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Systematic Review

Investigating Ecotourism Opportunities Measurements in a Complex Adaptive System: A Systematic Literature Review

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Abstract: Identifying and quantifying ecotourism opportunities are critical processes in sustainable tourism planning, which is challenging, since ecotourism is a Complex Adaptive System (CAS). This study investigated Ecotourism Opportunities Measurements (EOMs) in the literature and mapped the research trends to provide practical implications for research in this area. A systematic quantitative literature review began with a scientometric analysis in CiteSpace to examine the existing knowledge and the state of the art in EOMs. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol was then applied to refine the initial search results, and snowballing was used to collect additional articles. The refined set was then thematically coded and quantitatively analyzed. Our findings show that existing studies on ecotourism opportunities predominantly focus on the impacts of ecotourism on the environment, stakeholders' contributions toward ecotourism development, sustainability, and responsible behavior of local communities in ecotourism promotion. In addition, five dimensions have been identified under which ecotourism opportunities can be measured, including nature, environmental education/protection, sustainability, socio-cultural benefits, and tourist satisfaction. Existing scales or indices assess potential destinations qualitatively rather than quantitatively. In contrast, an index-based approach might help to solve the challenges of evaluating ecotourism opportunities as a CAS, as well as to quantitatively assess potential destinations to support decision-making related to ecotourism promotion.

Keywords: ecotourism opportunities measurements; scientometric; systematic review; complex adaptive systems theory

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1. Introduction

Ecotourism is a nature-based, sustainable, learning- and management-demanding form of tourism that encourages conservation, educates visitors and residents, and provides economic benefits to local communities [1–6]. Ecotourism opportunities combine natural, environmentally aware, culturally educative, and sustainably managed conditions that give value to a place [7–9]. These include qualities provided by nature (vegetation, landscape, topography, and scenery), qualities associated with environmental and cultural awareness (visitors and host communities), and sustainable conditions provided by management (developments, road networks, and regulations) [10–14]. These opportunities are strongly interconnected to manage tourism operations; they are also dynamic and develop in an adaptive fashion [7,11,15–17]. Learning is part of the nature of these opportunities [2,9,14]. Thus, when certain events, whether internal or external, natural or anthropogenic (e.g., natural disasters, economic fluctuations, climate change, epidemics (such as COVID-19), changes in demography), challenge the existing opportunity structure, the system shifts from its steady-state condition to new dynamic paths, which will be impermanent and modifiable [18–23]. Ecotourism's components evolve, learn, and adapt to their environment without losing their identities [18–20,22,24]. This complexity can be analyzed through studying ecotourism opportunities as a CAS.

There is no single, widely agreed definition of a CAS. However, many definitions suggest that a CAS is a multi-component, dynamic, non-linear, unstable system with the inherent capacity to learn and adapt to changes by reconfiguring its structure [18,25–28]. CASs continually interact with the external environment, adapt to changes, and adjust both their structure and behaviors [29,30]. At the same time, they, in turn, affect the environment, which means that they are dynamic and change over time. Moreover, a CAS is self-organized to optimize the existing resources and enable the system to face external or internal pressures.

CASs have been applied as a tool for conceptualizing tourism systems [18,31], understanding destination governance and management [20,29,32], developing sustainable tourism [33], and analyzing regional tourism organizations [19]. Stevenson, et al. [34] believe that a tourism system is developed by the interconnection of various parts, for example, through the natural attractions that appeal to visitors and visitors' needs for suitable accommodation, transportation, and security. Tourism systems are complex, as each element (attractions, accommodation, activities, etc.) within the system has its own identity, which emerges from the interaction of essential connections (supply and demand, supporting institutions, transit regions, environmental influences, etc.), variables (culture, peace, security, etc.), and processes (development, management, conservation, etc.); they are adaptive because these elements can evolve, learn, and work toward adjusting to their surroundings along with their parts [18–20,33].

Over the past three decades, a body of literature has emerged acknowledging the interconnected and learning features of ecotourism opportunities [35–41]. For instance, Lindberg and McKercher [36] reviewed a variety of ecotourism definitions and found that the overall goal of ecotourism management strategies is to control the interaction between tourists and the natural environment. They developed separate indicators for tourists and the natural environment to evaluate the progress of management systems towards desirable ecotourism outcomes. Weaver and Lawton [37] evaluated ecotourism's predefined goals by investigating the relevant academic literature regarding ecotourism. They clearly explained the interconnection among ecotourism opportunities on both the supply (protected areas, attractions, tour operators, among others) and demand (ecotourists, policies, planning, etc.) sides. Moreover, they also confirmed the adaptive nature of ecotourism opportunities, demonstrating that the external environment has strong effects on ecotourism opportunities by citing the impacts of foreign relations on ecotourism in South Africa [42], the negative effects of agricultural colonization on an ecolodge in the Amazon region of Peru [43], and so on. Romero-Brito, et al. [38] analyzed 214 cases worldwide where non-governmental organizations (NGOs) used ecotourism for conservation aims. The authors observed that the interconnections between stakeholders are often complex, and partnership arrangements influence governance, management, and outcomes of projects. Cabral and Dhar [44] conducted an integrative literature review on ecotourism in the Indian context to understand various perspectives through critical analysis and to identify gaps for future research. They found that the literature has established an interrelationship between the three dimensions of ecotourism opportunities: economic sustainability enhances local communities' living standards by creating jobs; ecotourism infrastructure development empowers vulnerable groups; and environmental awareness leads to environmental conservation. Ismail, et al. [39] reviewed the literature relating to ecotourism and identified that ecotourism's interconnections protect the environment, encourage local residents, and respect the socio-cultural traditions of the local community.

Ecotourism opportunity measurements (EOMs) are an important tool for supporting the development and management of ecotourism destinations. They produce systematic evidence for the degree to which a particular program can achieve its proposed objectives and the extent to which other unexpected consequences may arise [45,46]. Studies on EOMs have proliferated over recent decades to evaluate the potential of ecotourism destinations, and have ranked them with an aim to produce sustainable biodiversity conservation and to encourage the development of local communities [12,45,47–49]. In addition to

being useful for development and management purposes, EOMs provide a mechanism for communicating the importance of sustainable development [50] and enhancing visitors' awareness and understanding of the destination to ensure an appropriate match between tourists' expectations and experiences. EOMs can be used to better equip visitors to assess ecotourism destinations, just as tourists are able to anticipate what may be expected from hotels by virtue of their category or star rating [45]. Finally, longitudinal monitoring of EOMs can also help to generate early warning signals before the onset of crises, providing efficient information about all functions of the administration, human resources, land management, services, and programming [20,29,34,51].

EOMs often take Linear or Newtonian approaches to describing ecotourism systems. Newtonian approaches generate well-developed knowledge in some selected parts of the tourism system, but produce little knowledge of the relationships and interactions between these parts [34]. Moreover, the Newtonian approach considers the tourism system to be stable and balanced in the face of any type of external or internal triggering actions (e.g., natural disasters, economic fluctuations, climate change, epidemics (COVID-19), and changes in demography) [29,52]. Yet, recent COVID-19-related total losses in tourism revenue exceeded USD 2 trillion for 2020 and 2021 [53]. A Newtonian approach considers the tourism system to be in balance and implies that there is no need to take any precautionary measures against potential change. Thus, when change begins to occur, it often damages the existing system. An example of this has been documented at Mt. Rigi, Switzerland, where actions that triggered change to the tourism system, such as economic growth in China, terrorist activities in two other competing destinations, and the closing of another alternative destination in Switzerland, increased visitation dramatically and produced serious challenges for the local tourism industry [22].

Empirically examining ecotourism opportunities as a CAS can help to understand the linkages and relationships that exist within tourism systems and help stakeholders in understanding tourism mechanisms, planning, management, and development [54,55]. Although the current tourism literature provides an excellent understanding of CAS theories, EOMs studies in particular typically use a linear approach to EOMs, and few take a complexity theory lens to investigate ecotourism opportunities [45,48,56]. Therefore, this review explains the benefits of considering EOMs as a CAS, which constitutes an original contribution to the field of ecotourism.

Moreover, as our review will demonstrate, current studies on EOMs evaluate ecotourism opportunities qualitatively rather than quantitatively. Arguably, scholars lack an effective overview of EOMs, which would enable them to discern the frameworks and methods applied to this topic. A comprehensive review of the current literature on EOMs is required, and must be specifically designed to assess the theoretical and methodological trends and shifts since the publication of previous systematic studies (e.g., [43]). This study provides an in-depth understanding of the current state of the science of EOMs through a comprehensive literature review, the findings of which are then considered through the lens of complexity theory to discuss and draw implications for ecotourism planning and development practice.

This paper is structured as follows: The next section describes the adopted methods to collect the relevant material and analyze it. Section 3 presents the results in three segments: the first segment shows the results of the scientometric analysis, while the second segment discusses the systematic analysis of the literature, and the third segment exemplifies the insights that can be derived from a CAS approach using the ecotourism opportunities system of Alula, Saudi Arabia. Section 4 presents a discussion with practical implications of the results, and Section 5 details the conclusions of the study.

2. Materials and Methods

We started with the systematic quantitative literature review method developed by Pickering and Byrne [57]. Our development of this systematic approach consisted of a combination of structured and semi-structured phases (Figure 1). In phase 1, a keyword

strategy was adopted to search the relevant literature. After removing duplicates, the PRISMA protocol was used to filter the corpus and a snowballing procedure was adopted to collect additional literature (see Supplementary Materials Files S1 and S2). Phase 2 consisted of analysis; scientometric analysis was performed using CiteSpace to analyze the research trends. Quantitative analysis was applied while CAS theory was used to describe the features of complexity in a destination. The following section will explain these methods in detail.

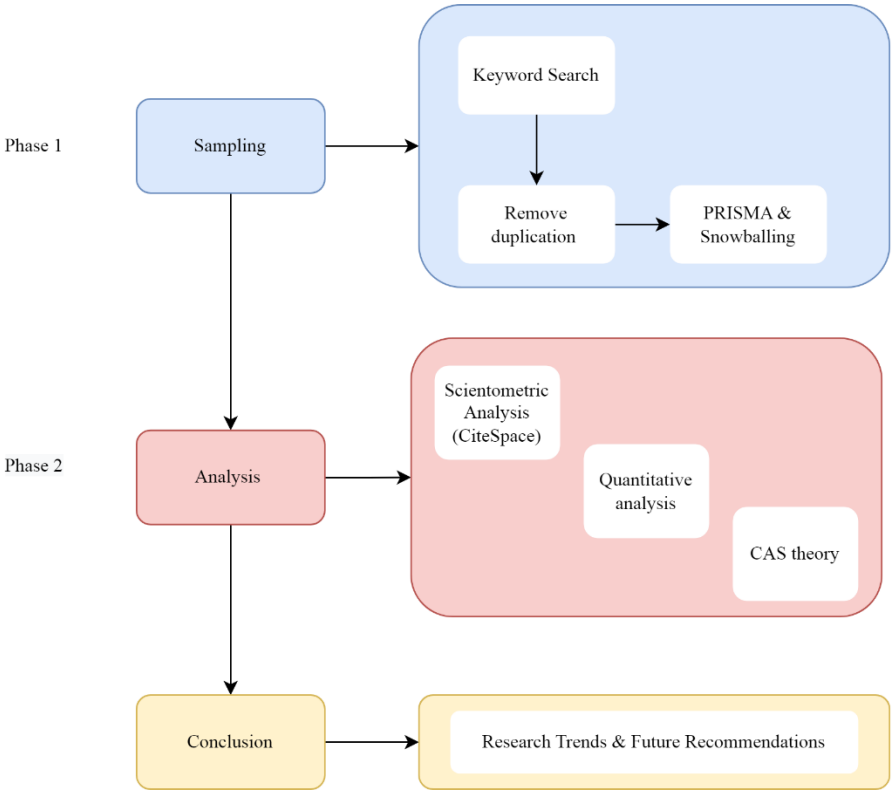

Figure 1. Research workflow.

2.1. Sampling Phase

A relevant keyword string (ecotourism, sustainable tourism, opportunities*, measurements*, index*, conservation, and protection) applied in Scopus, ProQuest, and Web of Science, yielded 957 publications. After removing 35 duplicates, 922 publications (large corpus) were collected, and 865 less relevant publications were excluded by one reviewer through applying the PRISMA protocol (Figure 2) [58], leaving a corpus of 57 peer-reviewed publications. These articles were then used as a starter set with the snowballing technique to find additional papers. In snowballing, the reference list (backward snowballing) and citations (forward snowballing) were reviewed [59]. The snowballing procedure produced 10 relevant studies that expanded the small corpus to 67 articles.

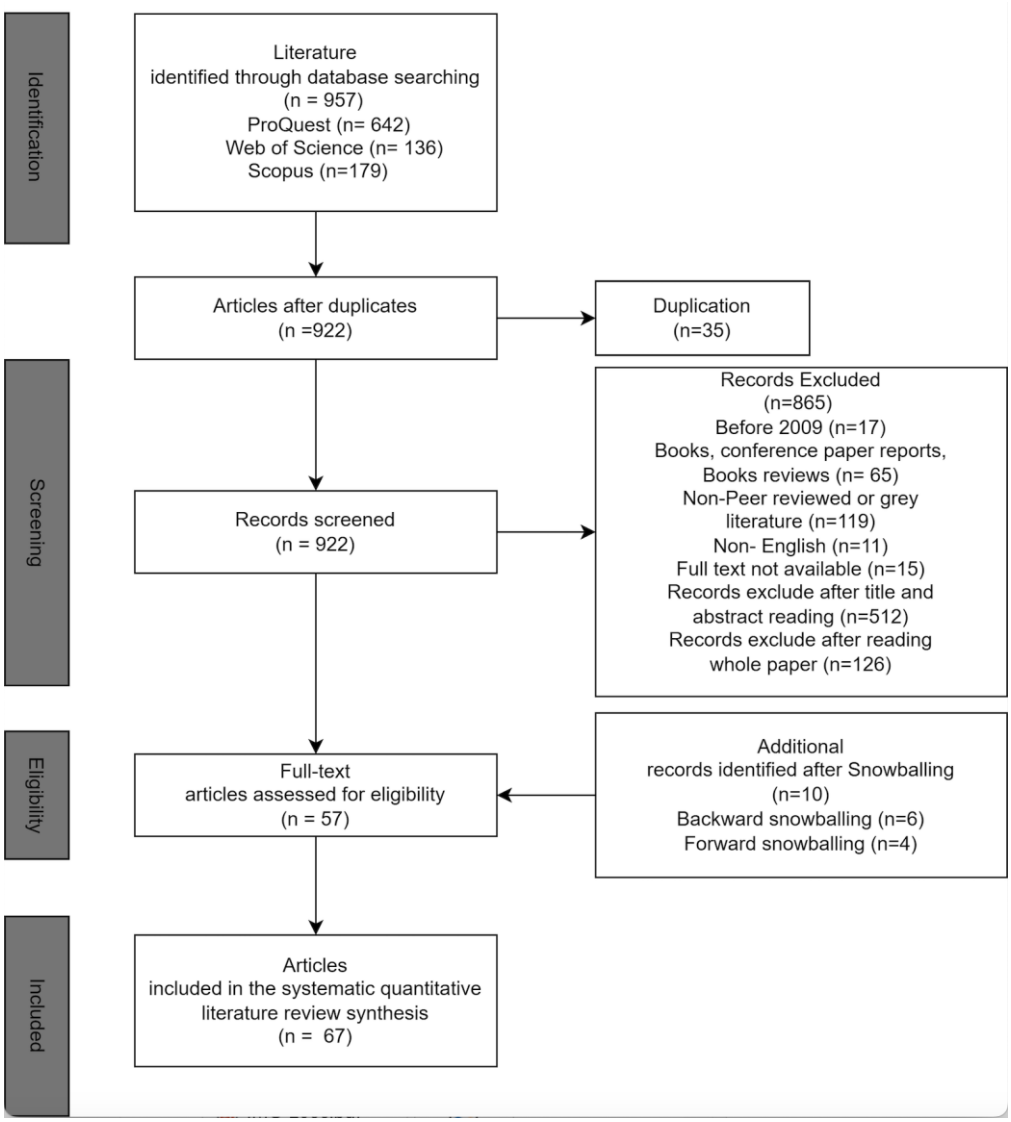

Figure 2. PRISMA protocol with snowballing.

2.2. Analytical Phase

CiteSpace is a scientometric application that is widely used in interdisciplinary fields to visualize the knowledge domain [60–62]. We performed Document Co-citation Network (DCN), Author Co-citation Network (ACN), and Journal Co-citation Network (JCN) analyses using the large corpus. Keyword co-occurrence analysis was used to monitor EOMs research trends and to project future research directions. We then identified articles' publication trends per year and assessed their spatial distribution worldwide.

In the systematic quantitative analysis, content analysis methods were used by one coder to analyze relevant articles, as this helps in examining trends and patterns in documents [63] and is applied widely in tourism research [2,64–67]. We thematically categorized the literature in the small corpus to find the most repeated trends, theories, and methodological approaches. We used these frequencies to describe the foci of existing studies and to produce tables, maps, and charts. We then applied CAS theory to a developing destination, namely Alula, Saudi Arabia, to exemplify the features of complexity in the ecotourism opportunities system.

3. Results

3.1. Scientometric Analysis

3.1.1. Document Co-citation Analysis

Figure 3 shows the DCN, including 532 references cited and 2131 co-citation links. The silhouette score measures the quality of a clustering configuration [62]. Its value varies between −1 and 1. A high value indicates more uniformity among the cluster members [68]. The first five clusters' silhouette scores are presented in Table 1. These scores indicate that the clusters are moderately reliable due to their closeness to the highest value of 1. Cluster #0, "first assessment", is the largest cluster, with 89 records. The core article of this cluster, with the title "Evaluating the net effects of ecotourism on the environment: a framework, first assessment, and future research", was written by Buckley [10], and the captured articles focus on the impacts of ecotourism on the environment.

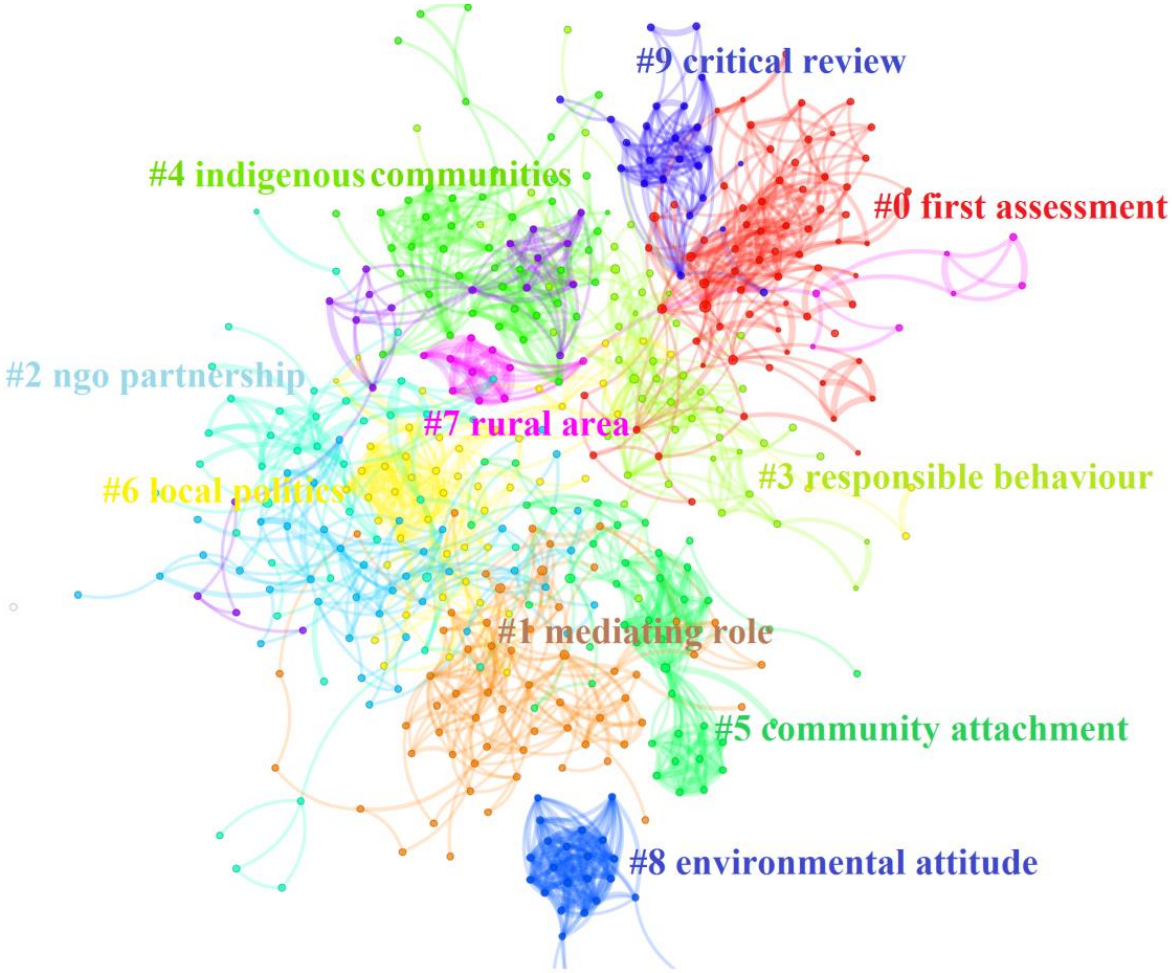

Figure 3. A visualization of the Document Co-citation Network (DCN).

Table 1. Scientometric analysis.

Top Five Clusters in the DCN					
Cluster	0	1	2	3	4
Size	89	80	79	70	64
Silhouette score	0.734	0.653	0.699	0.672	0.754
Top terms	First assessment	Mediating role	NGO partnership	Responsible behavior	Indigenous communities
Mean year	2009	2012	2010	2014	2009
Top Five Most Cited Papers in the DCN					
Citations	747	676	531	512	395
References	[37]	[66]	[69]	[70]	[71]
Cluster ID	0	0	0	2	0
Top Five Most Cited Authors in the ACN					
Author *	Honey M	Anony-mous	Weaver DB	Buckley R	Scheyvens R
Frequency	139	136	133	114	98
BC	0.05	0.01	0.09	0.04	0.07
Top Five Most Cited Journals in the JCN					
Journal	Tourism Management	Annals of Tourism Research	Journal of Sustainable Tourism	Journal of Ecotourism	Ecological Economics
Frequency	447	361	260	250	174
BC	0.01	0.01	0.02	0.03	0.02
Impact Factor	7.4	4.2	3.4	2.4	3.9
Top Five Most Frequently Co-Occurring Keywords from 2009 to 2019					
Keywords	ecotourism	tourism	conservation	management	protected area
Frequency	422	240	132	89	79
BC	0.14	0.14	0.19	0.18	0.11

* The second-most cited author was "Anonymous", reflecting documents with no identified author. This cluster would likely be composed of multiple authors. Therefore, we excluded this cluster from further analysis.

Table 1 also shows the top five most-cited papers among the large corpus. A review paper, "Twenty years on: The state of contemporary ecotourism research" by Weaver and Lawton [37], has the highest number of citations in this list. Papers in the large corpus frequently cited this paper to understand the concept of ecotourism and to assess the extent to which the relevant academic literature was engaged in investigating the phenomenon of ecotourism.

3.1.2. Author Co-citation Analysis

Figure 4 shows that the most frequently cited author in the large corpus is Honey. This author is shown as a key node due to their high Betweenness Centrality (BC) value. Betweenness Centrality measures the amount of information that emerges from these nodes. Honey covers the largest area of Figure 5, with a frequency size of 139. Table 1 lists the top five most frequently cited authors. Comparing this with the DCN, a moderate, consistent correlation was observed, as both Buckley and Weaver also appeared in the top five most cited documents.

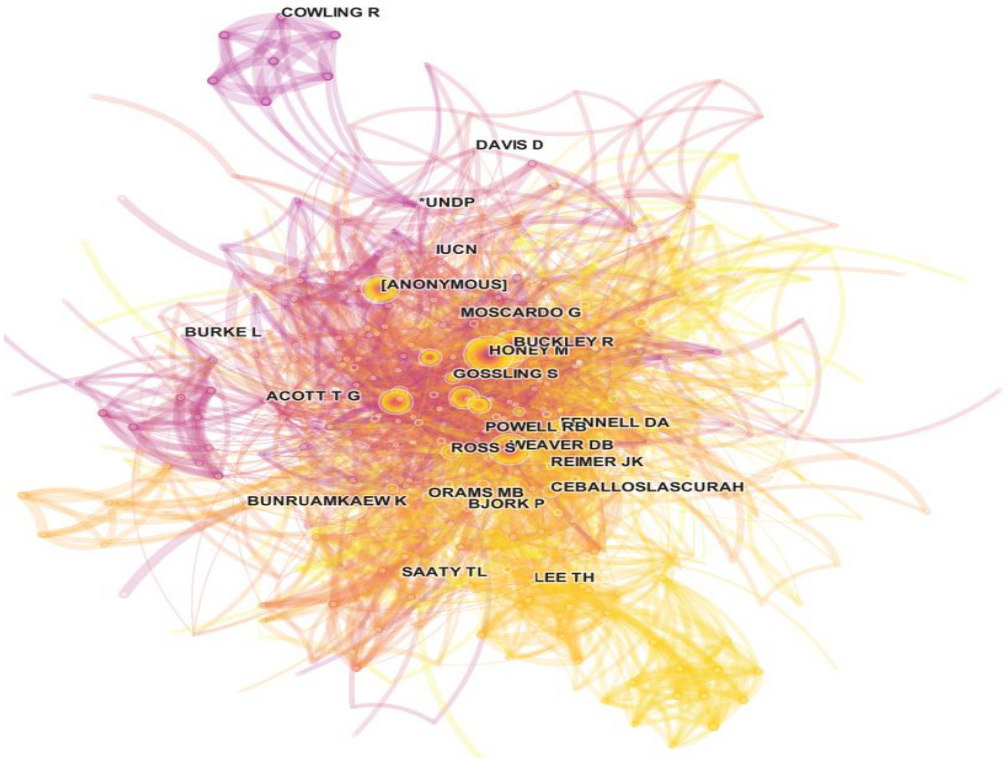

Figure 4. Author Co-citation Network. Starred authors are cited by other authors in the corpus, but they do not cite other authors in the corpus. (* According to CitSpace manual, CiteSpace marked time consuming queries "*" i.e. the UNDP cluster is somewhat relevant to the main theme of the CAN.).

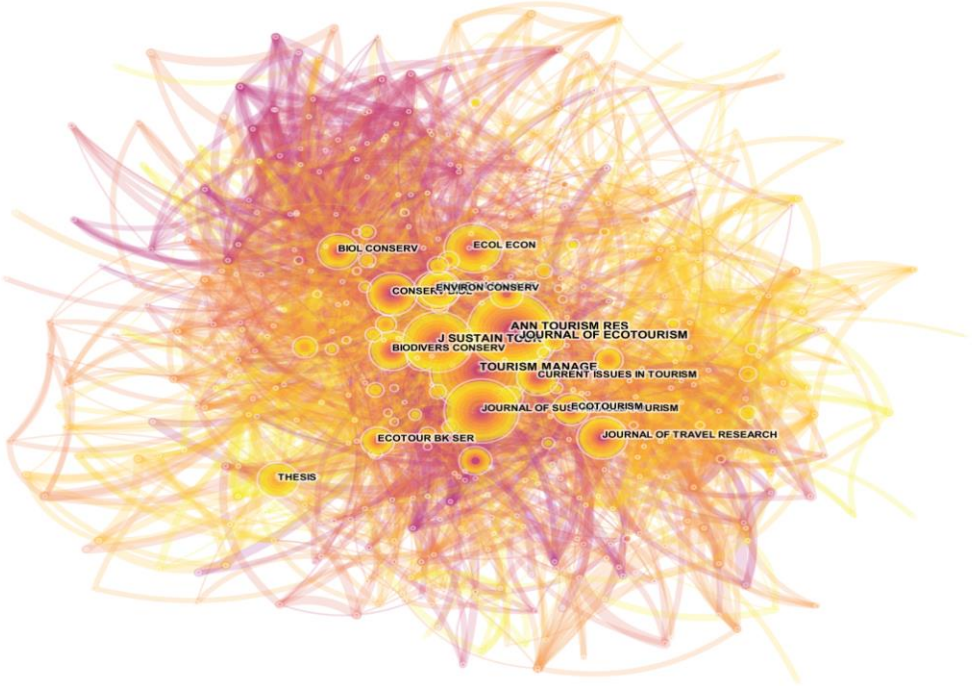

Figure 5. Journal Co-citation Network (JCN).

3.1.3. Journal Co-citation Analysis

The JCN displayed the journals that received significant numbers of citations for EOMs research (Figure 5). It showed that EOMs studies were cited in 530 different journals. *Tourism Management* was most prominent, with 447 co-citations. Table 1 displays the top five most cited journals in the large corpus. It can be observed that journals with higher impact factors generally have greater co-citation frequencies. This work has provided a systematic approach to identifying the publications with the most frequent discussion of EOMs, and has illustrated that a diverse body of knowledge influences studies of EOMs.

3.1.4. Keyword Analysis

Figure 6 shows the keyword analysis, where "ecotourism" received the most citations (Table 1). Figure 7 demonstrates the use of keyword burst analysis to visualize the year of the first mention of each topic and its duration. The analysis identified 456 keyword bursts. For example, popular research terms in 2009 included "Gi" (geographical investigation) and "national park", while 2010's hot topic was "reserve". Research topics from 2011 to 2015 were focused on "biodiversity" and "landscape". Figure 7 also demonstrates the distribution of burst terms at different times. "Willingness to pay" was the most recent burst term, used mostly from 2015 to 2017.

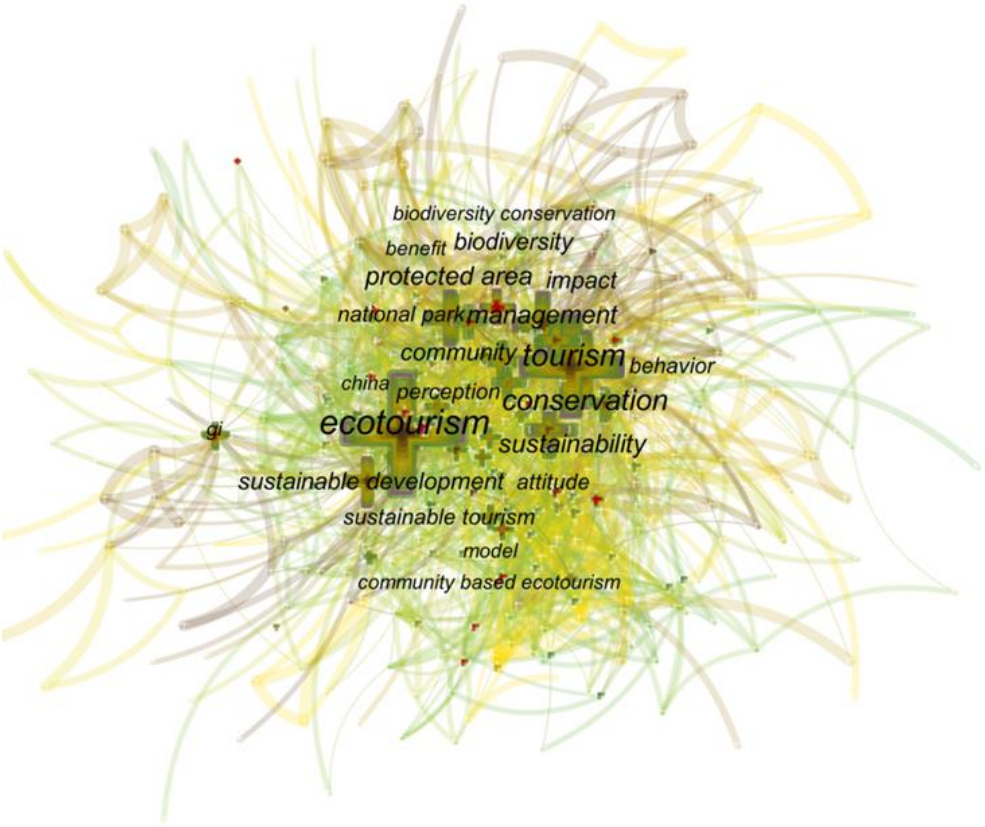

Figure 6. Keyword Co-occurence Analysis.

Keywords	Strength	Begin	End	2009-2019
Willingness to pay	3.7475	2015	2017	
Indicator	3.0061	2015	2016	
Reserve	2.823	2010	2013	
Biodiversity	2.7093	2011	2014	
Contigent valuation	2.4297	2014	2016	
Landscape	2.4171	2012	2015	
National park	2.3164	2009	2010	
Wildlife	2.3092	2013	2014	
Ecological tourism	2.2441	2013	2014	
Empowerment	2.0464	2015	2016	
Nature based tourism	2.0237	2014	2016	
Sunshine cost	1.9242	2015	2016	
Sustainable tourism development	1.9242	2015	2016	
Community participation	1.9095	2014	2015	
Gi	1.8109	2009	2011	

Figure 7. Top fifteen keywords with the strongest citation bursts.

3.1.5. Geographic Locations and Publication Period

The largest number of articles was published from 2016 to 2019 (Figure 8). Almost forty percent of the total articles studied ecotourism in Asia, of which China (n = 36) and India (n = 22) showed the largest number of contributions. Twenty-four percent of articles studied European locations. These publications focused on Portugal (n = 16) and Spain (n = 12). Seventeen percent of articles investigated EOMs within North America, with most publications focused on the USA (n = 26). Twelve articles studied Australia, while the smallest number of publications described South America or Africa. Figure 9 presents the spatial distribution of publications globally, with the largest numbers in Asia and North America, while other continents showed less significant contributions toward research on EOMs.

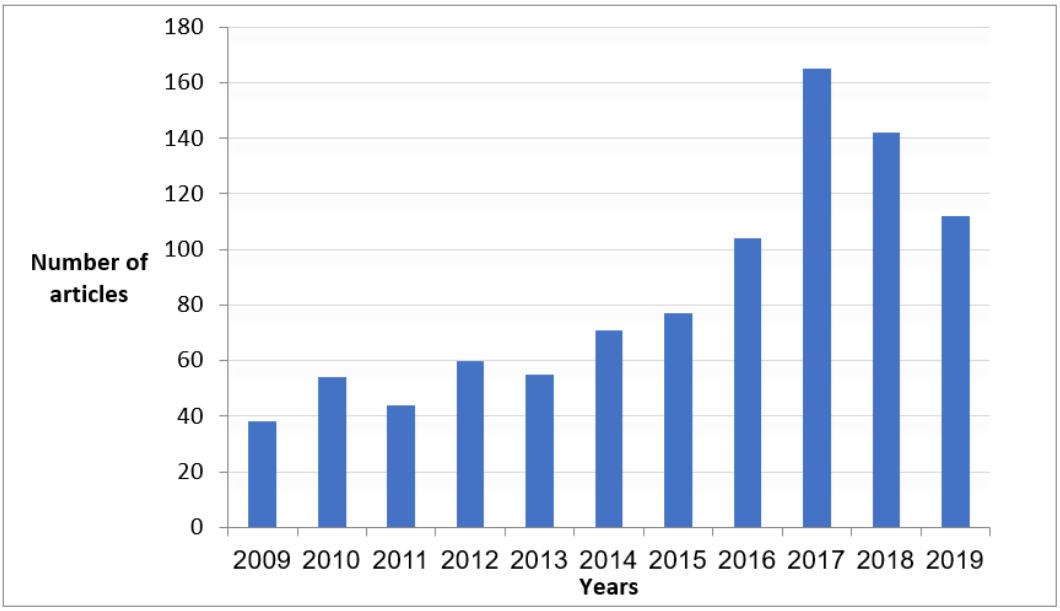

Figure 8. Publication trend from 2009 to 2019 (922 articles).

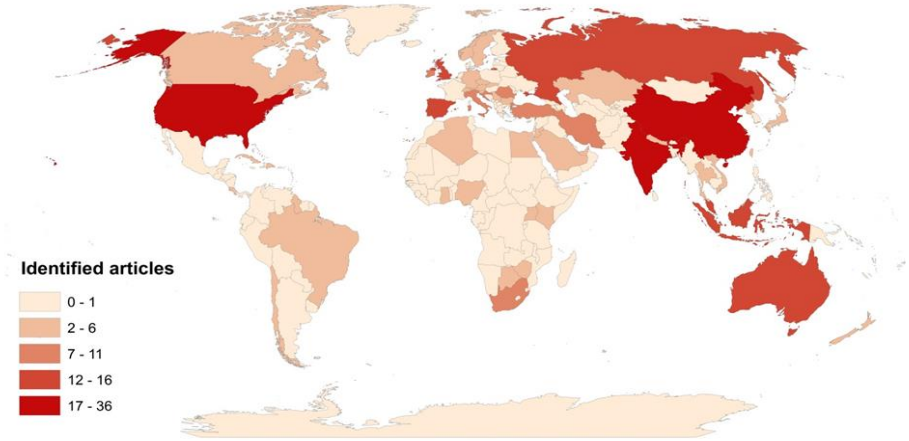

Figure 9. Spatial distribution of published articles.

3.2. Systematic Quantitative Analysis: Exploring EOMs

3.2.1. Ecotourism Opportunities' Dimensions

The most frequently cited papers in the DCN (Table 1) [37,66,69–71] and other literature [10,11,72–78] were analyzed to determine the frequently accepted dimensions of ecotourism opportunities. These are nature, environmental education/protection, sustainability, socio-cultural benefits, and tourist satisfaction. In a EOM, these dimensions can act as an umbrella to set the criteria and variables for the purpose of measuring ecotourism opportunities.

3.2.2. Ecotourism Opportunities Measurements (EOMs)

The method used most frequently to measure ecotourism opportunities in the small corpus was constructing indices. Seventeen indices were developed. Six of them focused on ecotourism specifically [49,79–84] (Figure 10), while two studies worked with the same index [49,82]. These indices explored how socio-economic and trip characteristic variables influence visitors' evaluations of ecotourism.

Index/ Indicators	Study area	Purpose	Analysis Method
Ecotourism Evaluation Scale (Baral et al., 2012)	Ghorepani, Nepal	Ecotourism evaluation by international visitors	Confirmatory Factor Analysis
Index of sustainability for ecotourism (Bhuiyan et al. 2016)	Lake Kenyir, Malaysia	To study sustainability from social, economic, and environmental points of view	Barometer of Sustainability
Assessment of residents' attitude towards ecotourism (Adeleke 2015)	Kwadlangezwa, South Africa	To assess local residents' attitudes towards ecotourism	Confirmatory Factor Analysis
Ecotourism Environmental Protection Measures and Their Effects (Wang et al. 2014)	China	To assess the impacts of industrial growth on Ecotourism Environmental Protection (EEP)	Statistical analysis
Reviewing ecotourism evaluation scale (Baral 2015)	Annapurna Conservation Area (ACA) in Nepal	To test an already developed scale (Baral et al., 2012) with new samples	Confirmatory Factor Analysis
Sustainable Ecotourism Indicators System (SEIS) (Xuling et al., 2009)	Kanas Nature Reserve, China	To analyze tourism's ecological security at natural heritage sites	Delphi method

Figure 10. Measurements in studies on ecotourism opportunities [49,79–84].

3.2.3. Methods and Tools Used in EOMs

Our study identified three methods that could be used for EOMs, as follows:

Ecotourism Opportunities Spectrum (ECOS): ECOS was developed by Boyd and Butler [7] to identify ecotourism opportunities and manage destinations. The small corpus studies used ECOS to identify opportunities and to qualitatively assess the potential of ecotourism destinations [56,84–88].

Ecotourism Potential (EP): EP assesses tourism value to provide coarse-grained indications of opportunities in destinations (such as low, medium, and high numbers of opportunities) without considering how much potential a destination possesses in a quantitative sense [47,56,84,89].

EOMs: EOMs can quantitatively measure ecotourism opportunities and combine these measurements into an index scale to synthesize quantitative evidence about the extent of available opportunities in a destination [45,46], as well as to provide a tool for countries to plan how to attain their tourism visions and goals.

ECOS has contributed to assessing the EP of destinations qualitatively. We did not find any studies that used ECOS to identify or quantify ecotourism opportunities to develop an Ecotourism Opportunities Index (EOI). An EOI can aid stakeholders in assessing the potential destination quantitatively. It may provide a comparable way to measure ecotourism opportunities across multiple sites, which can be difficult due to their variable nature across different destinations. A comparison between the ECOS, EOM, and EP techniques is presented in Figure 11. The comparison shows that these terms are closely related, but the approaches undertake different types of measurement.

Terminology	Measuring Formation	Purpose	Objective	Foundation	Measuring Type
Ecotourism Opportunities Spectrum (ECOS)	Plan OR framework OR procedure	It sets ecotourism opportunities and manages ecotourism	It is to manage ecotourism sites	It is based on the Recreation Opportunities Spectrum (ROS) and the Tourism Opportunities Spectrum (TOS)	Qualitative
Ecotourism Opportunities Measurements (EOMs)	Scale OR Index OR Indicator	It will measure ecotourism opportunities	It will measure the extent or level of ecotourism opportunities in a destination	It will take ECOS as methodology to locate the ecotourism opportunities	Quantitative
Ecotourism Potential (EP)	Application, Mathematical or statistical analysis	Locate ecotourism opportunities to check the potential of a site	Assess the potential of ecotourism site on the basis of opportunities	Ecotourism potential of a site can be analyzed by using different types of methodologies	Qualitative or Quantitative

Figure 11. Comparison between ECOS, EOMs, and EP.

3.3. Ecotourism Opportunities as a CAS

We found few studies using complexity theory to analyze ecotourism opportunities [22,90]. Therefore, we used an example to explain why taking a CAS approach can be helpful for ecotourism practitioners. Four concepts are commonly used to describe CAS [22]. Here, we relate these four concepts to a tourism example in order to show how complexity and chaos theory concepts might be paired with EOMs to help understand the development of ecotourism opportunities. In doing so, we used an analysis of Alula, a little-known but emerging ecotourism and cultural heritage tourism destination in Saudi Arabia.

3.3.1. Butterfly Effect (or Non-Linear Changes)

The butterfly effect is when small changes in initial conditions or the system's environment lead to large-scale, unpredictable, or non-linear changes [22,24]. Saudi Arabia is changing its economic priorities from oil to more sustainable economic activities, such as tourism, and this is acting as an underlying driver, making development in the little-

known destination of Alula more viable [91,92]. Thus, the turning attitude of the Saudi Government acted as an internal factor in developing Alula as a tourist destination. Externally, inspiration came from Petra, Jordan, a developed cultural heritage site which attracts about 100,000 tourists annually [93]. Both Alula and Petra have the same historical heritage features; they were the homes of the Dadan (6th–7th BCE) and Nabataean (4th BCE-106 AD) civilizations, and are both situated on an old "Incense route" [94]. Thus, the tourist system shows sensitivity where internal and external factors alter the system and generate large-scale, unpredictable, or non-linear changes in ecotourism opportunities.

EOMs can help in assessing the potential sites, and can help government agencies to develop destinations in a sustainable manner. They also highlight both the weak and the robust tourism capabilities in accommodation, transportation, food, and effective tourism planning. They can help in responding to non-linear or unpredictable changes by providing information on available ecotourism opportunities. Stakeholders could benefit from a tool that measures ecotourism opportunities to understand the strengths and challenges of a destination's ability to handle outcomes of non-linear change.

3.3.2. The Edge of Chaos

The edge of chaos describes the transition stage in a complex system where orderly behavior coexists with disorderly or turbulent behavior [22]. It is a place of intense learning, innovation, and creativity [34]. Alula is a cultural heritage destination as well as a natural heritage destination; it provides opportunities for preserving tombs, historical developments, monuments, and many more sites, and was ready to favor the government policy for tourism promotion. The Alula tourism system faced an edge of chaos, as it had previously been a little-known place since ancient times due to religious restrictions, strict tourism visa policies, and a lack of tourism infrastructure.

The edge of chaos offers conditions where innovations are needed for a destination. EOMs can help destinations to pursue sustainable tourism development, as discussed by the United Nations Sustainable Development Goals (SDG) Goal 8 [50], and to promote sustainability, as described by SDG Goal 11 [50]. They can help researchers and stakeholders to produce sustainable development plans to protect the tourism system within a destination.

Alula is innovating by becoming an ecotourism destination in addition to a cultural heritage tourist destination. It is an adaptive ecotourism destination promoting its opportunities by developing protected areas (Sharaan Nature Reserve and Sharaan Resort), transportation facilities (building international airports), arranging cultural events (Tentura festivals), and many more opportunities that were not part of Alula before 2016 [95,96]. The mission of Sharaan Nature Reserve is to restore, protect, and conserve the sensitive ecosystem native to Alula. Efforts are currently underway to restore the area, allowing for its natural inhabitants to reclaim the land [97–99]. To bring life to the ecosystem and protect the environment, the Royal Commission of Alula (RCU) set a plan to protect threatened species such as Arabian leopards, Nubian ibexes, red-necked ostriches, and Idmi gazelles. Moreover, they launched the project "Alula trees", which aims to plant three million trees and allocate 80% of Alula as a nature reserve, in which revegetation of 200 species is in progress [97,98].

3.3.3. Bifurcation

Bifurcation is a critical transformation time during which the system tends to have two possible trajectories. If the tourism system can self-organize and refine itself at such a bifurcation point, it will improve and evolve in the emergence process. Due to its significant ecotourism opportunities, the government wants to develop Alula as a tourist destination. However, hurdles such as religious restrictions and strict tourism visa policies initially bifurcated the system, along with a bipolar pattern in which the system aims at tourism promotion (developing tourism infrastructure, preserving natural and cultural places, etc.) but must eliminate the hurdles.

EOMs can provide the foundation to resolve stakeholders' conflicts by developing sustainable tourism opportunities at bifurcation points. EOMs provide information on the potential ecotourism opportunities that the system possesses, and can support opposing parties in exploring a range of potential solutions to disagreements. They also encourage protecting local communities' natural, cultural, and socio-economic interests by measuring them.

3.3.4. Strange Attractor, Self-Organization, and Emergence

Strange attractors, self-organization, and emergence bring the disruption of the system to the development phase. A strange attractor is a force that allows for a self-organizing process, and it is used to attract agents in a specific direction by influencing their behavior [18,24]. A strange attractor can be different in different contexts, either a shared vision in business or a manager with effective communication during a crisis [18,24]. In the tourism case examined herein, the strange attractor was the "Saudi Vision 2030" plan that provided grounds for tourism promotion in Alula. The RCU was established in 2017 to develop tourism infrastructure and satisfy the religious orthodoxy [100].

EOMs can act as strange attractors that encourage the system to self-organize, and they can help to resolve bifurcation in a destination by quantifying the potential of destinations to support the sustainable development of ecotourism opportunities within the destination. EOMs provide tools to measure ecotourism opportunities and, using input from stakeholders, can estimate the ability of a destination to tolerate a given number of tourists. Thus, EOMs can help to develop tourism opportunities in a certain destination.

4. Discussion

The results show that studies on EOMs have proliferated during the last decade; however, the complex adaptive nature of ecotourism opportunities makes measuring ecosystem opportunities challenging and demands systematic approaches, such as ECOS and the use of CAS theoretical concepts. In the scientometric analysis, wherein the top five clusters in DCN were identified, we found that the foundational knowledge and theories in research on EOMs are related to four key themes: (1) ecotourism's impact on the environment; (2) stakeholders' contribution to ecotourism development; (3) sustainability; and (4) responsible behavior of local communities in ecotourism promotion. In the keyword analysis, ecotourism is the biggest node, appearing in almost half of the papers in our database. Moreover, it also occupied about the half of the area in the keyword co-occurrence analysis (Figure 6) due to the repeated use of this keyword across the period whose literature was analyzed. Other related keywords such as tourism, conservation, management, and protected area also enhance the position of the ecotourism field, creating dense connections within it. "Willingness to pay" and "indicator" demonstrated the most substantial citation bursts from 2016 to 2018. Willingness to pay indicates the visitors' intention to protect the environment and promote ecotourism [101,102], whereas indicator refers to ecotourism's sustainability indicators. Visitors' attitudes and social comparisons, for example, comparison with others perceived as doing worse than oneself, influence visitors' willingness to pay [101]. Thus, there is a need to protect the environment and promote ecotourism education. The visitors' satisfaction is necessary to increase the willingness to pay, which might be achieved by enhancing the destination's ecotourism opportunities. Moreover, demonstrating the socio-cultural and economic benefits of ecotourism for local communities may encourage them to be more willing to pay for its promotion, thereby enabling the creation of more ecotourism opportunities. Because ecotourism opportunities vary among destinations, dimensions within ecotourism opportunities that can be identified must be included in EOMs. These dimensions are, in fact, the indicators that can help to develop and assess sustainability in tourism, as described by the U.N.'s SDGs 8 and 11 [50].

The scientometric analysis discovered that Honey was the most cited author in the ACN, while in the top five most cited papers in the DCN, Weaver and Lawton's article received the most citations (Table 1). The influence of research work or authors should

not be considered only from received citations [103]. The #0 cluster in the DCN shows that most studies followed Ralf Buckley's paper. Buckley's article appears among the DCN, the ACN, and backward snowballing processes. Thus, in our scientometric and quantitative analysis, Buckley was the most crucial author working with EOMs. However, the large corpus frequently cited Weaver and Lawton [37] to understand the concept of ecotourism and to assess the extent to which the relevant academic literature was engaged in investigating the phenomenon of ecotourism. Weaver and Lawton [37] covered subjects published before 2007 about ecotourism, such as venues, industry ecotourists, institutions, ecotourism impacts (such as ecological impacts, socio-cultural impacts, and economic impacts), quality control, ethics, and external environmental impacts. They found that ecotourism opportunities satisfied the three core dimensions of nature, environmental learning, and education, as well as ecological, sociocultural, and economic sustainability. However, Weaver and Lawton [37] also suggested that ecotourism, as a field of academic inquiry, was still in a state of adolescence. Thus, our analysis, which covered the period from 2009 to 2019, found an extension of these dimensions, with evidence that investigators analyzed five ecotourism opportunity dimensions in detail (as discussed in Section 3.2.1), rather than three. Moreover, Weaver and Lawton [37] reviewed studies that were based mostly on a qualitative approach to the evaluation of ecotourism opportunities. Our review suggests that the quantitative evaluation of ecotourism opportunities can bring a more objective approach in this field. Weaver and Lawton's review also did not identify the importance of the concepts of adaptation and interconnectivity, which are key to understanding ecotourism opportunities and system as a CAS [18,19].

The JCN showed that the journal with the most contributions in our large corpus was *Tourism Management*, and, interestingly, the same journal also contributed the most to the systematic quantitative analysis of the small corpus.

Research on EOMs published in English-language journals is limited to a few geographic regions. One possible explanation for the uneven geographic distribution of the academic literature on EOMs is that more researchers are studying EOMs in China, the USA, and India than elsewhere. These countries are among the most productive countries in the ecotourism sector, with large physical areas in which to develop potential ecotourism sites and large populations to support domestic tourism.

The observed indices reinforce our identified dimensions of ecotourism opportunities, as all the developed measurements can be classified under these dimensions. Involving visitors and local communities in ecotourism evaluation is essential, as they are key actors in destination development. They could also provide additional insights into the nature and changing dynamics of ecotourism projects and assess ecotourism's socio-economic and environmental outcomes.

We observed limitations in existing quantitative measurements of ecotourism opportunities. Some studies assessed ecotourism potential in a destination by taking ecotourism opportunities as measurable factors [104]. However, we could not find any existing measurements that were helpful in measuring ecotourism opportunities quantitatively. Thus, we have found limited knowledge regarding measuring ecotourism opportunities; thus, developing an EOI presents an opportunity for future research.

EOMs can act as a tool to measure the ecotourism opportunities within a CAS and to assess potential destinations quantitatively, which is essential for future tourism development. In the case of Alula, external and internal factors disrupted the existing ecotourism opportunities, and the system faced an edge of chaos due to the site's relative obscurity, religious restrictions, strict tourism visa policies, and lack of tourism infrastructure. However, due to ecotourism opportunities' adaptive nature, the system is learning and modifying to develop itself as an ecotourism destination. EOMs can help to assess the potential of a destination and provide an accurate picture of the available opportunities within the destination, both qualitatively and quantitatively. These measurements can further be used by researchers, industry practitioners, or local government bodies to develop these

opportunities and achieve the capacity of the destination to entertain the maximum number of tourists during peak times without damaging the ecosystem values of the site.

The discussion identifies some limitations in our knowledge of EOMs. One limitation of this review is that it only analyzed articles published in three leading scientific publication databases, namely Scopus, Web of Science, and ProQuest. Moreover, limited indicators under which ecotourism opportunities can be identified have been noted. Previous studies have not covered all the ecotourism opportunities dimensions necessary to assess the potential destination, although this is essential to developing an EOI for a destination.

5. Conclusions

Existing EOMs studies use a linear approach and do not produce a comprehensive understanding of EOMs that is connected to CAS theory. This is essential, as CAS can help to understand the interconnections of the ecotourism opportunities system and the (potential) unintended consequences of development actions. Moreover, the current studies on EOMs evaluate ecotourism opportunities qualitatively, enhancing the subjectivity of the measurements. This study investigated EOMs in the literature and mapped the research trends to provide practical implications for research in this area. For this purpose, a comprehensive review of the recent research on EOMs was conducted. The conclusions were drawn from two analyses: a scientometric analysis and a systematic literature review. This review assessed the geographical distribution and temporal trends in EOMs research, the adopted methodologies, ecotourism activities, and topics focused upon; it also identified under-researched areas. The scientometric analysis based on bibliographic records from EOMs studies has provided a snapshot of the related knowledge domain. We have found consistency between the scientometric and thematic analyses, as both showed similar trends and patterns in EOMs research. Both analyses showed trends in contemporary research in ecotourism, environmental sustainability, evaluation of sustainability indicators, participation of visitors and local communities toward ecotourism, and the impact of ecotourism on the environment. Measurements of ecotourism opportunities were made regarding residents' attitudes toward ecotourism, sustainability, ecotourism evaluation by visitors, and environmental protection.

This EOMs literature review updates scholars' knowledge on the potential application of new theories and methods that require further investigation. Accordingly, this study provides commentary on how one could view EOMs through the lens of complexity theory and explores the theoretical and methodological development of EOMs in the last decade. Moreover, this review draws the attention of researchers to the value of quantitatively measuring ecotourism opportunities, as well as combining these measurements into an index scale to synthesize quantitative evidence about the extent of available opportunities in a destination, which would provide a tool for countries to attain their tourism visions and goals. An index scale can be developed to resolve a vital issue in EOMs: providing a quantitative method to assess a destination's potential. In a CAS, these measurements can also serve as early warning signals to detect potential future problems in ecotourism destinations and to help governments and private agencies achieve the U.N. SDGs 8 and 11.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/su15032678/s1, File S1: PRISMA 2020 for Abstracts Checklist; File S2: PRISMA 2020 Checklist [105].

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