RESEARCH ARTICLE

GREEN HOTEL RESEARCH EVALUATION: A BIBLIOMETRIC ANALYSIS

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Manuscript Info	*Abstract*
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	Hotels implementing green initiatives are favorably perceived by tourists, emphasizing the role of sustainability in attracting guests, despite higher costs due to eco-friendly features. While green hotels effectively reduce energy consumption and waste, academic research on their impact remains limited. This bibliometric study advances understanding of the factors influencing customeractions and intentions toward green hotels, offering insights into their preferences. Using the Scopus database up to 2024, the study employed VOS Viewer and R to analyze citation, co-citation, and co-word analysis and other bibliometric mapping. It identifies key attributes of green hotels that meet tourist demands and provides actionable insights for hoteliers. Through three bibliometric analyses, the study outlines critical themes reflecting past, present, and future trends in sustainable hospitality, connecting the dots between theoretical studies and real-world business applications.

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Introduction:-

As environmental awareness rises globally, consumers are increasingly mindful of their actions and their environmental consequences, pushing the leisure industry to develop strategies that align with these concerns (Balaji et al., 2019; Arun et al., 2021). Hotels that embrace green initiatives are viewed favorably by tourists, underscoring the value of sustainable practices in attracting guests (Chen and Tung, 2014; Teng et al., 2018). Despite this, the hospitality sector faces criticism for its substantial waste production, such as energy consumption and food waste, with visitors also playing a role in environmental harm through their activities (Abdou et al., 2020; Bashir et al., 2019).

People who are environmentally conscious or who buy green products are more likely to stay at green hotels, which they will likely recommend to others and even pay a premium for, according to studies (Hall et al., 2016; Rahman and Reynolds, 2019). While green hotels are generally more expensive than conventional ones due to the additional costs of integrating sustainable features, customers who prioritize environmental sustainability remain loyal to such establishments. Hoteliers need to put money into creating and improving eco-friendly properties if they want to be successful in the modern digital market. as these investments are projected to generate increased revenues and profitability over time (Chia-Jung and PeiChun, 2014). Therefore, it is essential to pinpoint the primary factors that drive customers to select eco-friendly hotels, even when they come with a higher price tag, as this is vital for the success of the industry.

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Aligning consumer preferences with sustainable tourism initiatives not only fortifies the tourism ecosystem but also advances the Sustainable Goals (SDGs). This bibliometric review is founded on two essential premises: the urgent issue of environmental degradation caused by consumption by people and the necessity to understand how people behave to enable sustainable transitions and mitigate ecological concerns (Trudel, 2019). Within the realm of tourism and green hotels, human behavior and decision-making emerge as critical drivers for promoting the green economy and ensuring the preservation of the global environment (Yeh et al., 2021).

This study provides important insights into the underlying motives driving customers' choices for green hotels and increases predictability to decide aboutguests. Researchers, company owners, and stakeholders may all benefit from this study's results as they work to increase demand for eco-friendly hotel stays. Findings from this study are in line with those of Bavik and Koseoglu (2022) and highlight the importance of green hotels in satisfying the demands of both guests and the hospitality sector as a whole. Notably, whereas Arun et al. (2021) reviewed green hotels comprehensively, other studies have mostly concentrated on more general subjects such such as sustainability in hospitalityor green hospitality research (Kim et al., 2017). Arun et al. (2021) point out that current evaluations have missed a lot of the new material on eco-friendly hotels. Still there is scarcity of literatures that could explains the guests behavior regarding booking and loyal behavior of green hotels. While Fauzi et al. (2024) and others provided strong bibliometric analysis, their research was restricted to the WoS Core Collection or a specific database. Other studies have explored behavioral, psychological, contextual, and empirical aspects of this matter (Ferreira et al., 2023; Yadav et al., 2019). The sustainability initiatives that green hotels implement have an even greater impact on these issues. This gap has to be filled since sustainable tourism literature may be greatly enhanced by a better understanding of consumer behavior and tastes, and there is a rising interest in eco-friendly hotels within the tourist industry. With its unique knowledge map that incorporates bibliometric analysis and network visualization, this study adds significant value to the area of green hotel research by tracing past, current, and upcoming trends.

The study employs three bibliometric methods—citation analysis, co-word analysis, and co-citation analysis—to synthesize key themes in green hotel research, integrating topological and temporal dimensions via a network map. By identifying core issues, mapping the knowledge structure, and projecting future trends, the research provides a in depth knowledge of the field's evolution and anticipates its future trajectory. This approach ensures a holistic analysis of green hotel research, bridging past, present, and emerging trends.

Green hotel and sustainable behavior
Green hotels serve as a transformative force in advancing social, economic, and environmental progress, making them a cornerstone of the green economy (Hasan et al., 2019). Supported by financial incentives, eco-conscious consumer behavior, and sustainable investments, these establishments are transitioning from traditional models to sustainability-driven frameworks, thereby fostering a green economy (Purwandani and Michaud, 2021). To remain competitive, hotels are increasingly adopting green technologies and services, which not only attract eco-conscious travelers but also enhance environmental awareness among tourists (Songur et al., 2023). This shift necessitates integrating sustainability into all aspects of operations, aligning service quality with customer expectations through a comprehensive green marketing strategy (Assaker, 2020). Consequently, hotels are emphasizing their pro-environmental commitments to appeal to eco-conscious guests and boost revenue.

Green hotels, defined as accommodations that employ ecological practices to combat environmental degradation, aim to minimize negative impacts while maximizing benefits through sustainable policies (Han et al., 2010; Chen et al., 2021). A more rigorous definition requires adherence to international environmental management standards, extending green practices beyond the hotel to include collaboration with customers, communities, and suppliers, marking the industry's most advanced stage (Chan, 2011; Jiang and Gao, 2019). Key practices include energy efficiency, water conservation, waste reduction, green product usage, noise control, wastewater management, and partnerships with local organizations to develop eco-friendly policies (Olya et al., 2019). As a critical component of the tourism ecosystem, green hotels enable both providers and consumers to uphold environmental values, reduce reliance on non-renewable energy, and promote sustainability (Bagheri et al., 2020). This is increasingly relevant as a growing majority of travelers prioritize environmental considerations when planning trips and selecting accommodations (Abdou et al., 2020).

The pro-environmental practices of green hotels offer dual benefits: enhancing resource efficiency through energy and water savings, and serving as a strategic tool to attract eco-conscious customers (Hou and Wu, 2021; Chan, 2014). The evaluation of green practices in hotels and lodges by guests plays a pivotal role in determining the

effectiveness of marketing strategies, as their perceptions directly influence operational efficiency (Tan, 2023). To enhance this dynamic, TripAdvisor introduced the Green Leaders program, which gathers data on hotels' environmental achievements from travelers and employs data analytics to identify traveler priorities and areas requiring strategic improvements for enhanced sustainability (Arici et al., 2022). Given their pivotal role in environmental preservation, understanding the factors influencing tourists' choices of green accommodations is essential for advancing green hotel services and fostering sustainable tourism.

Methodology:-
Bibliometric approach
This study employs a quantitative bibliometric approach, utilizing bibliographic databases to construct science mapping, a method widely recognized for its effectiveness in analyzing scientific literature (Tan and Fauzi, 2023). The analysis focuses on quantitative metrics such as citations, contributions, authorship patterns, and co-authorship distributions over a specified timeframe (Khan et al., 2021). Bibliometric methods serve as a robust complement to systematic literature reviews and meta-analyses, offering a structured framework for evaluating scientific contributions (Zupic and Cater, 2015). The data are sourced from journal articles. These data are analyzed using three primary mapping techniques:

(1) Citation Analysis: As the foundation of science mapping, citation analysis measures the effect of scientific papers within a precisearena, with highly cited works indicating significant contributions and shaping the intellectual landscape (Zupic and Cater, 2015; Gundolf and Filser, 2013). This approach also highlights the foundational studies that underpin current research (Hota et al., 2020).

(2) Co-citation Analysis: By examining the frequency of co-cited references across texts, this technique identifies connections between sources and reveals the foundational knowledge of a field by analyzing its most influential publications. (Sarin et al., 2020).

(3) Co-word Analysis: By analyzing keyword co-occurrences, this technique constructs the knowledge structure of a field, identifying conceptual relationships and emerging trends (Zupic and Cater, 2015; Tan Luc et al., 2020).

Resaerch approach:
Like systematic literature reviews, bibliometric analysis initiates with a carefully designed keyword search strategy to ensure exhaustive data retrieval (Köseoglu&Arici, 2023). This process includes rigorous data cleaning, such as identifying synonymous terms and utilizing thesauri to capture all pertinent literature. The search strategy incorporates a keyword string combining terms like "green hotel*," "sustainab* hotel*," "eco* friendly hotel*," and "environment* friendly hotel*" to account for variations in terminology. The search is narrowed to titles, abstracts, and keywords within the Scopus database, with a focus solely on peer-reviewed journal articles to guarantee high-quality, dependable data. Books, book chapters, and conference proceedings are excluded due to their inconsistent peer-review standards. The initial search, conducted on January 2, 2025, yielded 710 documents, which were refined to 532 after excluding non-journal publications and non-English articles. Six additional articles were removed due to incomplete information, resulting in a final dataset of 526 documents. This approach aligns with established bibliometric practices that prioritize journal articles for their rigorous peer-review process and reliability (Lin, 2021). Data analysis was conducted using VOSviewer software and the Biblioshiny package in RStudio, tools widely recognized for their efficacy in bibliometric investigation.

Results:-
The analysis depicts that the 526 journal articles analyzed were authored by 1,310 individuals and collectively garnered 25,063 citations, with an average of 47.65 citations per article. Figure 1 depicts the annual publication trends in green hotel studies from 1994 to December 2024, indicating a consistent year-on-year increase in research interest. However, a notable decline in publications occurred in 2021, likely due to the global shift in focus toward the COVID-19 pandemic and its impact on the tourism sector (Dwivedi et al., 2022). As awareness of environmentally conscious behavior grows, an increase in related studies is anticipated in the coming years.
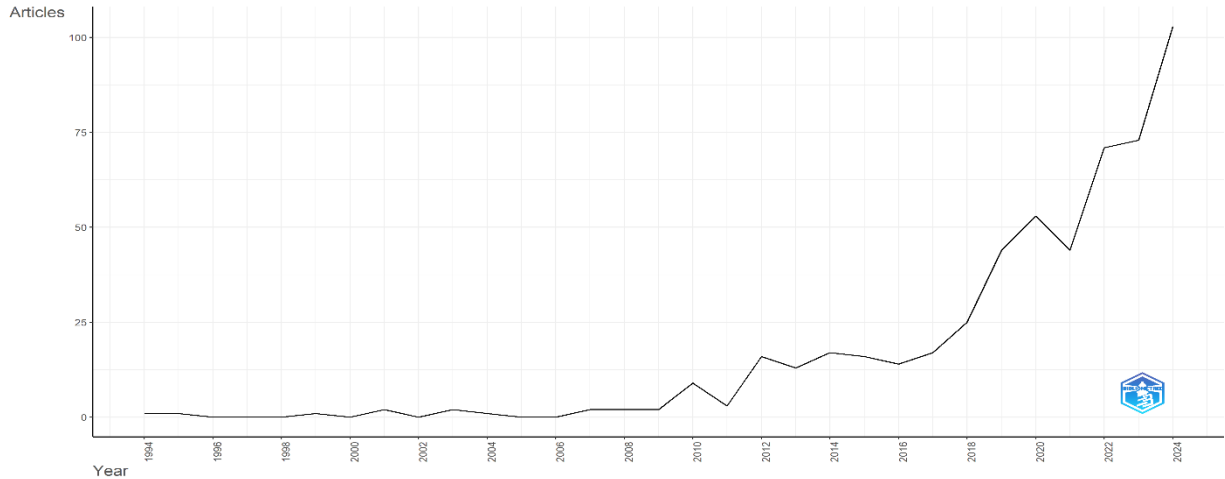
Figure 1:- Annual Scientific Production (1994-2024) (Source: Author's analysis).

Paper Citation analysis:
The results identify the most frequently cited publications, such as Han et al. (2010) with 1,323 citations, Chen and Tung (2014) with 1,085 citations, and Han (2015) with 813 citations. Table 1 outlines the top 10 articles cited high, including their total citations and annual citation rates. Inductive analysis of these works revealed three key themes: (1) consumer behavior and the planned behavior (TPB), (2) willingness to pay a premium for green hotels, and (3) expansions of the TPB.

Table 1:- Top 10 cited articles.

Paper	DOI	Total Citations	TC per Year	Normalized TC
HAN H, 2010, TOUR MANAGE	10.1016/j.tourman.2009.03.013	1323	82.69	3.59
CHEN MF, 2014, INT J HOSP MANAGE	10.1016/j.ijhm.2013.09.006	1085	90.42	8.08
HAN H, 2015, TOUR MANAGE	10.1016/j.tourman.2014.09.014	813	73.91	4.90
HAN H, 2010, INT J HOSP MANAGE	10.1016/j.ijhm.2010.01.001	708	44.25	1.92
LEE JS, 2010, J SUSTAINABLE TOUR	10.1080/09669581003777747	674	42.13	1.83
PHAM NT, 2019, TOUR MANAGE	10.1016/j.tourman.2018.12.008	493	70.43	6.62
KIM Y, 2010, J SUSTAINABLE TOUR	10.1080/09669582.2010.490300	485	30.31	1.32
HAN H, 2011, INT J HOSP MANAGE	10.1016/j.ijhm.2010.07.008	443	29.53	1.80
HAN H, 2015, INT J HOSP MANAGE	10.1016/j.ijhm.2014.11.004	398	36.18	2.40
VERMA VK, 2018, J CLEAN PROD	10.1016/j.jclepro.2017.10.047	375	46.88	5.17

(Source: Author's Analysis**)**

Consumers and Planned Behavior:
The TPB, derived from the Theory of Reasoned Action (TRA) (Ajzen, 1985, 1991), is a well-established framework for understanding individual decision-making processes. Recognized for its enhanced predictive accuracy, the TPB is particularly effective in forecasting guests' intentions to visit or revisit green hotels (Han et al., 2010). Kim and Hun (2010) further refined and expanded the TPB by integrating additional variables, including environmental concern, customer effectiveness, and environmentally conscious behavior, alongside the original constructs of attitude, subjective norms, and perceived behavioral control.

Willingness to Pay a Premium for Green Hotels:
Green hotels often command higher prices due to the substantial investments required for eco-friendly features. Perceived corporate social responsibility drives customers' willingness to pay a premium, with female customers more inclined than males to pay extra and share positive word-of-mouth (Han et al. 2011) . Similarly, Millar and Baloglu (2011) noted that guests are generally willing to pay slightly more for green rooms, with business travelers showing greater willingness than leisure travelers. It is considered that green hotel image and guests' attitude about

sustainability or green conscious behavior effect visit or revisit intention and willingness to pay premium on hotels (Han et al. 2009). Lee et al. (2010) reinforced these findings, emphasizing that green hotel branding strongly impacts customers' behavioral intentions. However, regional variations exist, as Manaktola and Jauhari (2007) found that Indian consumers, despite preferring green practices, are unwilling to pay more for such services.

TPB Extensions:
The TPB has been extensively utilized by scholars to predict green hotel behavior, with numerous extensions to its three core variables to enhance its applicability. Han and Kim (2010) expanded the framework by incorporating image, service quality, and past behavior, while Luong and Nguyen (2024) introduced social media influence as a modifying variable to predict Vietnamese guests' behavior when visiting green hotels. Furthermore, Wang et al. (2022) reinterpreted the TPB through the lens of goal framing theory, demonstrating a positive correlation between gain, normative, and hedonic goal frames and behavioral intention.
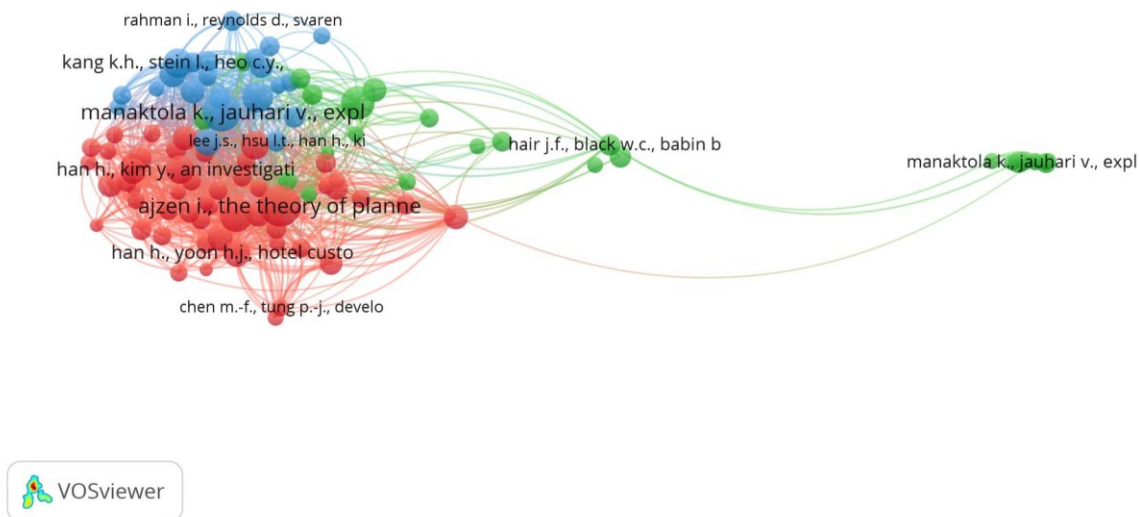
Co-Citation Analysis:
The three most co-cited works are Han et al. (2010) with 1,489 citations, Ajzen (1991) with 396 citations, and Kim (2010) with 408 citations. Table 2 outlines the top 10 co-cited references, and Figure 2 illustrates the co-citation network in green hotel research. The analysis identifies three interconnected clusters:

Cluster 1 (red), focused on "Tourist Willingness to Pay More for Green Hotels," shows that eco-conscious consumers are willing to pay a premium, driven by perceived value and quality (Lee et al., 2010; Hameed et al., 2022). However, regional variations exist, as Manaktola and Jauhari (2007) found Indian consumers hesitant to pay extra despite favoring green practices.

Table 2:-listing of articles based on co-citation analysis.

Author	Citations	Link Strength
Han H.2010	1489	12617
Ajzen I.	396	4936
Kim Y.	408	4867
Hair J. F.	301	4441
Sarstedt M.	304	4340
Ringle C. M.	260	3893
Lee J. S.	255	3232
Rahman I.	270	3047
Wang I.	234	2940
Lee S.	260	2773

Source: Author analysis

Figure 2:- Co-citation mapping analysis(Source : Author's own analysis).

Han et al. (2009) found that women and older consumers are more willing to pay a premium for green hotels, though their advocacy outweighs their spending. These groups also showed stronger positive perceptions, attitudes, and intentions to visit and recommend green hotels.

Cluster 2 (Green): TPB's Predictive Power:
This cluster highlights the TPB's strength in predicting behavior, outperforming the TRA in forecasting green hotel visits (Han et al., 2010). Kim and Han (2010) enhanced the TPB by adding perceived effectiveness and environmental concerns, improving its accuracy.

Cluster 3 (Blue): TPB Extensions in Green Hotels:
Han and Kim (2010) expanded the TPB by adding image, service quality, and past behavior, while Luong and Nguyen (2024) introduced social media influence to predict Vietnamese guests' green hotel behavior. Wang et al. (2022) reframed the TPB using goal framing theory, linking gain, normative, and hedonic goal frames to behavioral intention.

Co-Word Analysis:
From 2,115 keywords, 19 met the threshold of 20 occurrences. The most frequent were "green hotels" (111), "sustainability" (55), and "green hotel" (108). Table 3 lists the top 10 keywords, while Figure 3 shows the co-word network, highlighting three major clusters (red, green, blue) that represent core themes in green hotel research.

Table 3:- Top 10 Keywords.

Rank	Keyword	Occurrences	Total link strength
1	Green Hotels	111	45
2	sustainability	55	41
3	Green hotel	108	39
4	tourism	26	28
5	Theory of planned behavior	21	22
6	Green practices	23	21
7	Hospitality	18	20
8	Environmental concern	18	19
9	Hotel industry	26	16
10	attitude	17	14

Source: Author's own analysis

Figure 3:- Co-word analysis of articles.
Source: Author's own analysis

Cluster 1 (Red): Factors of Consumer Green Hotel Intentions
This cluster, with 21 keywords, focuses on factors influencing green hotel choices. The Theory of Planned Behavior (TPB) remains central (Nimri et al., 2020; Yeh et al., 2021), yet a persistent attitude-behavior gap exists. Despite positive attitudes and environmental concerns, consumers often fail to act, explaining stagnant green hotel bookings (Wang, 2022; Wang et al., 2019).

Cluster 2 (Green): Green Hotels and Sustainable Tourism
This cluster, consisting of 20 keywords, explores the evolving role of green hotels in fostering sustainable tourism, which seeks to mitigate environmental degradation while addressing economic and socio-cultural challenges (Torres-Delgado and Saarinen, 2014; Pan et al., 2018). Beyond their operational scope, green hotels align with broader global agendas by supporting key Sustainable Development Goals (SDGs), such as ensuring access to clean water (SDG 6), promoting renewable energy (SDG 7), encouraging sustainable consumption patterns (SDG 12), and combating climate change (SDG 13) (Ahmed et al., 2021; Abdou et al., 2020). Their integration into these frameworks highlights their potential as catalysts for transformative change in the tourism industry and beyond.

**Cluster 3 (Blue): Customer Satisfaction Toward Green Hotels**
With 12 keywords, this cluster underscores the importance of customer satisfaction in green hotels. High service quality is critical, with Lee and Cheng (2018) developing the Green Lodging Service Quality (GLSERV) scale to evaluate and enhance customer experiences.

Bibliometric Analysis and Thematic Trends
Using Biblioshiny in RStudio, keyword density and centrality were analyzed. Recent trends (2024) highlight "personal norm" as a prominent keyword, while "green hotel/hotels" and "sustainability" dominate in density and co-occurrence (Figure 4). A thematic map of 426 publications (Figure 5) identifies basic themes like social media, eco-friendly hotels, and TPB; niche themes such as extraversion and environmental management systems; and emerging themes like eco-friendly behavior and sustainable hotels. The findings reveal TPB, loyalty, and satisfaction as foundational, with emerging themes exploring predictors of premium payments and niche themes addressing demographics and environmental management systems.
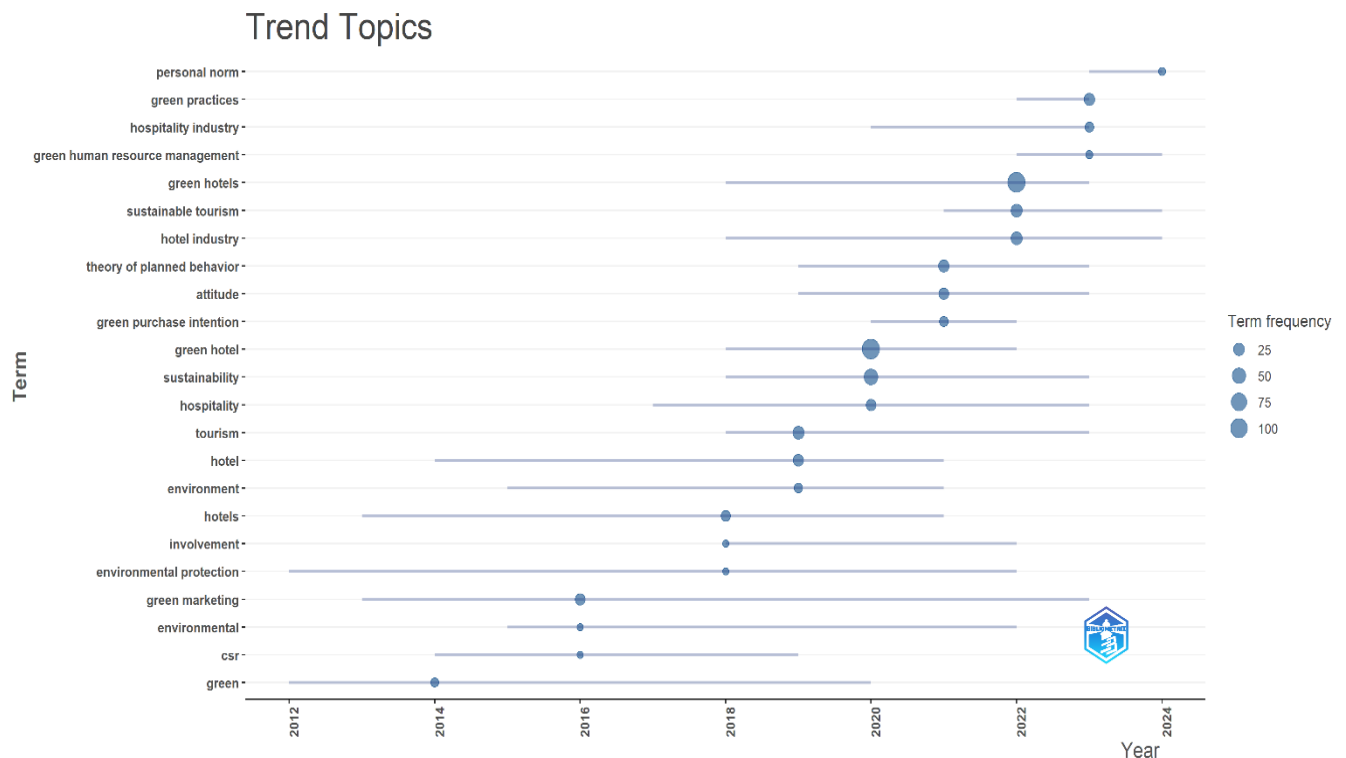
Figure 4:- Temporal Evaluation of Keywords.
(Source: Author own analysis)
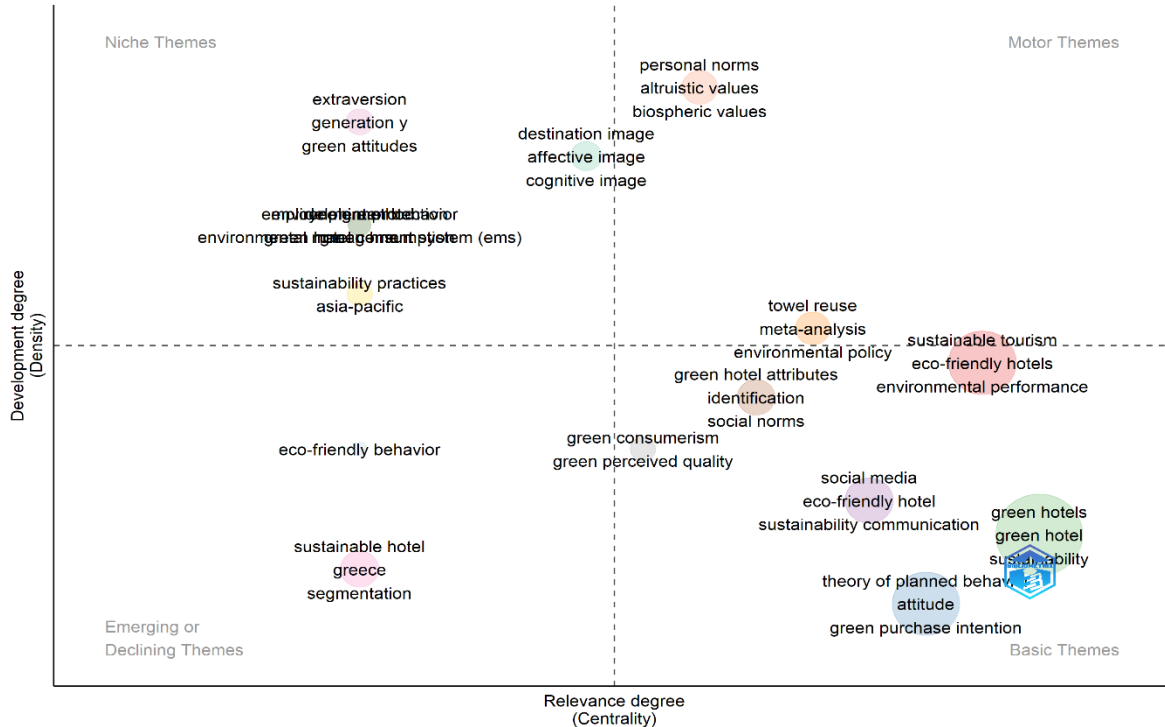
Figure 5:- Thematic Map Analysis.
(Source: Authors own analysis**)**

Co-authorship analysis
This study identifies the leading contributors to green literature globally, with Dr. Han emerging as the most prolific author, having published 25 articles as either lead or co-author. Dr. Wang follows, contributing 13 articles in prominent hospitality journals, while Dr. Wong and Dr. Lee have published ten and seven articles, respectively. In terms of academic impact, Dr. Han leads with 6,565 citations, followed by Dr. Wang and Dr. Wong, who have garnered 589 and 372 citations, respectively.

Table 4:- Top 10 co-authors in green hotel literature.

No	Top co-authorship	Document	Citation	Total link strength
1	Han, Heesup	25	6565	11
2	Wang, Lei	13	589	16
3	Wong, Philip Pong Weng	10	372	16
4	Lee, jin-soo	7	2229	7
5	Patiar, anoop	6	299	0
6	Zhang, Qi	6	125	12
7	Ali, faizan	5	554	4
8	Acampora. Alessia	5	349	7
9	Merli, Roberto	5	349	7
10	Yu, jongsik	5	154	6

(Source: Authors analysis**)**

Discussions and Conclusions:-
This study investigates the progression and future trajectories of green hotel research, identifying central themes and emerging trends. Through citation analysis, it reveals a predominant emphasis on consumer behavior, especially the inclination to pay higher prices for green hotels compared to traditional alternatives. The Theory of Planned Behavior (TPB) is recognized as the leading framework for understanding such behavioral intentions. Research has shown that augmenting the TPB with theories such as the value-belief-norm theory (Han, 2015) and goal framing

theory (Wang et al., 2022), or by introducing variables like environmental concern, image, service quality, and social media influence (Wang et al., 2022; Luong and Nguyen, 2024), has substantially improved its applicability and precision in varied scenarios, thereby enriching its predictive utility. These modifications and extensions have not only refined the TPB but also advanced research in the domain of green hotels. To stay competitive and financially viable, green hotels must match or surpass the service quality of conventional hotels while upholding their environmental advantages.

Conclusion:-

Green hotels are a pivotal step toward global sustainable development, successfully reducing energy consumption and waste. However, academic recognition remains limited, with only 532 peer-reviewed articles published since 1994. Bibliometric analyses emphasize consumer behavior and satisfaction as central themes. To boost adoption, efforts must focus on (1) supporting service providers in transitioning to green hotels and (2) raising consumer awareness of their benefits. This shift is vital for aligning with Sustainable Development Goals (SDGs) and advancing sustainable tourism. Public education on the environmental, social, and economic advantages of green hotels is key to fostering widespread acceptance and driving a sustainable tourism ecosystem.

Theoretical Implications:

Building on the work of Fauzi et al. (2023), this study employs the Theory of Planned Behavior (TPB) to explore environmentally conscious tourism, emphasizing how its core components—attitude, subjective norms, and perceived behavioral control—positively drive green purchasing behavior and influence decisions to choose green hotels (Bashir et al., 2019; Nimri et al., 2020). Although the TPB has been extensively applied in both its original and extended forms, scholars advocate for its further integration with complementary theories to strengthen its predictive capabilities (Wang et al., 2022).

Practical Implications:

This review offers actionable insights for hoteliers and service providers. Pricing strategies should emphasize the long-term benefits of green hotels, despite high initial investments. Effective communication about their environmental and economic advantages can encourage pro-environmental behavior, such as choosing eco-friendly accommodations (Akel and Noyan, 2024). Governments and regulatory agencies should incentivize green practices, especially for small and medium enterprises. Green marketing programs, like discounts for eco-friendly actions, can attract visitors and promote sustainable practices (Chia-Jung and PeiChun, 2014; Van Huy et al., 2023).

Female consumers, who exhibit stronger pro-environmental attitudes, represent a key market segment. Tailoring strategies to appeal to them can drive demand for green hotels and foster broader adoption of sustainable tourism practices (Han et al., 2009; Nimri et al., 2020; Moise et al., 2021).

Limitations and Future Research:-

This bibliometric review has limitations, including its reliance on peer-reviewed, English-language articles and the subjective nature of cluster theme extraction. Future research could explore alternative methods like bibliographic coupling to uncover current trends. Additionally, the dominance of specific scholars, such as Heesup Han, may limit the diversity of perspectives in the field.

Future research should examine alternative theoretical frameworks, such as the Protection Motivation Theory, Theory of Consumption Value, and Stimuli-Organism-Response (SOR) model, to deepen the understanding of cognitive and emotional drivers behind green hotel preferences (Ahn and Kwon, 2020; Olya et al., 2019). Additionally, studies should investigate the influence of leadership in advancing sustainable practices and assess how green hotels contribute to achieving Sustainable Development Goals (SDGs), including clean water (SDG 6), affordable and clean energy (SDG 7), responsible consumption and production (SDG 12), and climate action (SDG 13), across diverse geographical contexts (Abdou et al., 2020).By aligning operational practices with these goals, green hotels can achieve both economic growth and sustainability, ensuring a balanced approach for future generations.

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