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Mapping global research on AI-driven halal tourism marketing: a bibliometric and human-AI symbiosis perspectives

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Abstract

The high number of publications about AI utilization for marketing purposes of halal tourism, particularly in 2022-2023, creates a unique challenge for new researchers to identify truly original research gaps. This study aims to observe the research trend of the implementation of AI in promoting local halal tourist sites globally. This study used bibliometric analysis to process metadata for 114 documents downloaded from Scopus between 2019 and 2025. This study generates a bibliometric map using Vosviewer and Biblioshiny software to present the most used words in previous studies, affiliations of authors, and journals with the highest citations, and content analysis using papers related to the results of the bibliometric. Results show that the research fields of previous studies are diverse yet still fragmented, with a strong emphasis on behavioral analytics and sentiment analysis. On the other hand, this study also reveals from affiliations with the highest citations and their total link strength that high-citation institutions are spread globally, including non-Islamic countries, showing broad international interest in AI for halal tourism marketing. However, some institutions have citations but low collaboration network strength, indicating strong authority but limited cross-institutional engagement.

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Keywords: Artificial intelligence, Economic activity, Halal, Sentiment analysis, Sustainable tourism

1. Introduction

Marketing is essential to introduce the product before it is launched into the market. It also builds the brand image of the enterprise to create an appealing visualization or message to attract customers [1]. However, marketing that uses the wrong techniques, location, and target audience negatively impacts businesses, resulting in increased marketing costs and decreased ROI [2]. With the emergence of AI, the marketing landscape has undergone significant changes. AI could generate text and images using the text of the description that the user wants. Moreover, most of the AI tools used for marketing purposes were free.

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Brands previously limited in budget can now compete visually with larger brands. A study conducted by [3] stated that the landscape of marketing in the business world has become more inclusive and dynamic, fueling experiments with short-form, interactive, and immersive content. Moreover, the speed of generating images or text by AI could accelerate ad campaigns, enabling content adjustments to match market trends in near real time. Automation features in editing, music selection for content, and visual enhancements reduce the technical burden, freeing marketing [4].

The authors of this study checked the number of previous studies that observed the implementation of AI to promote halal tourism through the Google Scholar website. The search inserted several queries such as "halal tourism", "marketing", "AI", OR "artificial intelligence". There were 1790 documents from 2022 to 2025. The documents were searched since 2022 because ChatGPT, as an OpenAI, was released in 2022 and marked the emergence of AI for public use [5]. The documents were in the form of papers, a final project, and books. Even though the GPT was released 3 years ago, the number of previous studies related to the usage of AI for promoting halal tourism was amazing, considering the short amount of time. Here is the result of the search:

Table 1. Total documents related to the usage of AI for promoting halal tourism

Year	Total Documents
2022	610
2023	730
2024	450
2025	600

Source: Google Scholar

As shown in Table 1, the total number of documents related to AI for halal tourism surged from 2022 to 2023, creating challenges for novelty in future studies. The high number of publications, particularly in 2022-2023, creates a unique challenge for new researchers to identify truly original research gaps. Consequently, the risk of duplicating incremental research ideas is significant, which can reduce the substantial contribution to the development of science and practice in halal tourism marketing. This situation demands a more strategic approach to mapping the existing research landscape.

One effective method is bibliometric analysis, which can map topic trends, collaborations between researchers, and underdeveloped research areas. With this mapping, researchers can identify gaps that have not been thoroughly explored [6]. For example, bibliometrics may reveal that most previous research focuses on the technical aspects of AI, while the ethical, sustainability, or cultural adaptation dimensions of halal tourism promotion are rarely discussed. The results of this mapping will guide future researchers in designing [7]. Moreover, results of the bibliometric analysis from metadata of documents could reveal the affiliations of authors with the most citations and journals publishing papers related to AI utilization for marketing purposes of halal tourism. Discussing marketing halal tourism with AI could guide researchers in composing more unique, relevant studies that will contribute significantly to the development of knowledge and practice in global halal tourism marketing [8].

This study is positioned as a global bibliometric analysis of AI-driven halal tourism marketing. The dataset spans multiple countries and institutions, reflecting international interest in the intersection of AI and halal tourism. While Indonesian institutions are included in the dataset, they are analyzed as a part of the broader global landscape rather than serving as the central focus. Given the overlapping topic in previous studies about AI utilization for marketing purposes of halal tourism, this study aims to observe the research trend of the implementation of AI in promoting local halal tourist sites. The analysis highlights worldwide contributions, with examples from both Islamic and non-Islamic countries, to provide a comprehensive mapping of the field. This study used the theory of human-AI symbiosis [9] as the interpretive lens to contextualize the result of bibliometric results. The framework guides how results are understood in terms of cooperation between human researchers and AI tools in halal tourism marketing.

The theoretical implication of this study is to explore the novelty of the research topic related to the implementation of AI in promoting halal tourism, which could serve as a compass for further research. The practical implication of this study was to create a suggestion for the stakeholders of halal tourism through the study results based on the bibliometric results. The research questions are informed by the human-AI symbiosis perspective, focusing on how AI tools amplify human analytical capacity in bibliometric mapping and how human interpretation ensures cultural and contextual relevance in halal tourism marketing.

2. Literature review

2.1 Human-AI symbiosis in marketing

The concept of symbiosis between humans and AI stems from the early idea of human-computer symbiosis put forward by J.C.R. Licklider in 1960 in his paper, Man-Computer Symbiosis. Licklider envisioned a close cooperative relationship between humans and computers, where each party leverages the strengths of the other to solve complex problems more effectively. A study conducted by [3] stated that today's AI relies heavily on static training data through machine learning models. If AI encounters a new situation or concept not covered in the machine learning model, it lacks a natural mechanism to learn from direct user interaction. Therefore, AI still requires humans to provide new information so it can adapt its programming model to answer questions and carry out user commands. Through machine learning, humans input command models, while AI processes data spread across a global network of websites, understanding when, by whom, and how the data is processed [8].

The theory of human-AI symbiosis describes a cooperative relationship where human and AI systems work together in ways that amplify each other's strengths. It builds on earlier concepts of human-machine symbiosis, reframed for the cognitive era, in which AI is no longer merely a tool but an active partner in problem-solving, creativity, and decision-making. The basic principle of this theory, according to the study by [9] is complementary, where humans set goals, define constraints, and ensure that output aligns with values and societal norms, while AI provides enhanced analytical capacity and simulation of the processing data. The result can be a feedback loop where AI informs the users about the decision-making, then the user refines the AI models through feedback, and the system continuously improves [3]. This dual process reflects the symbiotic relationship, where AI amplifies scale and speed, while humans provide meaning and normative framing.

3. Research method

3.1 Data collection

This study used metadata of scientific articles downloaded from the Scopus website. Scopus was one of the reputable indexing institutions for international journals. Scopus always checks journals' databases and the ethics of publishing papers. Then, if there was any violation of rules, the journals would be re-evaluated by the editorial team [10]. If the journals did not pass the evaluation screening, it was considered discontinued and removed from the Scopus database. The queries were inserted in the search features to download the metadata of documents. The queries were ("artificial intelligence" OR "AI" OR "machine learning" OR "deep learning") AND ("halal tourism" OR "halal travel" OR "muslim tourism" OR "islamic tourism") AND ("marketing" OR "promotion" OR "advertising" OR "branding") AND ("consumer behavior" OR "customer experience" OR "market analysis" OR "target audience") AND ("digital tools" OR "online platforms" OR "social media" OR "e-commerce").

There were 174 documents found from 2018 to 2025. The samples were scrutinized using inclusive criteria, such as being articles written in English and published in journals. There were 132 documents left from 2019 to 2025. The next step was to convert the metadata into a CSV file and import it into OpenRefine to exclude papers with duplicate keywords in the abstract or title. This software was employed to harmonize keywords, such as merging synonyms, standardizing formats, and removing duplicate records. It was not used to exclude papers based on repeated keywords in abstracts or titles. OpenRefine uses a feature called transformation, which

is the process of transforming data in a column using specific functions. The goal can be to remove duplicate keywords, extract information, and unify the format of keywords indicated as synonyms before using them for bibliometric analysis [11]. After being filtered by OpenRefine, 114 data points remained as samples of this study. The process of inclusion and screening of documents that would be used as samples of this study is illustrated in Figure 1. It shows the flow diagram of the search strategy. After cleaning, 114 documents' metadata remained. 86 metadata of documents met all inclusion criteria, while 28 documents' metadata were excluded due to irrelevance policy suggestion. This sequence ensures reproducibility. Figure 1 below was the PRISMA diagram that illustrates the flow of the data collection and screening based on the inclusion/exclusion criteria.

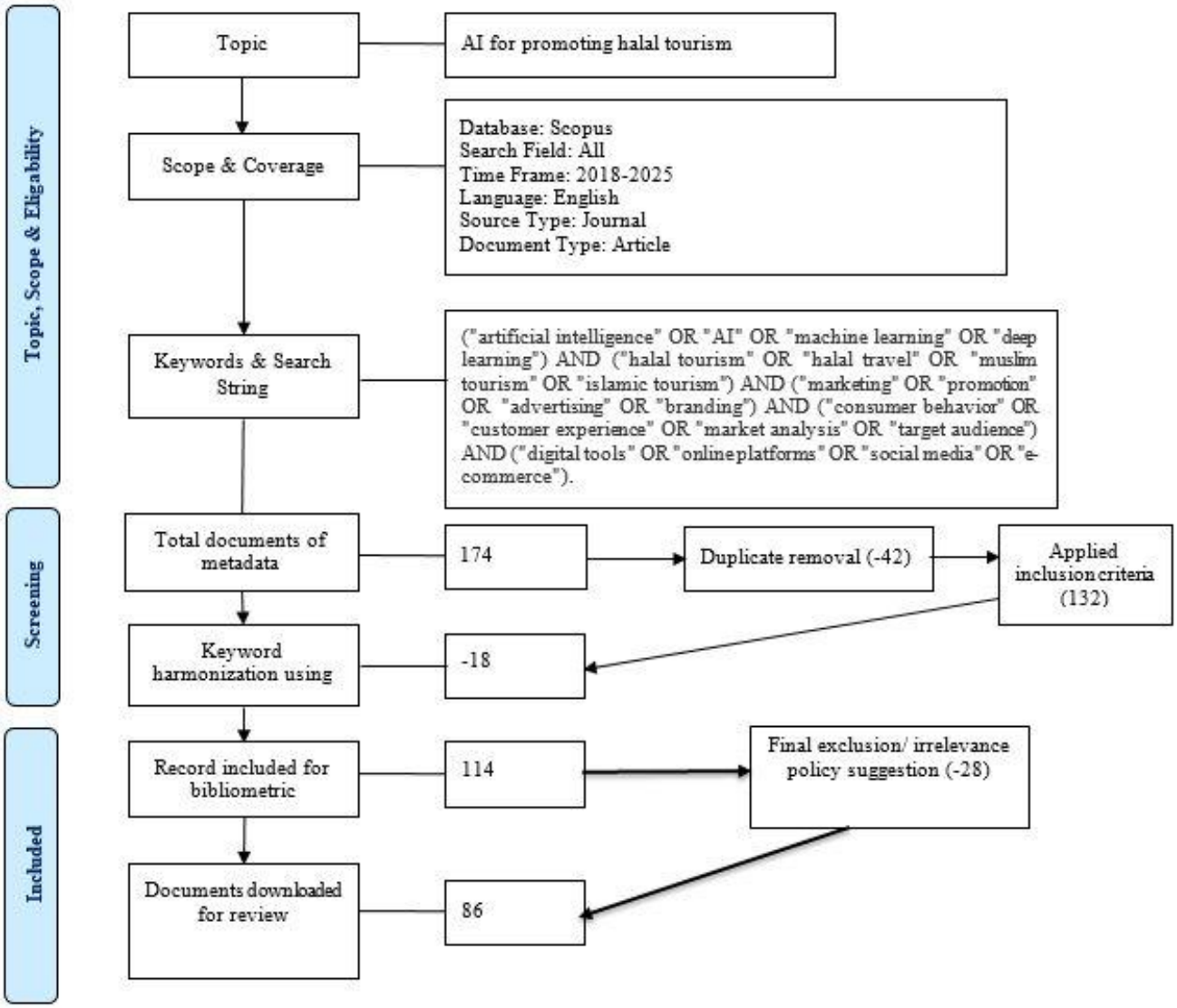


Figure 1. Flow diagram of the search strategy

Note: The final dataset consisted of 86 documents after cleaning and screening. This reconciles the discrepancy between text and figure by clarifying that 114 documents were initially retained after cleaning, but 28 were excluded at the final stage. Source: Arranged by authors and downloaded from equator-network.org

3.2 Data analysis

The metadata would be inserted into the Vosviewer file to show the most used word inside the abstract of papers in the CSV file of metadata. Vosviewer also views the affiliations of authors with the highest citations [12]. The results of the most used words in the abstract of previous studies would be presented in a figure, while the affiliation of authors with the highest citations in a table. The result of the most used words presented in a figure contains several colored clusters of different sizes, illustrating the frequency of the most used words. Both of

them would be explained based on the papers that include the most used words portrayed in a figure and papers affiliated with institutions with the highest citation. There were 20 papers downloaded that contain mostly used words. The 20 papers were based on the titles of documents in metadata in the form of a CSV file downloaded from Scopus, while the papers were downloaded from Google Scholar. On the other hand, 16 papers would be downloaded written by affiliations with the highest citations. The 16 papers are also based on the CSV file of metadata downloaded from the Scopus website.

This study also used Biblioshiny, a feature of bibliometric analysis provided by the software R Studio. The biblioshiny used to show the names of journals where papers related to AI for promoting halal tourism are published, the topic of those papers, and the number of citations they get. The result would be presented in a table. After analysis, at least 50 papers would be downloaded from journals shown in the table that contain those topics. The paper synthesized and explained the meaning of the table result and linked the discussion with the theory of human-AI symbiosis. This study also included the details of 86 papers used for analysis of the results of the bibliometric analysis, divided into several results such as the most used words, affiliation of authors with the highest citations, and the names of journals published previous studies with the highest citations and their topics. All of the 86 papers for samples would be presented in Appendix 1 at the end of this paper.

4. Results and discussion

4.1 Content analysis

Before conducting a literature review, this study analyzes the metadata of documents in a CSV file to visualize the authors' keywords mostly used by previous studies. In Figure 2 below, the visualization of the author's keyword reflects the topic discussed in the paper to deepen understanding. Moreover, bibliometric mapping highlights the most used keywords to determine the direction of research. These clusters provide a visual overview of how AI applications in halal tourism marketing are distributed to provide a clearer picture of emerging trends and underexplored areas.

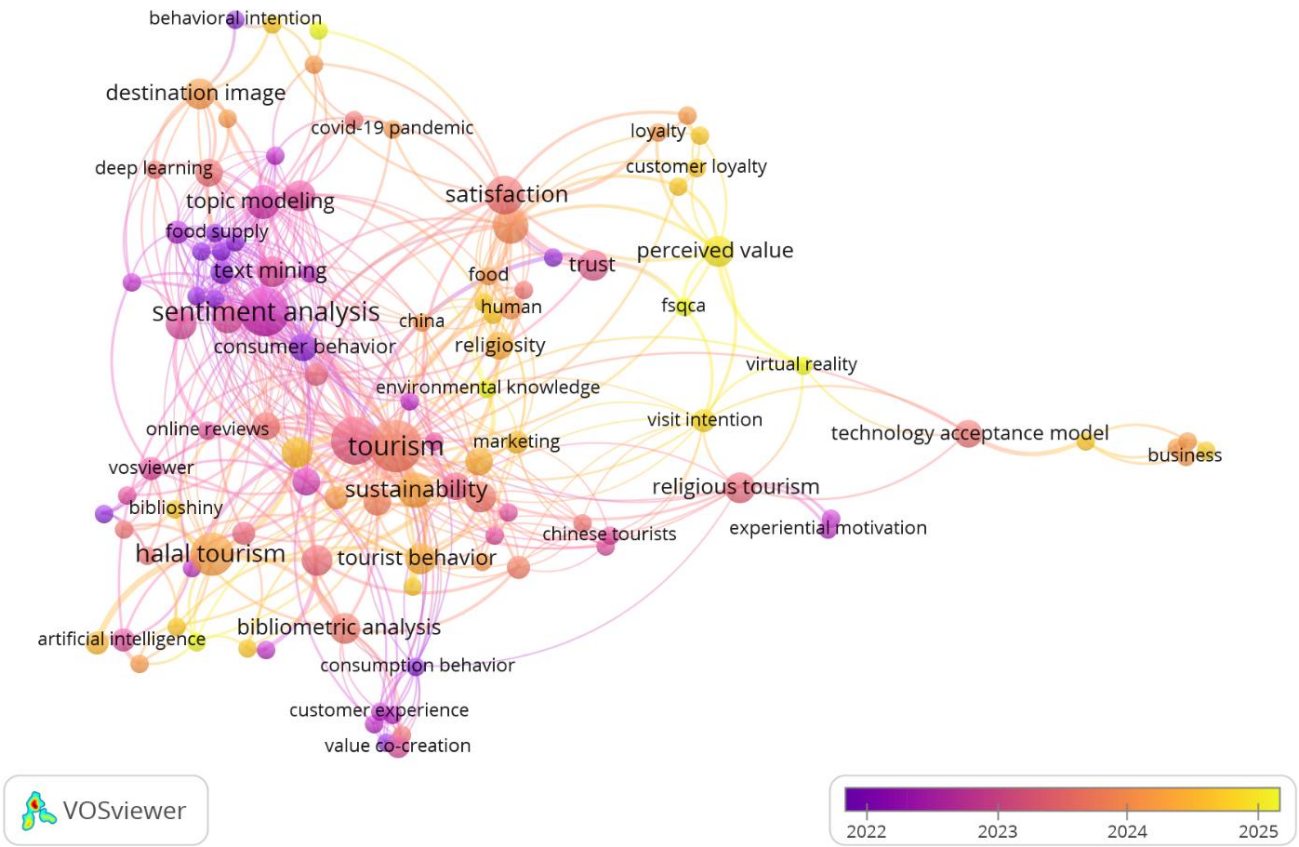


Figure 2. Most used words in the abstract of the samples of this study

Source: Data processed by Vosviewer

The size of clusters in Figure 2 illustrates the relative frequency of keywords that appeared in the abstract. Larger clusters in Figure 2 (e.g., orange) indicate dominant thematic areas with broad coverage. On the other hand, smaller clusters (e.g., yellow) illustrate emerging but less-explored topics. It is relatively important for the interpretation of content inside papers by combining frequency (size), thematic coherence (color grouping), and citation strength of associated papers. Figure 2 employs specific visual metrics to determine the direction and weight of the existing research. There are several standards to interpret these results. First is the cluster size that illustrates the frequency of keywords appeared in a paper. Second was relative Importance**.** Larger clusters illustrate dominant thematic areas with broad coverage, signifying established pillars in the field. Third was emergent topics. Smaller clusters represent emerging but less-explored niches, which often signal untapped research potential. Fourth was thematic coherence. Color groupings represent sub-fields where keywords frequently co-occur, showing how different concepts such as AI and Sustainability are intellectually linked in current literature.

Clusters of keywords are visualized in Figure 2, where colored clusters such as purple, red, orange, and yellow highlight dominant and emerging themes. Figure 2 illustrates the division of subtopics based on cluster colors and sizes. Each cluster is linked to AI-assisted halal marketing, based on the theory of human-AI symbiosis. There are four cluster colors: orange, purple, red, and yellow. The orange cluster was the biggest in Figure 2. It consists of topics such as tourism, sustainability, tourist behavior, and consumer experience from 2022 to 2025. The correlation between the implementation of AI and the topics in orange clusters based on several previous studies was that AI could be used to analyze tourist behavior patterns, detect sustainability trends, and process behavioral data, through the commentary and reviews in Google Reviews and social media [4].

The symbiotic form between human and AI was that stakeholders in halal tourism could become more coordinated & adaptive by using AI as a behavior mapper. AI is becoming the foundation of a data-driven and local value-driven halal marketing strategy, supporting evidence-based policies [13]. The large size of the orange clusters. Stakeholders in tourist sites could provide domain intuition while AI scales data insight & personalization for marketing campaigns. Moreover, in orange clusters, temporal density analysis shows that sustainability keywords gained prominence after 2022. They coincide with global debates on responsible tourism. This suggests a growing research gap in integrating AI with sustainable halal tourism practice.

The purple clusters were moderate in size. The topics in purple clusters were halal tourism, bibliometric analysis, text mining, sentiment analysis, and deep learning. Based on the sample of these studies, such as previous studies conducted by [14], [15], [16], AI can filter and extract published data and traveler opinions, identifying early trends that can help avoid profit loss. The symbiosis between halal tourism researchers and AI could make AI a reflective & diagnostic tool. AI can serve as an analytical tool to help researchers determine research direction, interpret analysis results, and maintain halal values. As a result, the research process could be accelerated by directing the development of insight-based halal tourism content, positioning, and identifying the problem in the tourist site, which was faster than without using AI [17]. Moreover, within the symbiosis framework between AI and humans, AI has a purpose as a context amplifier by processing large-scale textual data, while human interpretation ensures alignment with halal values and tourism ethics [4].

The red clusters were also moderate in size. The topics in red clusters were satisfaction, trust, customer loyalty, religiosity, and perceived value. Based on the sample of this study, such as the previous study conducted by [18], AI could be used for predicting satisfaction and loyalty of the visitors, measuring perceived value and trust of society about the products of SMEs in halal tourist venues. AI supports the personalization of tourist destinations, and the stakeholders maintain their meaning and spiritual value to increase halal tourist retention and satisfaction through a value-based and emotion-based approach. Keywords about trust and loyalty show steady growth across the dataset. However, the clusters about religiosity only appear prominently after 2023. This illustrates there was an emerging niche that connects AI-driven personalization with religious values.

The yellow clusters were small in size. The topics in yellow clusters were the technology acceptance model, virtual reality, motivation, and business from 2024 to 2025. Based on the samples of this study, such as a study

conducted by [17], AI could provide interactive simulations, models for technology adoption, and measures of digital readiness. AI as a technology facilitator to help SMEs promote the tourist site as value curators in directing cultural narratives in tourism technology, ensuring ethical compliance in business processes. AI not only processes data from customer reviews but also actively informs the design of the tourist experience and marketing segmentation for stakeholders in the halal tourism sector. Moreover, the overlay visualization illustrates that VR and TAM-related keywords are recent (2024–2025), marking them as emerging themes. These highlight opportunities for future studies in immersive halal tourism experiences and the digital readiness of SMEs.

In this framework, AI excels at processing vast amounts of data, recognizing patterns, and generating predictions at speeds beyond human capability. Humans, as users of AI in contrast, can contribute to contextual understanding, ethical reasoning, and the ability to interpret meaning in ways machines cannot fully replicate. Symbiosis arises when these capabilities are intentionally integrated, creating outcomes that neither could achieve alone. The theory of human-AI symbiosis envisions AI not as a replacement for human intellect but as a catalyst for augmented intelligence. Its success depends on transparent design, continual human oversight, and alignment with shared values [8]. By fostering interdependence rather than competition between humans and AI, this partnership has the potential to unlock creative solutions to complex global challenges, from sustainable development to personalized education and beyond. In the context of marketing, this theory suggests AI could analyze global travel trends, social media sentiment, and consumer behavior, while human experts interpret these insights within a religious, cultural, and ethical framework [17]. This ensures marketing strategies remain not only data-driven, but also value-aligned. AI becomes a sense amplifier, scanning an enormous information landscape, and humans act as the meaning makers, grounding recommendations in lived experience and purpose [3]. The longitudinal mapping in Figure 2 demonstrates that while technical AI applications such as text mining and machine learning are well established, cultural, ethical, and themes related to sustainability are only emerging. This imbalance suggests a research gap where future studies should integrate socio-cultural dimensions with technical innovation to ensure AI-driven halal tourism marketing remains aligned with Sharia value.

Table 2. Affiliation of authors with the highest citations

Organization	Documents	Citations	Total Link Strength
Uniwersytet Mikołaja Kopernika w Toruniu, Torun, Poland	2	79	0
Qassim University, Al-Mulida, Saudi Arabia	2	67	0
universitas Pendidikan Indonesia, Bandung, Indonesia	3	62	2
Faculty of Commerce, Kafr El-Sheikh, Egypt	3	54	3
Faculty of Commerce, Shibin El Kom, Egypt	3	54	3
Politeknik Negeri Bandung, Bandung, Indonesia	2	53	1
Faculty of Commerce, Tanta, Egypt	2	52	2
Kyung Hee University, Seoul, South Korea	2	50	0
School of Hotel and Tourism Management, the Hong Kong Polytechnic University	4	44	3
Sejong University, Seoul, South Korea	3	42	3
Akdeniz Universities, Antalya, Turkey	2	41	0
Universiti Malaysia Terengganu, Kuala Terengganu, Malaysia	2	40	1
Bangkok University, Bangkok, Thailand	2	37	2
Macau University of Science and Technology, Taipa, Macao	2	37	2
Universitas Airlangga, Surabaya, Indonesia	7	33	3
Khon Kaen University, Khon Kaen, Thailand	3	29	1
Management Development Institute, Gurgaon, Gurugram, India	2	29	2

Organization	Documents	Citations	Total Link Strength
Narsee Monjee Institute of Management Studies, Mumbai, India	2	29	2
Punjab University, Patiala, India	2	29	2
Universidad de Guanajuato, Guanajuato, Mexico	3	26	0

Source: Data processed by Vosviewer

Table 2 shows that some institutions from non-Islamic countries, such as Poland, South Korea, Hong Kong, Thailand, Macao, India, and Mexico. It means research about the utilization of AI for marketing purposes of the halal tourism sectors becomes an interesting topic globally. Table 2 shows contribution by institution which presents affiliations with the highest citation and their authors' collaborative link strength. Table 2 shows the number of documents, citations, and total link strength. According to the study conducted by [19] stated that more documents create broader thematic coverage or sustained investigation of a certain topic. Higher citations could create stronger authority, credibility, and potential to shape narratives in marketing content, as observed by academicians. Total link strength means the degree of collaborative network connectivity, so that when an institution has higher TLS, it means that it is better positioned to share and amplify ideas across institutions.

However, there were institutions with high citations but low total link strength, such as Uniwersytet Mikołaja Kopernika and Qassim University. Based on the study by [20], these were authoritative nodes, but isolated networks. It means that those two institutions have strong academic influence, as shown by their high citation count, but have few collaborative connections, as shown by total link strength. AI can bridge them into broader halal tourism marketing alliances by detecting thematic overlaps and suggesting joint campaigns despite weak co-authorship ties. Based on the lens of human-AI symbiosis, bibliometric outputs advise that AI tools emphasize institutional overlaps, while previous studies done by humans contextualize these overlaps as opportunities for collaboration between institutions. Moreover, AI could identify that Qassim University has high citation but low total link strength (TLS) frequently cites work from Sejong University that has high citation and TLS. Academicians from both universities might then initiate cross-institutional fieldwork or joint workshops for research.

There were also balanced total link strength and citations, such as the Faculty of Commerce, Kafr El-Sheikh, and Sejong University. It means that those two universities have a mid-high influence with strong network connectivity in the context of researching halal tourism and AI [20]. On the other hand, there was also an institution with high productivity but moderate citations, such as Universitas Airlangga. It implies prolific output but moderate citation impact. As a result, it needs collaboration from other overseas institutions to describe more about the strategy to utilize AI for marketing in the halal tourism sector [3].

Table 3. Journal with the highest citations published the samples of this study

Title of Papers	Journal	Year	Subject	Main Topic	Citation
Integrating AI with Religious Tourism Strategy	International Journal of Tourism Research	2020	Religious Studies, Strategy	AI Integration, Religious Tourism, Strategic Planning	62
Halal Wellness Tourism and Smart Technology	Journal of Travel & Tourism Marketing	2023	Wellness, Technology	Smart Tourism, Halal Wellness, AI Applications	54
Consumer Trust in AI-Based Halal Travel Apps	Computers in Human Behavior	2021	Psychology, Technology Acceptance	Trust, TAM, Halal Travel Apps	53
Mapping Halal Tourism Research Using Bibliometrics	Sustainability	2022	Bibliometric Analysis	Halal Tourism, Research Trends, VOSviewer	52

Title of Papers	Journal	Year	Subject	Main Topic	Citation
AI and Perceived Value in Halal Hospitality	Asia Pacific Journal of Tourism Research	2020	Hospitality, Consumer Behavior	Perceived Value, AI, Halal Hospitality	50
Virtual Reality for Halal Destination Promotion	Technological Forecasting and Social Change	2023	Innovation, Tourism	VR, Halal Destination, Immersive Experience	44
Trust and Satisfaction in AI-Enhanced Halal Travel	Journal of Destination Marketing & Management	2021	Consumer Psychology	Trust, Satisfaction, AI Enhancement	42
Religious Motivation and AI in Halal Tourism	Annals of Tourism Research	2022	Religion, Motivation	Religious Motivation, AI, Halal Tourism	41

Note: This table is directly generated from a feature of the R Studio software, Biblioshiny, in August 2025. Papers listed here are verifiable in Scopus and included in Appendix A
Source: Data processed by Biblioshiny

Table 3 shows that the Journal of Islamic Marketing has the highest citation. It emphasizes the papers with the main topic, such as AI, halal experience, and personalization. Table 3 lists the journals with the highest citations. It shows the Journal of Islamic Marketing as the most influential outlet. Based on the context of the theory of human-AI symbiosis, effective symbiosis requires both parties, human and AI, to adjust each other's mode of operation, called mutual adaptation [21]. For example, AI interfaces can be designed to explain reasoning in human-understandable terms, while users as humans can learn to frame problems in ways that leverage the AI's computational strength [22].

4.2 Conceptual framework and proposed future agendas

The key aspect of the research was identifying a research gap. Any study must aim to fill the research gap that previous studies on a certain topic have left. Without filling the research gap, the study would become a copy of the previous studies on the same topics and would not give any potential development for the specific field of research. A study by [23] stated that Gaps create opportunities to use new approaches, new technologies, or combinations of disciplines that have never been applied before. Moreover, Gaps provide a clear focus on what needs to be researched, avoiding duplication and strengthening relevance [24]. By showing that there is a significant gap, researchers can build an argument that their study is worthwhile and urgent. For example, there is no AI-based halal marketing model that complies with local regulations and values in Southeast Asia. This is important to get support from institutions, journal reviewers, or research funding.

In addition to the bibliometric outputs, the authors propose several conceptual models to guide future research directions. These diagrams below are interpretive frameworks, not direct results of bibliometric software. They illustrate potential research gaps, the dynamic of human-AI symbiosis, and pathways for advancing halal tourism marketing research, following the results of bibliometric analysis as the basis.

Figure 3 depicts the untapped potential of the study when AI computational strength and human cultural intelligence are combined. The human-AI symbiosis from an ethical and cultural adaptation lens depicted by orange & red clusters in Figure 2, shows that AI has the potential to scan large-scale visitors' feedback and review datasets to map emerging needs and sentiment trends. On the other hand, users of AI as humans interpret those signals through halal compliance and ethical marketing guidelines. From this lens, the research gap was that previous studies rarely combine sustainability analysis, consumer behavior insights, and AI-powered tools into one marketing model [18].

Moreover, this study noticed that future studies could also use framing human-AI symbiosis as a novel lens for halal tourism marketing. This was done so by highlighting global institutional participation (Table 2) while

noting collaboration gaps. Identifying underexplored intersections (sustainability + consumer behavior, AR/VR + loyalty).

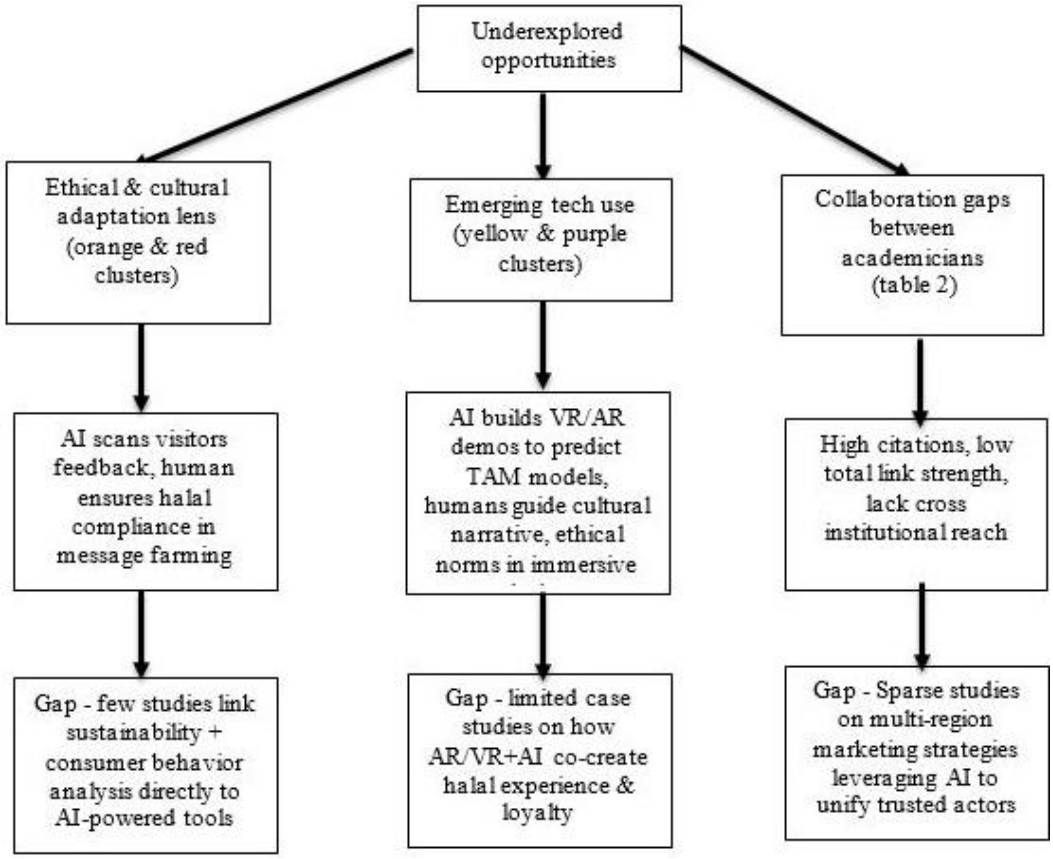


Figure 3. Conceptual research gap diagram

Source: The authors' proposed model

The human-AI symbiosis from the emerging tech use lens is portrayed by yellow & purple clusters in Figure 2, which shows that AI could build immersive VR or AR prototypes to run a predictive technology adoption model, for example, TAM. On the other hand, users of AI could shape immersive content with cultural narratives and ensure the experiences respect halal principles and local norms [25]. From this perspective, the research gap was that only a few previous studies observed how AR or VR technology fused with AI to create halal experiences in the marketing process to drive loyalty and retention among the public [26].

The human-AI symbiosis, as depicted in Table 2, reveals collaboration gaps between authors' lenses, showing that AI maps knowledge networks, identifies high citations but low link strength relative to total link strength, and potential partners [4]. On the other hand, academicians answer those reports of low total link strength by conducting negotiation trust and policy alignment across regions and institutions, so that the research collaborations between institutions of different countries could be increased. From this perspective, the research gap was a lack of studies on multi-region, AI-assisted strategies, observation that unifies trusted authorities across the halal tourism marketing ecosystem [17]

From those lenses and the research gap formulated in the statements above, this study assembled the symbiosis loop of human and AI. In each gap, human judgement ensures halal integrity and persuasive cultural fit, while AI extends the scale of persuasive target and influence, speeds up the process of making content for promotion, and foresight the future trends of demand that could be applied in a tourist destination [27]. The most impactful halal tourism marketing will emerge when users and AI operate in complementary loops where insights flow from AI to users, refinement flows back, and the cycle repeats (Figure 4).

These gaps highlight the need for future studies to integrate sustainability with consumer behavior through AI-driven halal tourism marketing. The novelty of this study lies in applying the principle of human–AI symbiosis

as a conceptual lens for interpreting results of bibliometric analysis, rather than introducing it as a methodological variable. This approach enriches the analysis by framing AI-driven bibliometric mapping within a cooperative human–machine paradigm (Table 2). On the other hand, there is an urgency to identify collaboration gaps and identify underexplored intersections, such as sustainability with consumer behavior and AR/VR with loyalty. This reinforces the reviewer's acknowledgment of methodological rigor and conceptual contribution.

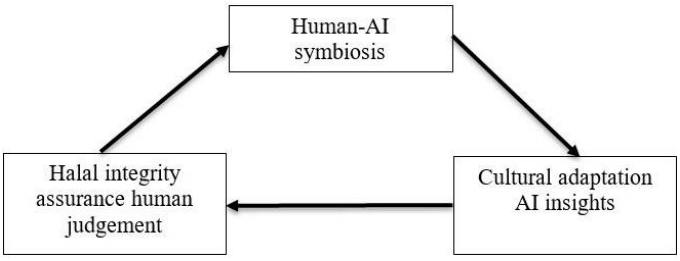


Figure 4. Symbiosis loop diagram

Source: The authors' proposed model

4.3 Future directions of research about the utilization of AI for marketing purposes

Besides the research gap, this study also provides future directions for academicians who want to continue to observe the utilization of AI-powered tools for marketing purposes of halal tourist sites or subtopics related to halal tourism culture. The future direction of research could be seen in Figure 5. The foundation of the research was halal tourism marketing, representing the sector's core objective, such as promoting destinations, services, and experiences that comply with halal principles. The halal tourism marketing must be through a digital platform to conduct online booking and write reviews for tourists [28]. The digital platforms have also become the channel for influencers to campaign for tourist destinations. Future research could also integrate the topic of multi-vendor halal travel hubs [27]. Other halal tourism topics could also observe personalization strategies to bridge between the halal tourism sectors and AI, focusing on tailoring offers and messages to individual traveler needs. On the other hand, future research that aims to observe AI applications in marketing could delve deeper into tailored marketing campaigns using AI, automation booking systems, and GPT utilization in customer service.

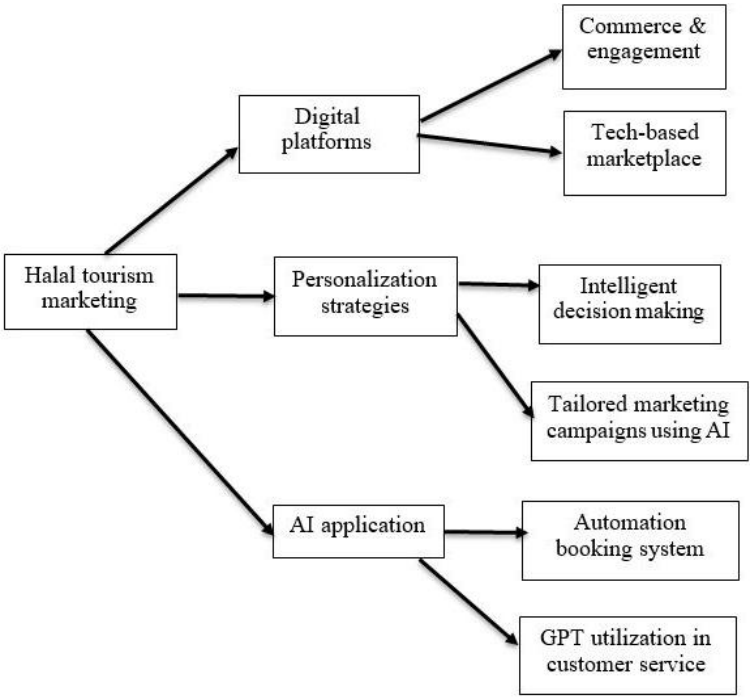


Figure 5. Future directions of research for halal tourism marketing and AI utilization

Source: The authors' proposed model

Figure 5 shows the integration of core halal tourism marketing principles with digital platforms and AI applications to achieve intelligent decision-making and enhanced commerce engagement for stakeholders to be adapted. First, policymakers should focus on adjusting AI-driven consumer behavior analysis with sustainability policies to ensure halal compliance in the regulation of digital marketing. Meanwhile, for SMEs, the owners could utilize AI for research purposes through low-cost sentiment analysis and VR/AR demos to enhance branding. It needs training programs to align with ethical and cultural adaptation. Lastly, for destination managers, the need to adopt AI tools for visitor feedback analysis and loyalty prediction. They also need to collaborate with academicians to design culturally sensitive immersive experiences.

5. Conclusions

Based on the result above, conducted by using the bibliometric of metadata of documents downloaded from Scopus, there were four colors of clusters of the most used words in previous studies, orange was the biggest, purple and red were moderate in size, and yellow was the smallest cluster. The research field is diverse but still fragmented, with a strong emphasis on behavioral analytics and sentiment analysis. On the other hand, this study also reveals from affiliations with the highest citations and their total link strength that high citation institutions are spread globally, including non-Islamic countries, showing broad international interest in AI for halal tourism marketing. However, some institutions have citations but low collaboration network strength, indicating strong authority but limited cross-institutional engagement.

There is untapped potential for building stronger global research alliances to share methodologies and case studies. Thus, the result above also shows that high-impact journals span marketing, tourism management, technology adoption, and sustainability, reflecting the interdisciplinary nature of the field. The most influential studies combine AI technical capabilities with cultural/religious alignment. But there is still a gap in multi-region, cross-cultural AI marketing models for halal tourism.

Based on the orange and red clusters that focus on consumer experience, trust, and religiosity) and the yellow cluster that highlights the digital readiness of SMEs, policymakers must step in to strengthen the role of human to face the human-AI symbiosis loop. Implementing specific training programs will empower human stakeholders and SME owners to accurately interpret AI analytical insights, maintain domain intuition, and guide cultural narratives while ensuring strict halal compliance and ethical alignment.

Declaration of competing interest

The authors declare that they have no known financial or non-financial competing interests in any material discussed in this paper.

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Author contribution

Hartelina, Nafik: study conception and design; Wardhana: data collection; Wardhana, Ida: analysis and interpretation of results; Denizar: proofreading. All authors approved the final version of the manuscript.

Declaration of use of AI in the writing process

The author(s) used Grammarly AI during preparation of this work to check grammatical mistakes only. The author(s) reviewed and edited the work as necessary and take(s) full responsibility for the final version.

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Appendices

Table A. List of samples of this study divided based on clusters of Vosviewer's analysis

Title of Paper	Cluster's color	Size	Topic
Rebuilding sustainable green tourism supply chains through technology adoption and social media branding in Zimbabwe post-COVID-19	Green	15	Sustainable Tourism & Green Supply Chain
A Place to Remember? Exploring Perceived Destination Sustainability Effects on Memory and Place Attachment	Green	15	Sustainable Tourism & Destination Experience
From click to confirmation. The effect of hotel website quality and online reviews in fostering booking intentions	Yellow	18	Consumer Behavior & Digital Hospitality
Empowering the Global Tourism Workforce: How Digital Transformation Influences HR Development	Blue	20	Digital Transformation & HR in Tourism
From Asymmetry to Satisfaction: The Dynamic Role of Perceived Value and Trust to Boost Customer Satisfaction in the Tourism Industry	Yellow	18	Service Quality, Trust & Satisfaction
To Adopt or Not to Adopt: Configurations for GenAI Recommendation Adoption in Sustainable Consumer Behavior	Blue	20	AI Adoption & Sustainable Consumer Behavior
The moderating effect of halal certification awareness on farmers' behavior for halal rice	Red	14	Halal Certification & Agricultural Policy
Fostering eco-conscious tourists: How sustainable marketing drives green consumption behaviors	Green	15	Sustainable Marketing & Green Consumption
SMART TOURISM ECONOMICS: Introducing a Technology-Driven Competitive Advantages Framework	Blue	20	Smart Tourism & Competitive Advantage
The Underlying Importance of Value in Artificial Intelligent Travel Application Acceptance Model	Blue	20	AI in Travel & Consumer Acceptance
Integrating ChatGPT in halal tourism: impact on tourist satisfaction, e-WoM and revisit intention	Red	14	AI Integration in Halal Tourism
Shaping the itinerary: Perceived quality of recommendation systems on travel intentions	Blue	20	Recommendation Systems & Travel Intention
Critical criteria for restaurant technology application: the interrelationship effect of influencing technology acceptance and brand equity	Blue	20	Technology Acceptance in Hospitality
Promoting Sustainable Tourism Through Employee Skills (SDG-4)	Green	15	Workforce Skills & Sustainable Tourism
Can sustainable tourism and hospitality consumption value enhance customers' psychological responses?	Green	15	Sustainable Consumption & Customer Psychology
Investigating the influence of Islamic values, environmental knowledge and environmental concerns on EV adoption intentions	Red	14	Islamic Values & Sustainable Technology Adoption

Title of Paper	Cluster's color	Size	Topic
What if I shy away from cash payments during travel? The changing dynamics of intentions to use digital payment systems	Blue	20	Digital Payments & Travel Behavior
Customer Loyalty in Halal Fashion Brand: The Role of Social Information Processing and Brand Personality	Red	14	Halal Fashion & Brand Loyalty
The influence of perceived coolness of souvenirs on millennials' travel intention	Yellow	18	Perception & Travel Intention Souvenirs
Promotion of rural tourism through virtual reality: the impact of content richness on perceived value and behavioral intention	Blue	20	VR in Rural Tourism Marketing
Determinants of user behavior in 360º virtual tours	Blue	20	Virtual Tours & User Behavior
From perception to decision: key factors influencing destination choice	Yellow	18	Destination Choice & Consumer Decision-Making
Exploring the Nexus of Over-Tourism: Causes, Consequences, and Mitigation Strategies	Purple	12	Over-Tourism Policy & Governance
The Moderating Effects of Perceived Risk in the Water Theme Park Industry	Yellow	18	Risk Perception & Revisit Intention
Virtual Reality's Impact on Tourist Attitudes in Islamic Religious Tourism	Red	14	VR in Religious Tourism
Examining the role of Islamic environmental values in pro-environmental behavior among Muslim tourists	Red	14	Islamic Environmental Values & Halal Tourism
The role of halal food quality and perceived religious risk on consumer loyalty	Red	14	Halal Food Quality & Loyalty
Factors influencing adoption of e-payments by microenterprises' owners in Indonesia	Blue	20	E-Payment Adoption & Fintech
Nexus of Consumer Trust in FinTok Influencers, Consumer Engagement, Data Privacy Concern, Financial Literacy and Travel Scam Avoidance	Blue	20	Social Media Influence & Travel Safety
Play, Click, Travel: Unleashing the Role of Smart Booking and Gamification Affordance in Online Travel Agencies	Blue	20	Smart Tourism, Gamification & OTA Engagement
Determinants of patients' perceived halal health-care services and its impact on word-of-mouth communication	Red	14	Halal Health Services & Patient WOM
Understanding AI-enabled conversational agent customer experiences in religious tourism	Red	14	AI Conversational Agents in Religious Tourism
Modeling halal tourism as a reflective–reflective second-order construct: linking attributes to tourist outcomes	Red	14	Halal Tourism Attributes & Tourist Loyalty

Title of Paper	Cluster's color	Size	Topic
The effect of religiosity, materialism and self-esteem on compulsive and impulsive buying behavior	Yellow	18	Consumer Psychology & Buying Behavior
Halal tourism and ChatGPT: an overview of current trends and future research directions	Red	14	AI Integration & Halal Tourism Trends
Metaverse customer journeys in tourism: building viable virtual worlds	Blue	20	Metaverse Applications in Tourism
Customer engagement in Saudi food delivery apps through social media marketing	Yellow	18	Social Media Marketing & Customer Engagement
Antecedents of Happiness and Tourism Servicescape Satisfaction and the Influence on Promoting Rural Tourism	Green	15	Rural Tourism & Visitor Happiness
Academic writing in the age of AI: Comparing the reliability of ChatGPT and Bard with Scopus and Web of Science	Blue	20	AI Tools in Academic Research
Perceived service quality and risks towards satisfaction of online halal food delivery system	Red	14	Halal Food Delivery & Service Quality
Islamic food laws: customer satisfaction effect of halal purchase intention in China	Red	14	Halal Food Laws & Purchase Intention
Identifying and Prioritizing Antifragile Tourism Strategies in a Neutrosophic Environment	Purple	12	Tourism Strategy & Resilience
Machine learning-based model for customer emotion detection in hotel booking services	Blue	20	Machine Learning & Customer Emotion Analysis
Effects of interaction between brand positioning and chatbot conversational style on perceived fit and brand attitudes	Blue	20	Chatbots & Brand Perception
What does the media tell us about a destination? The Cancun case, seen from the USA, Canada, and Mexico	Purple	12	Destination Image & Media Analysis
Locus of control, environment, and small-medium business performance in pilgrimage tourism	Red	14	Pilgrimage Tourism & SME Performance
Animal Ethics and Tourism: Deepening a Stimulus–Organism–Response (SOR) Framework	Green	15	Animal Ethics & Sustainable Tourism
Sentiment Analysis: a Comparative Study of Online Booking Platforms Used for Spa Tourism in Northern Oltenia, Romania	Yellow	18	Sentiment Analysis in Spa Tourism
Analyzing of online user reviews via latent Dirichlet allocation: Moroccan mobile banking case	Blue	20	LDA Topic Modeling & Service Feedback
Attributes Influencing Tourist Satisfaction: Sentiment Analysis and Topic Modeling of Online Reviews	Yellow	18	Tourist Satisfaction & Text Mining

Title of Paper	Cluster's color	Size	Topic
Generative artificial intelligence: a proactive and creative tool to achieve hyper-segmentation and hyper-personalization in the tourism industry	Blue	20	GenAI in Tourism Marketing
Leveraging user-generated content (UGC) in pre-travel behavior	Blue	20	UGC & Destination Image
Data vulnerability and privacy risk among hotel guests who share personal data	Blue	20	Privacy Risk & Data Sharing in Hospitality
Sustainable Halal Value Chain performance for MSMEs	Red	14	Halal Value Chain & MSME Development
Aspect-Based Sentiment Analysis on Social Media Comments: The Attributes of Service Robots in the Hotel and Restaurant Industry	Blue	20	Service Robots & Customer Sentiment
Fishing tourists' green behaviors at coastal destinations	Green	15	Green Behavior in Coastal Tourism
Unlocking destination cultural reputation: the role of sustainable on-site activity involvement as moderator	Green	15	Cultural Tourism & Destination Reputation
Exploring Sustainability Dynamics in Chinese Folk Belief Consumer Behavior	Red	14	Religious Tourism & Sustainability
Twitter's capacity to forecast tourism demand: the case of Saint James	Purple	12	Social Media Data & Tourism Demand Forecasting
Investigating the brand equity strategy of halal food in a promising emerging Islamic market in a non-Muslim country	Red	14	Halal Food Brand Equity & Marketing Strategy
Social visibility of consumption as a phenomenon driving the self-expression and travel intention of Muslim tourists	Red	14	Social Visibility & Muslim Travel Intention
Examining the influences of satisfaction and trust on the behavioral intentions of customers in casual dining restaurants	Yellow	18	Satisfaction, Trust & Behavioral Intention in Dining
Artificial intelligence methods to support the research of destination image in tourism: a systematic review	Blue	20	AI Methods for Destination Image Analysis
The influence of co-creation and subjective norms on customer loyalty: customer satisfaction as a mediator	Yellow	18	Co-Creation, Subjective Norms & Loyalty
A science mapping analysis of halal tourism in Asian leisure destinations	Red	14	Halal Tourism Trends & Research Mapping
Tourists' engagement in cultural attractions: psychological and behavioral engagement in indigenous tourism	Green	15	Cultural & Indigenous Tourism Engagement

Title of Paper	Cluster's color	Size	Topic
Protecting coastal tourism through developing tourists' environmentally responsible behavior	Green	15	Coastal Tourism & Environmental Responsibility
Explaining tourist revisit intention using NLP and classification techniques	Blue	20	NLP & Predictive Analytics for Revisit Intention
Buyer–seller interactions and customer satisfaction – moderating role of COVID-19 protocols	Yellow	18	Buyer–Seller Interaction & Service Quality
Hedonic and utilitarian values to improve behavioral intentions and consumer satisfaction on products	Yellow	18	Hedonic & Utilitarian Value in Consumer Behavior
A comprehensive deep learning approach for topic discovering and sentiment analysis of tourism text	Blue	20	Deep Learning for Tourism Sentiment & Topics
Tourist experience challenges: a holistic approach	Green	15	Tourist Experience Models & Post-Pandemic Challenges
AI-enabled technologies to assist Muslim tourists in Halal-friendly tourism	Red	14	AI in Halal-Friendly Tourism
Is customer satisfaction achieved only with good hotel facilities? A moderated mediation model	Yellow	18	Hotel Facilities, Service & Satisfaction
Factors influencing revisiting behavior to Taal Volcano during post-recovery eruption	Purple	12	Disaster Recovery & Tourism Revisit Intention
Mediating role of attitude in halal cosmetics purchase intention: an ELM perspective	Red	14	Halal Cosmetics Purchase Intention & Attitude
Understanding fitness app users' loyalty and word of mouth through gameful experience and flow theory	Yellow	18	Gamification, Flow & Loyalty in Apps
Determinants of purchase intention through online on halal cosmetics	Red	14	Online Halal Cosmetics Purchase Intention
Mediating role of authenticity in the relationship between destination image and loyalty	Green	15	Destination Image, Authenticity & Loyalty
Analyzing online reviews of foreign tourists to destination attractions in China	Blue	20	Text Mining & Sentiment in Destination Reviews
Understanding senior citizens' intentions to use VR for religious tourism in India	Red	14	VR Adoption in Religious Tourism
The experience of visiting an amusement park: technology adoption and service quality	Yellow	18	Service Quality, TAM & Visitor Experience
Identifying factors influencing consumers not to skip TrueView advertising on YouTube	Yellow	18	Digital Advertising & Consumer Engagement

Title of Paper	Cluster's color	Size	Topic
An analysis of the possibilities and challenges of long stay tourism in Thailand	Purple	12	Long-Stay Tourism Policy & Market Potential
Driving factors to competitive sustainability of SMEs in the tourism sector	Purple	12	SME Competitiveness & Sustainability in Tourism