributions and data analysis. The first step in phase two is to encode and select software to process the data.

The study utilized VOSviewer software, a widely recognized tool for constructing and visualizing bibliometric networks (Van Eck & Waltman Ludo, 2013). VOSviewer enables the creation of detailed maps that depict the relationships among various elements, such as journals, authors, and individual studies, based on different types of bibliographic coupling, co-citation, or co-authorship relationships. The software's ability to visualize complex data networks makes it particularly useful for exploring the underlying structure of scientific research, as it provides transparent and interpretable maps that can highlight key areas of scholarly activity and collaboration (Jasn & Ludo, 2010).

Moreover, VOSviewer supports the analysis of large datasets and allows for the customization of maps according to specific analytical needs, enhancing the ability to interpret the data meaningfully (Van Eck & Waltman, 2017). This capability is crucial in the context of bibliometric studies, where understanding the intricate relationships between different scholarly outputs is essential for drawing accurate conclusions about the development and dynamics of research fields.

The second step in phase two is data analysis and discussion of research results. The data were analyzed using a three-stage methodology to understand the research landscape comprehensively. The first is a descriptive analysis, which systematically presents the necessary information about the 45 documents. This provides an overview of the data set, including publication year, authorship patterns, and journal distribution, providing the background context for subsequent analyses. This is followed by a general citation analysis, which identifies relationships between articles based on the frequency with which other works cite the two documents (Small, 1973). Co-citation analysis helps uncover the intellectual structure of a research field by identifying clusters of documents that are frequently co-cited, suggesting a thematic or

conceptual link between them. These clusters indicate core research areas, highlighting influential works and emerging trends. Finally, there is co-keyword analysis, a technique for quantifying how often specific keywords appear together across an entire dataset. Co-keyword analysis is instrumental in mapping the scientific structure of a research topic by identifying prominent themes and trends (Callon et al., 1983). The results of this analysis are visualized in the form of a co-keyword map, which illustrates the relationships between keywords. This provides insights into the interconnectedness of different research themes and identifies potential areas for future investigation.

RESULTS

1. Annual growth rate of publications and their distribution by countries

Figure 2 illustrates the research publication productivity on DT within the RT sector, highlighting a significant upward trend in recent years. The term "digital transformation" in 2012 has elevated its global importance, fundamentally altering business operations, product manufacturing processes, and marketing strategies.

Nonetheless, scholarly research on DT within the RT industry began to gain momentum only after 2017. However, academic research on DT in the RT industry only began to flourish after 2017, specifically the study titled '*Community Perceptions on the Usage of digital marketing for Homestays: The Case of Ba'kelalan, Malaysia*,' published in the International Journal of Business and Society (Cheuk et al., 2018) and the study titled '*Agricultural informatization: Research and design on the rural tourism recommendation system'* published in the International Agricultural Engineering Journal (Zhang & Yu, 2017). The volume of publications experienced a gradual rise, with a notable surge occurring in 2021–2022, during which ten papers were published. This upward trend persisted, culminating in 2023 with the publication of 14 research papers. Despite the relative novelty of the research area, the growing number of publications reflects an increasing scholarly interest in DT within the RT sector.

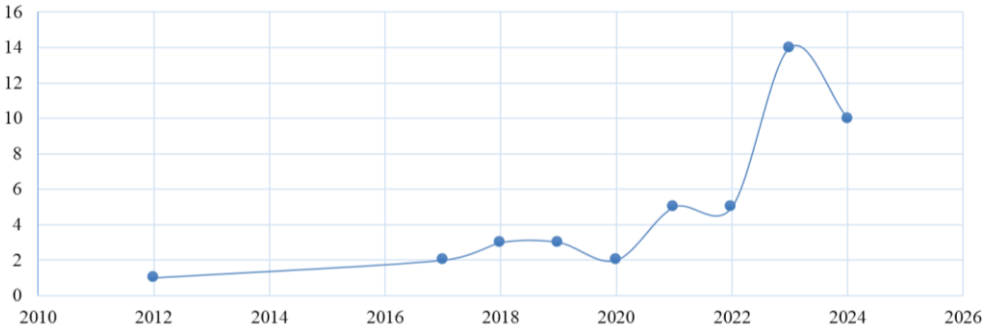

Figure 2. Number of publications by year during the period 2012 to 2024 of Scopus database to July 15, 2024

Figure 3 shows 34 countries actively publishing articles related to DT in RT. The map illustrates the collaboration between countries, with darker colors indicating higher publication frequency. The most significant number of authors and publications related to DT in RT originate from China, with nine articles. Other countries with prominent positions in terms of authors and publications include Malaysia (6 publications), followed by Spain (4 publications), Poland (4 publications), and the United States (3 publications). Among these countries, Malaysia exhibits the most substantial network, with 671 link strength. Notably, a country has conducted nine research studies, indicating significant opportunities for scholars from other nations to engage in this field. These observations underscore the necessity for further research on DT within the RT, with the potential for researchers from various countries to actively contribute to expanding the existing knowledge base.

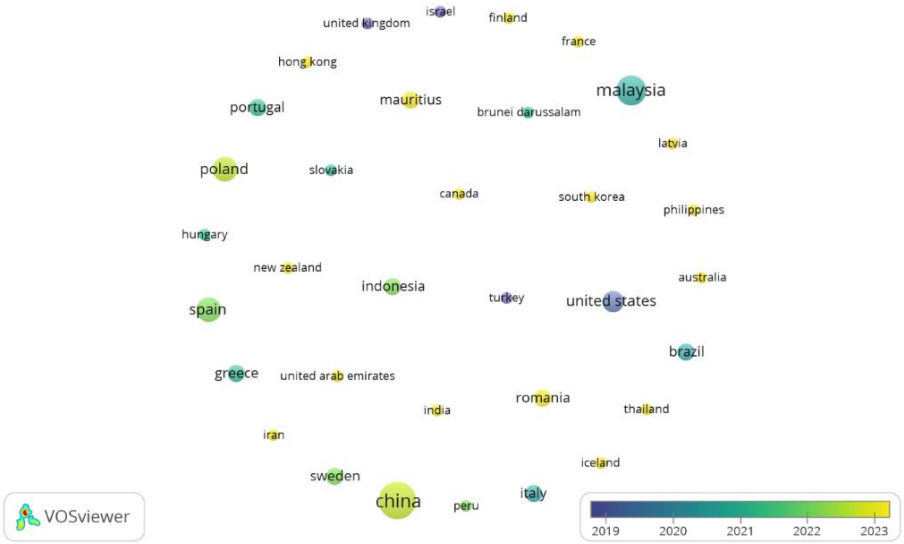

Figure 3. Distribution of scientific output by countries of Scopus database to July 15, 2024 (Source: Analysis using VOSViewer software)

The study used bibliographic coupling (countries) networks to investigate the collaborative relationships among authors from different nations. Based on a data set, Figure 4 presents the cross-collaboration patterns of 34 countries among researchers. Using VOS software and co-authorship analyses, 17 countries with three clusters were identified as closely connected. The first cluster includes scientific collaboration on DT in RT among Finland, France, Iran, Malaysia, New Zealand, South Korea, and Sweden. The second cluster comprises Brunei, Greece, Ireland, Romania, the United States, and Turkey. The third cluster involves India, Mauritius, and the United Arab Emirates. Notably, researchers from Malaysia, the United States, Mauritius, Sweden, India, France, New Zealand, and Finland demonstrated the highest levels of collaboration with international authors. This network may be attributed to the interest in RT activities and local policies promoting culture- and community-based activities in certain countries with similar characteristics. The node representing "Malaysia" exhibited the highest number of connections. Thicker lines between countries signify a substantial volume of collaborative publications. These findings are consistent with contemporary trends, emphasizing the concentration of research on DT in the RT sector and the high level of author collaboration in Malaysia. Besides, the results reveal a lack of research collaboration among scholars from Canada, Hong Kong, Israel, Latvia, the Philippines, and the United Kingdom.

Figure 4. Degree of scientific collaboration between countries of Scopus database to 15.07.2024 (Source: Analysis using VOSViewer software)

2. Network of authors and journals

The analysis utilized the Vosviewer software to explore content distribution across various sections of bibliographic information. Table 1 shows the top ten most-cited authors and articles related to DT in RT, the total number of citations of the top ten contributing authors for each publication, and their affiliations. The data indicate that Skinner Heather is the most influential author, with 122 citations, followed by Chin Wei Lee, Atun Resmiye Alpar, and Misso Rosa, with 41, 33, and 22 citations, respectively. The leading researchers are primarily affiliated with institutions in the UK, Brunei, Turkey, and Greece, suggesting that these countries have made substantial contributions to research on DT in the RT sector.

Table 1. List of the ten most-cited documents on DT in RT(Source: Table by the authors)

No	Authors	Article title	No of citations	Affiliation
1.	Skinner Heather et al., (2018)	Meeting the needs of the Millennials and Generation Z: gamification in tourism through geocaching	122	Manchester Metropolitan University Business School, United Kingdom
2.	Chin Wei Lee et al., (2021)	Agritourism resilience against Covid-19: Impacts and management strategies	41	Universiti Brunei Darussalam, Brunei
3.	Atun Resmiye Alpar et al., (2019)	Envisaging sustainable rural development through 'context-dependent tourism': case of northern Cyprus	33	Eastern Mediterranean University, Turkey
4.	Misso Rosa et al., (2018)	Sustainable development and green tourism: New practices for excellence in the digital era	22	Aristotle University of Thessaloniki, Greece
5.	Xabier Martínez-Rolán et al., (2019)	Instagram as a network for the promotion and hypermediation of rural tourism: The case of aldeias históricas	19	Universidade de Vigo, Spain
6.	Sorooshian Shahryar (2021)	Implementation of an expanded decision-making technique to comment on Sweden readiness for digital tourism	16	University of Gothenburg, Sweden
7.	Torabi Zabih-Allah et al., (2023)	On the post-pandemic travel boom: How capacity building and smart tourism technologies in rural areas can help - evidence from Iran	15	Tarbiat Modares University, Iran
8.	Mark Chris Lapuz (2023)	The role of local community empowerment in the digital transformation of rural tourism development in the Philippines	12	National University, Philippines
9.	Król Karol (2021)	Digital cultural heritage of rural tourism facilities in Poland	12	University of Agriculture in Krakow, Poland
10.	Król Karol and Hernik Józef (2022)	Digital Folklore of Rural Tourism in Poland	12	University of Agriculture in Krakow, Poland

The most-cited article corresponds to Skinner Heather, significantly contributing to the construction and discussion of gamification in tourism through Geocaching among Millennials and Generation Z (Skinner et al., 2018). Following this is the study by Chin Wei Lee, which addresses the resilience of RT in response to COVID-19 through its impact and management strategies (Chin & Pehin, 2021). Sorooshian Shahryar's work also focuses on Sweden's readiness for digital tourism using an expanded decision-making technique (Sorooshian, 2021). Another notable study by Lapuz Mark Chris M examines the role of empowering local communities in the process of DT in RT in the Philippines (Lapuz, 2023). These studies contribute to strengthening and expanding research opportunities on the applicability of DT in RT.

During the analysis period, 36 journals published articles on DT in RT, with Sustainability (Switzerland) leading with six articles, followed by Worldwide Hospitality and Tourism Themes with three articles, International Journal of Business

and Society with two articles, and Geojournal of Tourism and Geosites with two articles (Figure 5, Table 2). Journals that published only one article on DT in RT but received the most citations include the Journal of Tourism Futures (122 citations), Cogent Social Sciences (41 citations), and Environment, Development and Sustainability (33 citations).

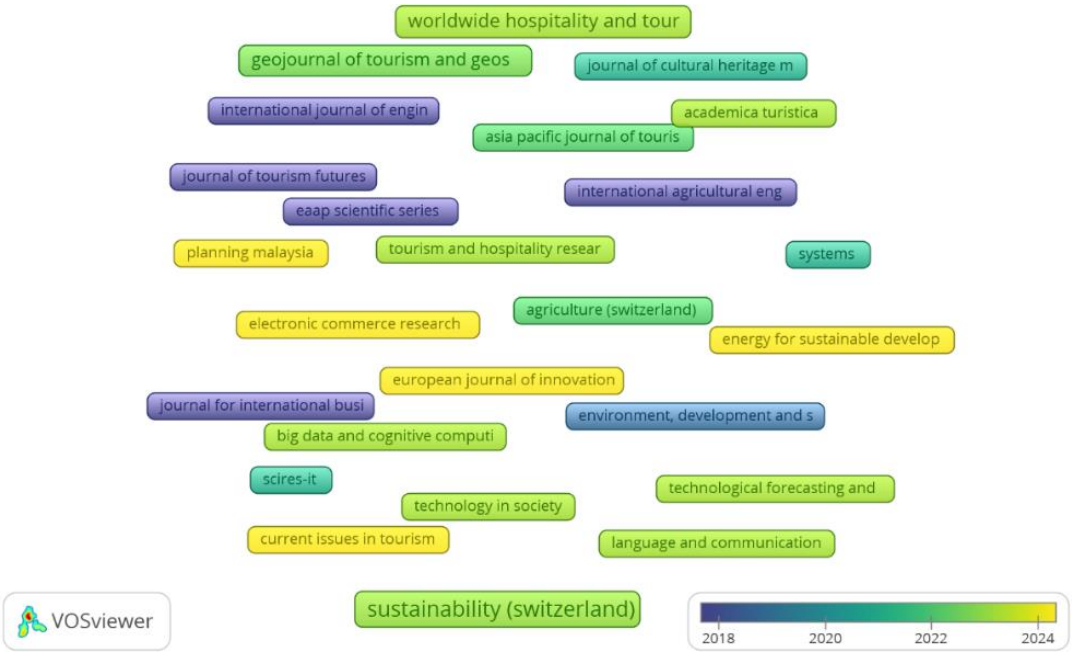

Figure 5. Journals publishing on DT in RT of Scopus database to July 15, 2024(Source: Analysis using VOSViewer software)

The United Kingdom leads with 15 journals with high Q1 and Q2 impact factors, Switzerland with five journals, the Netherlands with four journals, the United States with three journals, Malaysia with two journals, and the remaining countries such as Malaysia, Romania, Portugal, Italy, Slovenia, Spain, etc. have one journal.

Most journals publish topics related to DT, community-based tourism associated with sustainability, management, and action aspects of RT, helping to find the development perspectives of peoples and territories; some journals focus on publications in the fields of awareness, attitudes, management, and social sciences.

Table 2. Most influential journals, by number of articles and total citations (Source: Table by the authors)

Rank	Journal	No. of articles	Rank	Journal	Total citations	Average citations / document
1	Sustainability	6	1	Journal of Tourism Futures	122	122
2	Worldwide Hospitality and Tourism Themes	3	2	Cogent Social Sciences	41	41
3	Geojournal of Tourism and Geosites	2	3	Environment, Development and Sustainability	33	33
	International Journal of Business and Society	2	4	Sustainability (Switzerland)	28	4.67
4	Technology in Society	1	5	Journal for International Business and Entrepreneurship Development	22	22
	Journal for International Business and Entrepreneurship Development	1	6	Revista Latina de Comunicacion Social	19	19
	Systems	1	7	Worldwide Hospitality and Tourism Themes	18	6.0
	Cogent Social Sciences	1	8	Systems	16	16
	Revista Latina de Comunicacion Social	1	9	Technological Forecasting and Social Change	15	15
	Journal of Cultural Heritage Management and Sustainable Development	1	10	Technology in Society	12	12
	Environment, Development and Sustainability	1		Journal of Cultural Heritage Management and Sustainable Development	12	12
	Technological Forecasting and Social Change	1	11	Agriculture (Switzerland)	11	11
	Journal of Tourism Futures	1	12	Journal of Agriculture, Food Systems, and Community Development	10	10
	Journal of Agriculture, Food Systems, and Community Development	1	13	Asia Pacific Journal of Tourism Research	8	8
	Agriculture (Switzerland)	1	14	Geojournal of Tourism and Geosites	7	3.5
	International Agricultural Engineering Journal	1	15	International Agricultural Engineering Journal	6	6

3. Co-Citation Analysis

Co-citation analysis measures the similarity between documents based on their citation relationships. It allows scholars to explore the core interests of a particular field (Kessler, 1963). A high co-citation threshold may exclude emerging research topics that have not yet received sufficient citations, risking the omission of valuable studies (Trujillo & Long, 2018). Therefore, the authors set the minimum co-citation threshold at 2. We identified one cluster and 31 authors. Figure 6 shows a single red cluster. The most frequently cited authors in studies on DT in RT are (Kotler & Haider, 1993), Sharpley (2002), (Luo et al., 2004; Clarke, 2005; Greaves & Skinner, 2010; Garren, 2012), (Andreopoulou et al., 2008), (Lo et al., 2012), (Zhou et al., 2017), (Gao & Wu, 2017). The most frequently cited study on RT is by Richard Sharpley (2002). The study suggests that RT is a means to achieve economic and social development, explores the role of RT, highlights the challenges, and identifies several issues that hinder the success of RT (Sharpley, 2002).

Abby Liu's study, focusing on rural capacity to absorb tourism (Liu, 2006), advocates for the development of RT and emphasizes the involvement of rural communities in tourism. Stakeholders' perspectives, tourism planning authorities, community expectations, and their feedback in addressing tourism concerns are all considered. The study also indicates that insensitivity to cultural and ethnic differences between hosts and tourists hinders local participation. Nicola Greaves (2010) explores a destination's image and underlying factors that deter tourists. Respondents provided a range of words and images that reflect their perceptions of the destination (Greaves & Skinner, 2010). Additionally, May-Chiun Lo's findings indicate that the tourism industry has had a significant impact on the cultural aspects of the local community (Lo et al., 2012).

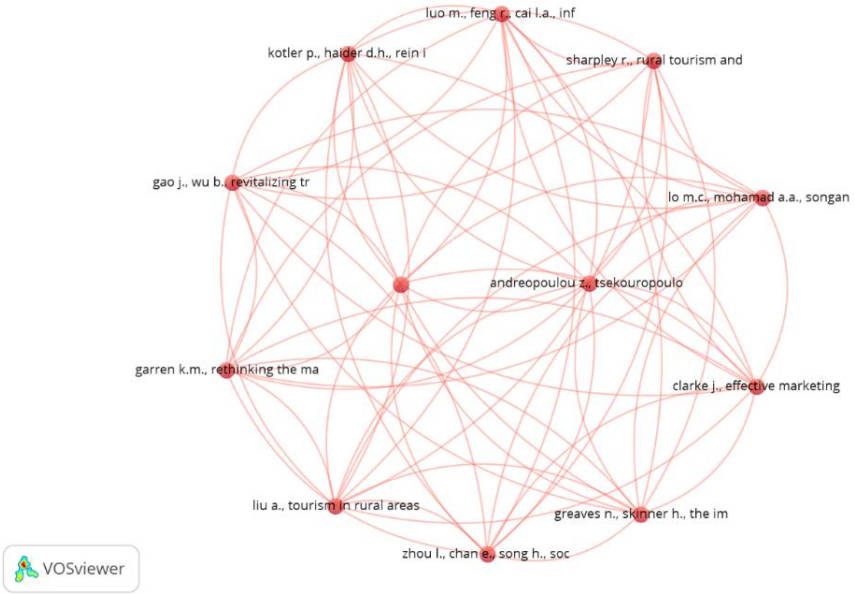

Figure 6. The co-citation of DT in RT research of Scopus database to July 15, 2024 (Source: Analysis using VOS Viewer software)

The application of IT and digital solutions for RT is cited in studies by Man Luo (2004) and Andreopoulou (2008, 2013). Based on consumer behaviour theory, Man Luo's research emphasizes the role of the Internet, examining the relationship between tourists' use of the Internet and other information sources. The study also found that demographic characteristics such as gender, income, trip purpose, and type of tourism are related to tourists' choice of information sources, influencing their accommodation and spending levels during the trip.

According to Andreopoulou's studies, creating online virtual markets unrestricted by time and space is a revolutionary concept in the agricultural sector (Andreopoulou et al., 2008). Andreopoulou's research also revolves around ICT, Internet marketing, online innovation for sustainable development, and RT. The study addresses environmental concerns, focusing on green IT, supporting the construction and improvement of the natural environment and resource monitoring systems as a means to protect and restore the potential of natural ecosystems (forests, lakes, rivers, wetlands, etc.), improving infrastructure and communication technologies, including GIS technology. Forests and agricultural lands are also assessed in the studies as crucial in mitigating climate change through carbon storage and the exchange of greenhouse gases between the atmosphere, soil, and vegetation (Andreopoulou, 2013).

Studies on digital folklore cite the works (Zhou et al., 2017; Gao & Wu, 2017). In the early stages, tourism destinations often seek external funding for establishment and investment at various levels. Therefore, the movement of businesses at these destinations is an important phenomenon that needs to be explored theoretically and empirically. Lingxu Zhou's (2017) research uses early-stage destinations in rural China to explore the experiences in tourism development, such as institutional support, community openness, and personal social networks (Zhou et al., 2017). Following Lingxu Zhou's research, Gao Jing highlights the growing attention paid to traditional villages with historical and cultural significance in China. RT has also been recognized as essential to rural development and poverty alleviation. Through a systematic literature review, the research proposes an RT-based Traditional Village Revitalization model better to understand the relationship between RT and village revitalization. Integrated Rural Tourism and Sustainable Livelihood theory and ideology are integrated in the research (Gao and Wu, 2017). Farmer cooperatives are

identified as a means of equitable benefit distribution and community participation. Cohesion, endogeneity, empowerment, and trust are the critical factors in the village revitalization process mentioned in the studies.

Studies on Digital Communication and Marketing for RT cite the works of (Kotler & Haider, 1993; Clarke, 2005), and (Garren, 2012). Philip Kotler argues that the key to place marketing lies in investing in infrastructure, creating a skilled workforce, stimulating entrepreneurial spirit, expanding local businesses, developing public-private partnerships, identifying and attracting compatible businesses, creating unique attractions, fostering a service-friendly culture, and effectively leveraging advantages (Kotler & Haider, 1993).

Philip Kotler also discusses place marketing strategy as a framework for economic development during the 1990s and beyond. The study mentions 'place buyers,' which includes tourists, new residents, factories, corporate headquarters, and investors, and 'place sellers,' which include economic development agencies, tourism promotion agencies, and mayoral offices. According to Clarke, marketing for RT exists at various destination levels, from national to regional to local (Clarke, 2005). Clarke also suggests that RT destinations can design a portfolio of attractions categorized as 'seeing,' 'buying,' and 'being/doing' from the perspective of leisure consumers. 'Seeing' includes fixed attractions such as castles, historic houses and gardens, museums, religious buildings, railways, and festivals.

This type's motto for communication and promotion is 'Look, see, and think.' 'Buying' refers to attractions that offer goods such as souvenirs (low-value, mass-produced, large quantity, low profit), crafts (high-value, skill-intensive, limited quantity, high-profit margin), and food and beverages. 'Being/doing' attractions involve activities centered around skill acquisition and personal interests, attracting tourists for self-development, such as cave exploration, forest hiking, horseback riding, hot air ballooning, gliding, and participating in wellness activities.

These activities may stem from local identity or may be unrelated but benefit from the rural location and environment. These attractions' divisions are based on leisure purposes, domestic/international tourists, first-time or repeat visitors, and peak or off-peak seasons (Clarke, 2005). Garren Karoline distinguished between traditional marketing and destination marketing concerning rural areas by analyzing the challenges in destination marketing. She introduced a rural destination marketing model that integrates marketing activities, assets, destination characteristics, target market selection criteria, and destination branding to create a user-friendly model (Garren, 2012).

4. Co-occurrence keyword (content analysis)

This study segment utilized content analysis alongside VoSviewer software to analyze 45 articles. The authors selected all keywords that appeared at least twice, including both columns, the Author keyword, and the Index keyword. The results showed that 39 keywords were divided into 5 clusters. Figure 7 illustrates the network diagram representing the co-occurrence of keywords. This analysis provides significant insights into the relationships and development of the keywords under investigation.

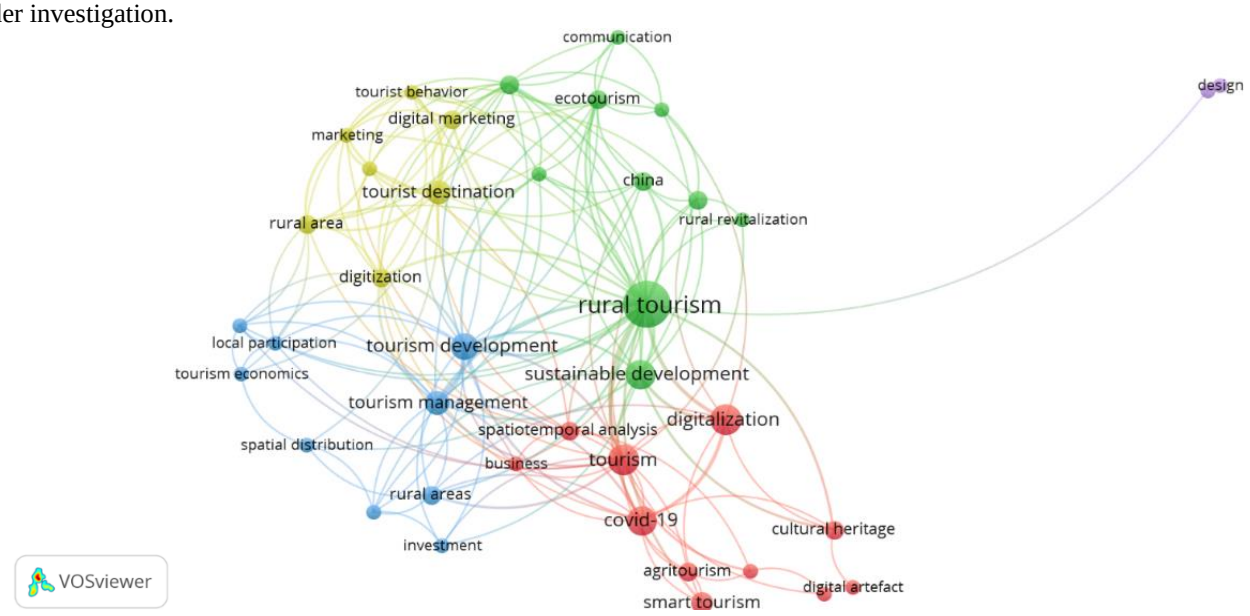

Figure 7. DT in RT research co-keyword network of Scopus database to July 15, 2024(Source: Analysis using VOSViewer software)

Cluster 1 (red) with 11 keywords. The keywords are smart tourism, COVID-19, digitalization, digital folklore, digital cultural heritage, digital artifact, and cultural heritage. This cluster was designated '*Digital Folklore and Smart Travel Technology Before and After the Pandemic.'* The prominent research in the cluster is on digital culture (material and intangible culture). The authors argue that analyzing the essential attributes of a website or its cultural content can be considered digital cultural assets (Król & Hernik, 2022; Król, 2021). Scholars often evaluate the presence of ready-made digital recordings and rustic folklore. These are usually found on the websites of RT farms in local communities of ethnic groups (Król & Zdonek, 2022). Another research direction highlighted in this cluster is the digital tools used for payment and customer communication by RT service providers (Auzina et al., 2023), destination recovery strategies through the combination of direct and digital marketing to attract tourists (Muangasame & Tan, 2023) and the role of using innovative

tourism technology in developing countries. Studies have explored the development of intelligent technology during the pandemic and its impact on post-pandemic RT development (Torabi et al., 2023). The main research methods of cluster 1 were face-to-face interviews with a snow-balling technique (Torabi et al., 2023), participatory action research (PAR) of tourism stakeholders, community-based digitalization strategies in all stages of planning, development, implementation, and management of rural cultural heritage tourism products (Muangasame & Tan, 2023). A qualitative research method also mentioned in the studies of this cluster is the netnographic analysis of tourism enterprises' social media pages. The Netnography method was initiated by Kozinets and accepted by many qualitative researchers as a branch of the ethnographic approach (Kozinets, 2015). The main advantage of the Netnography approach is that consumers can voluntarily disclose information, including sensitive information (Muangasame & Tan, 2023). The uniqueness of the studies in this cluster is the application of a locally participatory approach to developing a collaborative strategy for community heritage management based on rural capacity building towards digitalization and empowerment.

Cluster 2 (green) has ten main keywords: rural tourism, sustainable development, sustainability, rural revitalization, green tourism, ecotourism, communication, information, and communication technology, China. Based on these keywords, this cluster was titled '*Digital Technology Solutions Support Green and Sustainable Tourism Development*.' Studies in cluster 2 consider the classification of tourism approaches to assess sustainable tourism diversification. The articles in this cluster are divided into three groups: (1) green and sustainable tourism, (2) solutions to support RT service providers, and (3) application of new technologies (Qin et al., 2022; Lapuz, 2023; Singh et al., 2023). Studies have addressed the seasonal characteristics of RT, tourist characteristics, geospatial distribution, RT return rates, and IT systems for RT, including interaction, visibility, information collection, and log processing, emphasizing personalization capabilities to help users make quick and accurate choices. Research results also show that digital technology can promote RT by minimizing business difficulties and risks, enhancing RT resilience. Activities such as digital payments, online booking systems, social media marketing, and virtual reality tours significantly and positively promote tourism industry sales and enhance internal management (Singh et al., 2023). By participating in the DT in the RT process, residents are empowered based on their characteristics (Lapuz, 2023), reducing 'scale discrimination' and supporting 'low education level bias.'

DT thereby supports small-scale businesses and increases resilience in the industry (Zhong et al., 2024). Research in this cluster mainly uses theories such as the stakeholder engagement theory (Lapuz, 2023), treatment effect model (TEM) (Zhong et al., 2024), digital footprint data of visitors with spatial characteristics, and spatial development model of RT (Qin et al., 2022). Cluster studies use qualitative research methods such as semi-structured interviews, descriptive statistics, inference (Lapuz, 2023), and quantitative research methods using big data (Yang et al., 2024).

Cluster 3 (blue) has nine main keywords: digital storage, investment, local participation, rural areas, spatial distribution, stakeholder, tourism development, tourism economics, and tourism management. We labeled this cluster *'Applying Information Technology in Developing Community-based RT (CBRT).*' Studies concluded that the COVID-19 pandemic has enhanced and accelerated digital tools and ICT use in several sectors, including tourism. However, the use of information technology in CBRT is still relatively new. Studies in this cluster consider CBRT as a driving force for rural development through job creation, heritage preservation, and local community participation (Maquera et al., 2022). The papers in this cluster present the conceptual development model of intelligent digital platform (IDP) (Maquera et al., 2022), the scale of rural accommodation establishments on the two most popular digital booking platforms, Booking.com and Airbnb (Bumbak, 2024), and the development possibilities based on business process management and business model canvas (Maquera et al., 2022). The research results of the third cluster also demonstrate the popularity of the sustainability theory of energy in the tourism supply chain (Chiwaridzo, 2024). From there, the success factors are described: (1) value creation, (2) value delivery, (3) value capture dimensions, (4) promoting and enhancing DT operations, (5) appropriate platform architecture and strategic assessment of platform providers, and (6) startup culture (Zhao et al., 2021). The results also confirm that digital product differentiation and stakeholder collaboration are key factors (Fernandez-Villaran et al., 2024).

Some of the countries mentioned in this cluster are Peru (Maquera et al., 2022), Romani (Bumbak, 2024), and Canada (Neumann & Mason, 2023). The research methods used are empirical mapping of the spatial and temporal distribution of lists from the region (Bumbak, 2024) and semi-structured interviews with industry stakeholders (Neumann & Mason, 2023).

Cluster 4 (yellow) has seven main keywords: digital marketing, digitization, marketing, rural area, tourism market, tourist behaviour, and tourist destination. Based on these keywords, this cluster was designated *'Digital Communications and Marketing for RT*.' Studies in this cluster analyze the tourism industry DT process (Alonso et al., 2024), digital media marketing and virtual tourism (Li et al., 2024), and tourist purchasing behaviour. Idyllic life destination image greatly influences tourists' choice of rural destinations (Li et al., 2024). RT has been shown to benefit local communities from an economic perspective. Digital marketing allows tourists to access destination information effectively, at low cost, without intermediaries (Cheuk et al., 2018). Studies in this cluster have also explored both the supply and demand aspects of RT, proposing regression models that combine indicators related to digital advancement with changes and characteristics of low-density areas (Alonso et al., 2024). Studies have also examined barriers to digital marketing adoption from the perspective of RT service providers (Cheuk et al., 2018). Physical, logistical, and social constraints can negatively impact community readiness, hindering the adoption of digital marketing at the individual and destination levels.

Findings show that marketing and promotion activities have emphasized strengthening the local business environment and cultivating close relationships with stakeholders (Abdul Rahman et al., 2024). Theories mentioned in this cluster include sensory marketing theory (Li et al., 2024), a new conceptual model based on Delone and McLean's Information Systems Success Model (Rodrigues et al., 2023). Research methods used include a discourse analysis of Chinese newspapers and WeChat articles (Li et al., 2024), in-depth interviews (Cheuk Sharon et al., 2018), mixed

methods (Abdul Rahman et al., 2024) collecting opinions of local operators, expert opinions and proposed artifacts of potential suitability of items (Rodrigues et al., 2023). Several regions were evaluated in the cluster, such as the European Union (Alonso et al., 2024), Greece (Papadaki, 2024), Malaysia (Cheuk Sharon et al., 2018; Abdul Rahman et al., 2024). For example, Malaysia's Perak Tengah district applied Virtual Reality Geographical Information System (VRGIS) in developing its tourism roadmap, also known as 'Peta Pelancongan,' to encourage communication and data exchange, which are essential for the success of the area (Abdul Rahman et al., 2024).

Cluster 5 (purple) has two keywords: design and geographic information system (gis). Therefore, we labeled this cluster '*Geographic Information System and Scanning Technology in RT*.' The research in this cluster investigates scanning technologies and digital photogrammetry with the help of drones in RT to expand agricultural production capacity (Călina et al., 2022). This cluster includes studies conducted in various locations, such as the south-central region of Romania (Călina et al., 2022), tourist boarding houses in Mălaia, and fiber farmers in New York (Trejo et al., 2020). The theoretical framework employed in this cluster includes the Actor-Network Theory and the cartography of controversies method (Trejo et al., 2020). These theoretical approaches help to analyze the interplay between various actors and technologies within the research context. The cluster emphasizes practical methodologies for integrating technology into digital land navigation and tracking farms. This is achieved through the scanning or digitizing of maps—physical, printed, or digital—using photogrammetric techniques and aerial field scanning of the target areas (Călina et al., 2022). By leveraging these advanced technologies, researchers aim to improve the efficiency and accuracy of agricultural production and resource management in RT.

DISCUSSION AND CONCLUSION

1. Conclusion

In summary, this study thoroughly examines research on DT within the RT sector over the past twelve years. Although the volume of research papers and the number of researchers in the DT in RT has grown in recent years, it still needs to be bigger than other management studies. Therefore, we have presented a bibliometric analysis of the content of DT in RT to fill the gap and analyze the prominent research clusters in this field. A database of 45 articles from Scopus shows that the first study on DT in RT was published in 2012. The descriptive analysis indicates a growing emphasis on DT within the RT industry, particularly since 2017. The most significant number of articles is in 2023, with 13 articles; the first half-year data of 2024 (up to July 15) is ten. There are 34 countries actively publishing articles related to DT in RT, of which China, Malaysia, Spain, Poland, and the United States are the countries with the most prominent numbers. The most influential study identified in this analysis is "Meeting the Needs of Millennials and Generation Z: Gamification in Tourism through Geocaching" by Skinner Heather (2018), underscoring its importance in the literature. Influential authors such as Chin Wei Lee, Atun Resmiye Alpar, and Misso Rosa and reputable journals such as the *Journal of Tourism Futures* and *Cogent Social Sciences* emerged from the analysis, highlighting their significant contributions to the field.

With a minimum co-citation threshold of 2, our study yielded a single cluster with 31 authors. The researchers' performance assessment revealed that Andreupoulou was the most cited author in the field of DT in RT. Emerging research clusters in the DT in RT literature were manually but thoroughly identified. The study also emphasizes the predominant keywords in the research, including "rural tourism," "tourism development," "digital marketing," "digitalization," "smart tourism," "digital artefact," and "sustainable development." These keywords represent the core themes and issues explored in the literature, highlighting DT's significance for sustainable development and its economic and social impacts on the RT sector. With co-occurrence keyword and content analysis, the results showed that there were 39 keywords divided into five clusters: (1)-Digital Folklore and Smart Travel Technology Before and After the Pandemic, (2)- Digital Technology Solutions Support Green and Sustainable Tourism Development, (3)-Applying Information Technology in Developing Community-based Rural Tourism, (4)-Digital Communications and Marketing for Rural Tourism, (5)-Geographic Information System and Scanning Technology in Rural Tourism. Older studies have garnered more citations, suggesting a scarcity of recent literature in this domain. Numerous studies exhibit similarities in experimental areas, models, methodologies, and findings, underscoring the necessity for additional research to fill existing gaps and investigate new dimensions of DT in RT.

2. Theoretical implications

The article's findings show some crucial theoretical significance for the process of DT in the RT industry. These meanings highlight the importance of taking advantage of 4.0 technology, digital tools, and media information technology to the local community in the countryside (Maquera et al., 2022; Singh et al., 2023). DT in RT is crucial before and after the pandemic. In addition, digital culture, optimization of experience on the website, and technology integration can enhance the experience of tourists and conserve cultural heritage and innovation in the RT industry (Król & Zdonek, 2022). The study emphasized the importance of green tourism and sustainable tourism development in shaping the DT of the RT (Lapuz, 2023). Taking advantage of IT, resolving environmental challenges, and improving rural destination management organizations are crucial for effective smart tourism management.

This research is covered by theories such as Stakeholder Engagement Theory, Participatory Action Research (PAR), Sensory Marketing Theory, Treatment Effect Model (Stamp), Intelligent Digital Platform (IDP), and Information Systems Success Model. The theory that covers this research is the Digital Footprint Data of visitors with space characteristics and the space development model of RT. Finally, educating and understanding the growth motivation in the industry is essential to shaping the future of RT. These theoretical implications provide. This is a valuable guide for researchers in promoting the process of DT in the RT.

3. Practical implications

The practical implications of this study's findings significantly influence the RT's DT. Industry stakeholders can leverage these implications as actionable recommendations to develop and implement strategies and initiatives that support and advance the DT process. Firstly, investing in technological infrastructure is essential for tourism businesses and rural destinations. This involves enhancing interactions, visibility, information collection, and log processing, focusing on personalization capabilities to enable users to make swift and precise decisions (Singh et al., 2023). The adoption of cutting-edge technologies such as the Internet of Things (IoT), artificial intelligence (AI), and virtual reality (VR) presents considerable practical advantages. These technologies improve visitor experiences, optimize operational processes, and boost customer satisfaction. Additionally, integrating sustainable practices is a critical implication that can reduce the environmental footprint of tourism activities (Qin et al., 2022). Utilizing digital technologies and engaging with local communities can further advance RT by alleviating business challenges and risks and enhancing its resilience.

Advancing social media, interactive and gamified experiences, and employing scanning technologies and digital photogrammetry with drone assistance in RT to enhance agricultural production capacity (Călina et al., 2022). Collaboration and partnerships are crucial in overcoming the challenges associated with DT in the RT sector. Forming alliances with technology providers, local communities, government agencies, and industry associations facilitates sharing knowledge and best practices (Maquera et al., 2022). Investing in digital skills development, training programs, and start-up culture is vital for equipping tourism professionals with the competencies needed for the digital age (Zhao et al., 2021). When participating in the DT process in RT, residents are empowered based on personal characteristics, reducing scale discrimination and low education level bias. Since then, DT has supported small-scale business households and increased the ability to restore the industry (Zhong et al., 2024). Moreover, advocating for supportive policies and regulations is critical for promoting DT. Engaging with policymakers to support technology adoption, data protection, privacy, and sustainable practices is vital for creating a favorable environment for DT within the RT. Additionally, ensuring accessibility and inclusivity is essential. Complying with web accessibility standards and designing user-friendly interfaces that address diverse user needs to enhance the overall experience for all individuals (Król and Hernik, 2022). By implementing these practical measures, stakeholders in the tourism industry can effectively navigate the DT process, enhance business performance, and address the evolving expectations of travelers in the digital era.

4. Limitations and Future Research

The scarcity of literature on this topic presents a challenge for emerging researchers seeking existing studies on DT within the RT industry. Our research was confined to the Scopus database; therefore, future studies should consider exploring additional databases such as Web of Science, Dimensions, PubMed, and Google Scholar. The scope of our analysis was limited to English-language articles and specific subject areas.

Future research could benefit from examining various perspectives and incorporating a more comprehensive array of literature from diverse fields. Despite these limitations, our study provides valuable contributions to the existing body of knowledge and has implications for research and management in this field.

Moreover, Figure 7 depicts the research trajectory, highlighting potential areas for future investigation. By analyzing DT's dimensions, characteristics, and significance in RT, the authors have established a foundation for further examining its implications and identifying new areas for exploration in this field (Table 3).

Table 3. The potential line for future research (Source: Table by the authors)

Line of research	Field
Digital Folklore and Smart Travel Technology	Explore capacity-building programs' impact on improving digital literacy and reducing the digital divide between urban and rural areas. This activity will enhance the individual and organizational capacity of tourism stakeholders to access and use smart tourism technology innovatively.
	Explore the acceptance and use of smart tourism technology in rural areas after the crisis.
Digital Technology and Sustainable Tourism	Consider the needs and desires of tourists using virtual technology. Wine tourism is associated with RT, which needs to be considered in the future, bringing high profits and sustainability.
Information Technology in RT	Discover how smart technology enhances the overall travel experience on RT tours.
Digital Communications and Marketing for RT	Examine the impact of social media, smartphones, and multimedia platforms on tourism promotion and leverage digital technology to market and sell tourism services.
Geographic Information System and Scanning Technology in RT	Research on geographic information systems to manage and control the quality and efficiency of tourism service provision and sustainable agricultural production.

Our study suggests future research directions for DT in RT by comparing the recurrence and occurrence of new keywords in research. Such ideas deserve the attention of researchers and businesses and should be further explored.

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