



IRSTI 06.71.57

DOI: <https://doi.org/10.32523/2789-4320-2024-3-346-361>

Article type (research article)

Trends in the research of sustainable tourism living labs: a bibliometric analysis

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Abstract. The primary aim of this study is to examine research trends regarding the application of the living lab approach in sustainable tourism development. We analyzed 796 scientific papers published between 2001 and 2022 from the Lens.org database using bibliometric parameters. Data analysis was conducted using tools such as VOSviewer and Harzing's Publish or Perish. We sorted the data by authors, journals, institutions, countries, and citation counts. Additionally, we analyzed the network of keywords and terms from abstracts, grouping them to understand the organization of research in this field.

Our findings reveal that the living lab methodology, which focuses on co-creating user-centered, open innovations in real-world environments, has demonstrated a positive impact on sustainable development. Despite its potential, this methodology remains underutilized in tourism. This research highlights the structure of publications related to sustainable tourism living labs. The scholarly works reviewed address various ecological and social aspects, including technology, risk behavior, aging, gender, and health issues.

Keywords: living lab, sustainable tourism, bibliometric analysis, VOSviewer, sustainable development, Lens.org.

Received: 08.04.2024. Accepted: 30.05.2024. Available online: 26.09.2024.

Introduction

The "living labs" approach in science is defined as "innovative ecosystems" where consumers and professionals collaborate to co-create new products and services. This approach is also used as a policy tool to foster innovation in the service and public sectors across various cities and regions worldwide [1]. Initially emerging in the private sector in the U.S. and Finland in 2000, living labs have since expanded globally. They facilitate real-world product testing and experimentation, supported by advancements in information and communication technology [2]. The Living Lab approach is used to create innovation in a wide range of sectors and contexts, including urban planning, technology, services, health, culture and tourism, social wellbeing, education, transport and energy, among others [3]. Recently, living labs have been introduced as helpful instruments for identifying the requirements of communities, enhancing local development, supporting, and incorporating technological and social advancements in the policies and procedures of local administration, and improving local development. In addition to this, it should also be noted that living labs are one of the factors that contribute to the overall development of a community [4].

Since living labs approach has great potential in enhancing innovations and sustainability [5], This interest extends to practitioners, researchers, industry stakeholders, policymakers, and society at large. Understanding the framework that links living labs to sustainable tourism is crucial for future research and policy development in this area.

The main goal of the study is to analyze the trends and structure of research regarding the application of living laboratory approaches for sustainable tourism development. The research questions include: 1) identifying the most influential and productive authors, countries, institutions, journals and publication periods and 2) the structure of research in publications related to the application of living labs approaches in the process of creating innovations for sustainable tourism.

To address our research questions, we conducted a brief literature review and employed quantitative bibliometric analysis using Lens.org databases, VOSviewer, and Harzing's Publish or Perish software. Detailed methodology is discussed in the Methodology section. Our study, which is presented in the final discussion, aims to provide a comprehensive view of the scientific relationship between living labs and sustainable tourism. By synthesizing various literature strands and uncovering hidden patterns, we aim to inform scholars, practitioners, and policymakers about the potential of living labs to shape sustainable tourism and highlight its transformative potential.

Literature review

Living lab. Living lab is a research platform for open, user-centric, co-created innovations, where new products and approaches are tested and evaluated in the real environment with a broad set of stakeholders [6,7]. European Networks of Living Labs structured stakeholders in the base of the Quadruple Helix Model, namely: Citizens, Government, Industry and Academia [8]. While users can play including co-creation, testing and informing roles in

living lab methodology [9]. One of the main advantages of living labs to increase involvement of stakeholders, including business, local communities, government bodies in promoting co-creation of value for sustainable development [10,12].

Zavratnik, Superina and Duh, (2019) considered that “living labs are a valuable player in enhancing circular economy, digital transformation, local self-sufficiency and other elements of sustainable living” [13]. In addition, live labs research can help drive changes in customer behavior to achieve sustainability goals [14].

Sustainable tourism. Sustainable development today is one of trends in all economic sectors including tourism. Tourism plays an important role in the economy of various countries and is recovering after COVID-2019 crisis [15]. Moreover, tourism is transforming for a more sustainable future and has the potential to contribute directly and indirectly to all 17 goals of SDGs [16]. Sustainable tourism considers the economic, social and environmental impacts of tourism activities and seeks to minimize negative impacts while maximizing positive contributions to local communities, economy and environment.

Recent research in the field of sustainable tourism has covered a wide range of areas, including ecotourism, corporate social responsibility programs in tourism, local community engagement, education and knowledge transfer, green innovation, smart destinations and others [11]. Overall, sustainable tourism is an important approach to tourism development and management that aims to ensure that tourism activities have a positive impact on local communities, the economy and the environment, while minimizing negative impacts. This helps create more equitable, sustainable tourism destinations and contributes to global efforts of achieving sustainable development.

Capability of living lab for creating sustainable tourism innovations

The innovative capability of living lab approach in scientific literatures is considered mostly for sectors as ICT [22], Smart Cities [12,23], rural and social development [13,23]. In the tourism sector living labs are discussed and considered in the context of destination management [7], rural development [22,25], and rare in sustainable innovations aspects [26].

The systematic literature review in applying lab-driven innovations for sustainable development in tourism conducted by Høegh-Guldberg et al. (2022) noted possible conflict of interests between stakeholders due to trust issues [27]. However, there are number of success cases incorporating strategic collaboration for co-creation open innovations in achieving SDGs through shared platforms [28] residence engagement for destination governance [29], contribute to innovations in rural areas [26] corporate social responsibility in hospitality and social innovations [25] and other examples from the tourism sector. One of the examples of Sustainable tourism living lab is the Balearic Islands in Spain, where through wine tourism sustainability principles were promoted to mass tourism [30]. There are also examples of living lab in tourism for the conservation and promotion of underground built heritage [31] and in tailor-made low-carbon strategies adapting to the unique assets of ski resorts [20]. Living lab approach was used in recent studies for co-design process of tourism experience system and collaborative knowledge creation in tourism [32,33].

However, according to Koens et al. (2024) living labs are not suitable to solve difficult problems and their potential in tourism should be evaluated with conscious [34].

Overall, living labs as a methodology for co-creating user-centered open innovation in real-world environments have demonstrated positive impacts on sustainable development. Although its potential for creating sustainable tourism is still not widely exploited.

Methodology

In this study we were guided by the paper of Zupic and Čater, (2014) to do a bibliometric analysis to map the structure in the publications relating to sustainable tourism living labs [35]. First, we made a search in Lens.org scholarly works database. The Lens.org platform is an aggregator of metadata including scholarly works and patents. For the search we chose keywords “living lab and sustainable tourism”, by applying filters for dates from 2011 to 2022. Our initial search identified 796 scholarly works, including journal articles, journal issues, books, book chapters, conference proceedings and articles, dissertations, patents and others. By using analytical tools and dashboards in the Lens.org platform, we sorted all papers by their most prolific authors, the journals in which they were published, and the institutions of the contributing authors. This helped identify leading researchers and influential institutions in the field. The papers were categorized by the authors' countries of affiliation to highlight geographical trends in research activity. We used VOSviewer and Harzing's Publish or Perish software to analyze the data. These tools helped in visualizing relationships between authors, institutions, and research topics. VOSviewer is tool to create network maps of co-authorship, citation, and keyword relationships. It allows for the visualization of the intellectual structure of the research field. Publish or Perish software provided additional bibliometric metrics, such as citation counts and h-indices for authors and institutions. Our methodological approach provides a systematic analysis of the literature on living labs in sustainable tourism. By using bibliometric tools, we aimed to reveal key trends, influential contributions, and the overall structure of research in this emerging field. Detailed results are presented in the following section.

Results and Discussion

The search result showed the type of publications over time, the most productive and influential authors, their works and affiliated with them institutions, countries, journals, field of study.

Figure 1 shows the trend in annual publications on living labs and sustainable tourism from 2001 to 2022. The rising trend demonstrates a growing academic focus on this topic. By type of publication the journal articles and journal issues have the major density. The most productive period was between 2017 and 2020, from 2021 the number of publications has dropped dramatically. One of the reasons could be COVID-19 pandemic time affected the operations of living labs. However, according to the data of European Networks of Living Labs interest to living labs approach is still high. For example historically the above organization registered +480 living labs worldwide during 15 years, while in 2022 on the Digital Living Lab Days welcomed 391 participants from 31 countries [8].

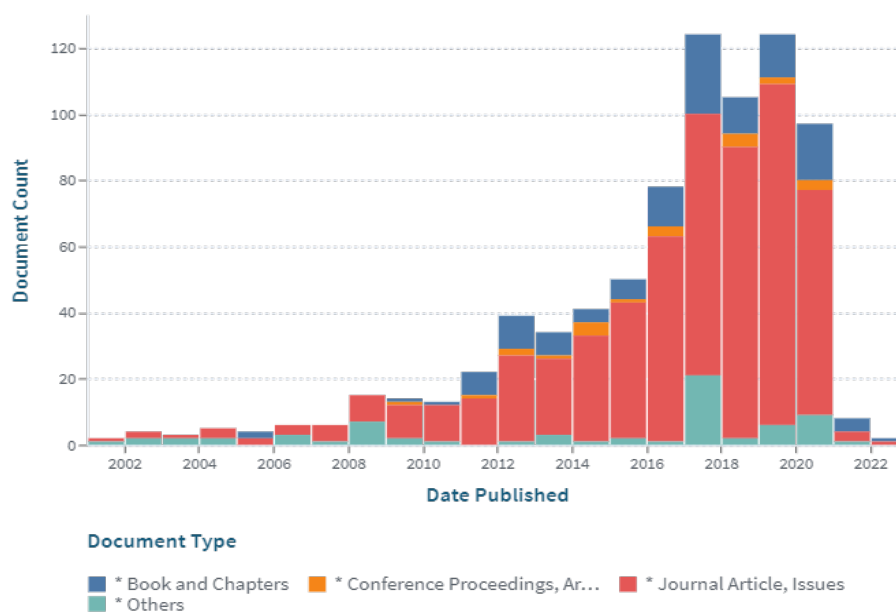


Figure 1. Scholarly works over time

Note: the Lens.org retrieved by authors

Despite the fact that during this period a significant number of publications (796) were published on the topic of the application living lab approach for sustainable tourism, there were not the authors with a considerable number of publications (Figure 2). Among the top three productive authors relating to the topics: Anne L Cohen, Benoit Goossens and Carel P van Schaik.

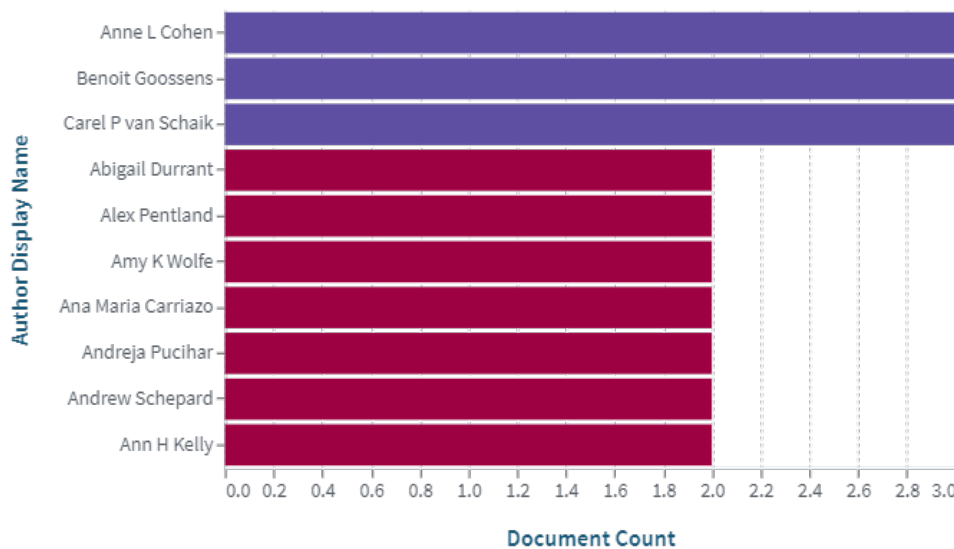


Figure 2. Most active authors in the field

Note: the Lens.org retrieved by authors

The figure 3 displayed the top ten institutions by document count. There the leading position is dedicated to James Cook University, Australia, followed by University of Exeter, UK, NOAA, US and Cardiff University, UK.



Figure 3. Top 10 institutions by document count

Note: the Lens.org retrieved by authors

Regarding fields of study the major documents came from Geography (128) and Political science (123) (Figure 4). Sustainability studies are also in the top ten fields of study relating to living lab research methods and sustainable tourism.



Figure 4. Top fields of study

Note: the Lens.org retrieved by authors

Among the most active countries conducting research on the topic under consideration, the most productive is the UK with 193 papers, representing 24% of the total. The United States published 14% of all documents counted, with Australia and European countries also among the leaders (Figure 5 and Table 1).

Table 1. Top 10 Most active countries

Institution Country/Region	Document Count	%
United Kingdom	193	24
United States	113	14
Australia	60	7
Italy	44	5,5
Germany	41	5,1
Netherlands	32	4
Spain	29	3,6
Switzerland	28	3,5
Sweden	28	3,5
Canada	25	3,1
China	25	3,1

Note: analyzed by authors

Research related to the application of living labs in sustainable tourism is mainly published by the journal “Sustainability”, published by MDPI AG (Switzerland), followed closely by PloS One, published by the Public Library of Science. While other journals have published a relatively small number of works in the field under study and, accordingly, have less influence (Figure 5).

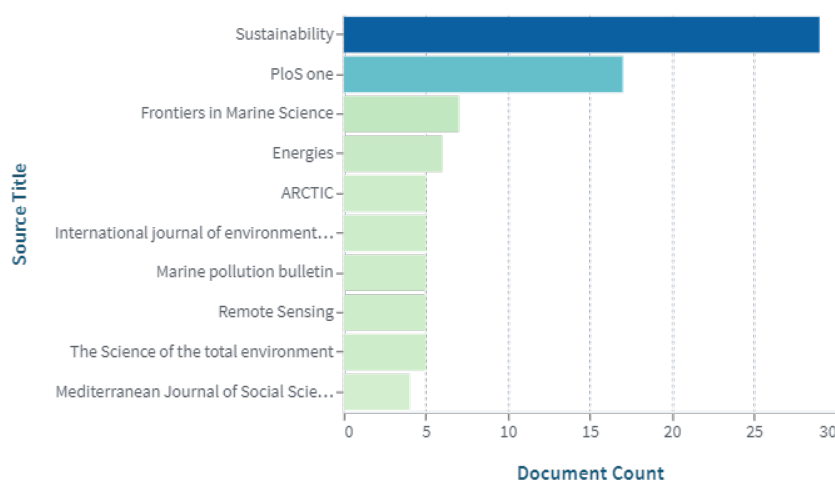


Figure 5. Top journals by publishers

Note: the Lens.org retrieved by authors

For citation analysis, Lens.org metrics showed a total of 35,933 citations for the sampled 796 scientific papers. To explore the most influential scientific works in this field, we used Harzing's Publish or Perish software. For this purpose, we filtered the ten most relevant studies

and ranked them by number of citations. The results are presented in Table 2. The first-ranked article was cited 29 times by other scientists and was published in the journal “Sustainability”. The work of M. Cerreta and S. Panaro (2017) “From Perceived Value to Shared Values: A Multi-Stakeholder Spatial Decision Analysis (M-SSDA) for resilient landscapes” is the most influential study that was carried out in a living laboratory in the Cilento National Park [36]. And second important work in the investigating area is about students living lab by E.M. Jernsand published on Tourism Recreation Research. As a whole the citation metrics of the studies are not high which indicates that this area is still lack of research and potential of living labs for sustainable tourism is not showed fully.

Table 2. Citation metrics

Cites	Authors	Title	Year	Source
29	M. Cerreta and S. Panaro	From perceived values to shared values: A Multi-Stakeholder Spatial Decision Analysis (M-SSDA) for resilient landscapes	2017	Sustainability (Switzerland)
9	E.M. Jernsand	Student living labs as innovation arenas for sustainable tourism	2019	Tourism Recreation Research
6	M. Sisto	The Mefite in the Ansanto Valley (Southern Italy): a Geoarchaeosite to Promote the Geotourism and Geoconservation of the Irpinian Cultural Landscape	2020	Geoheritage
5	A. Polderman	How can ski resorts get smart? Transdisciplinary approaches to sustainable winter tourism in the European Alps	2020	Sustainability (Switzerland)
3	K. Cigir	Creating a living lab model for tourism and hospitality businesses to stimulate CSR and sustainability innovations	2018	WIT Transactions on Ecology and the Environment
3	F. Basbeth	Smart Destination Branding: The Need for New Capability and Opportunities for Entrepreneurship	2018	Proceeding - 2018 International Conference on ICT for Smart Society: Innovation Toward Smart Society and Society 5.0, ICISS 2018
2	A. Pucihar	User-centered design of a web-based platform for the sustainable development of tourism services in a living lab context	2014	Lecture Notes in Information Systems and Organisation

2	A. Šifrer	Development of the prototype solution for user involvement in the living lab approach	2012	MIPRO 2012 - 35th International Convention on Information and Communication Technology, Electronics and Microelectronics - Proceedings
0	P.D. De Klerck	Assessing the 'value' of nature-based solutions at the Belgian coast for sustainable tourism, using a ecosystem-based management approach	2020	Proceedings of the 2020 International Conference and Utility Exhibition on Energy, Environment and Climate Change, ICUE 2020
0	L. Sittoni	Beneficial and nature-based sediment use - Experiences from Dutch pilots	2019	Australasian Coasts and Ports 2019 Conference
0	M. Tortora	Humanism and business: The case of a sustainable business experience in the Florentine tourist sector based on the civil economy tradition	2018	Sustainability and the Humanities

Note: retrieved from Harzing's Publish or Perish software

We conducted keywords analysis which showed two main clusters in the research area (Figure 7). In this network 22 items which occurred at least 5 times in 796 selected scholarly works and here keyword “animal” occurred 50 times. The first cluster of studies related to “animals” and included terms such as conservation of natural resources, biodiversity, ecosystem, conservation of natural resources, coral reefs, environmental monitoring, ocean and sea, ecology and others. Issues occurring in this first cluster related to environmental aspects of sustainable development. The second cluster is dedicated to “humans” observing issues relating to gender (male, female), aging (adult, adolescent, young adult, middle aged), health (public health, global health), which are also social issues of sustainable development.

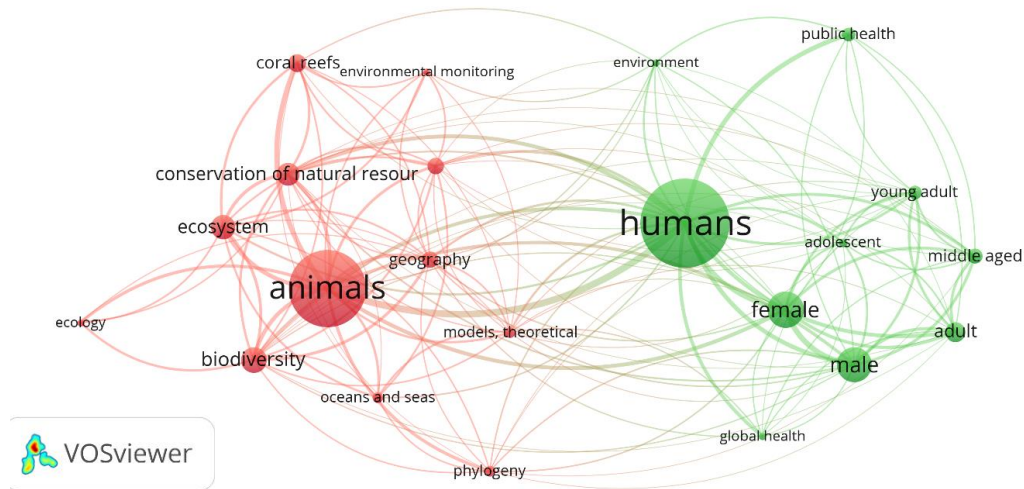


Figure 6. Keywords dispersed in network visualization map from 2001-2020

Note: retrieved by authors from VOSviewer

To deepen the structure of research relating to our topic, we extracted terms from the titles and the abstracts of 796 scholarly works and conducted quantitative text analysis with VOSviewer software. The results are shown in the figure 8, consisting of five clusters with 202 items and 12076 links.

First cluster is called “population wellbeing” (blue cluster in Figure 7), here studies relating population, health, death and related risks, outcomes. This cluster is related with the “human” cluster explored in the above keywords analysis. And as a one more sub-cluster of the “human” cluster we can consider the second cluster found by the title and abstract terms analysis (purple cluster in Figure 7), which we called “behavior”.

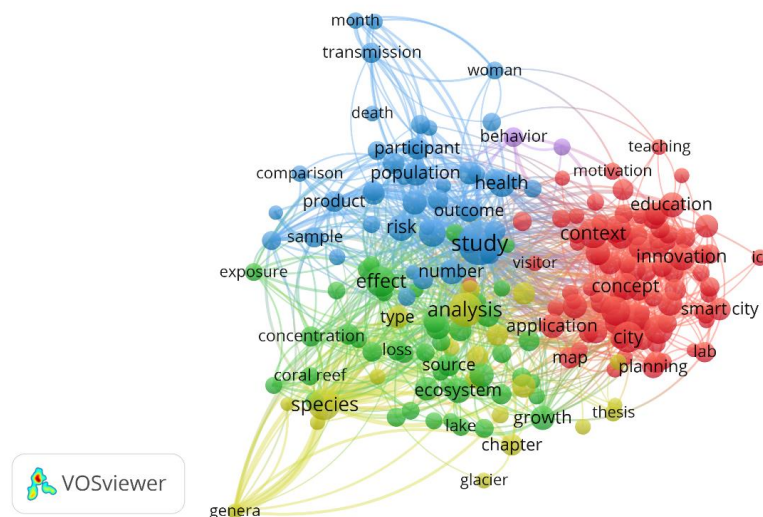


Figure 7. The title and abstract terms network map from 2001-2020

Note: retrieved from VOSviewer

Third cluster (red in Figure 7) dedicated to study innovation, technology, smart city and etc. [37]. Indeed many projects studying and testing living lab methodologies are focusing on urban sustainability, smart cities and associated issues [38,39]. The Fourth cluster (green in Figure 7) is called “impact analysis”, there you can see terms such as effect, loss, growth, concentration, exposure and other. Fifth cluster dedicated to “classification” with the most occurring terms: analysis, species, type, order, collection and other.

The analysis of 796 publications from 2001 to 2022 demonstrates that the living lab approach has become an increasingly prominent methodology in sustainable tourism research. This trend underscores the potential of living labs to address complex challenges in tourism, key implication of findings related to three main areas.

- Living labs facilitate the involvement of diverse stakeholders, including tourists, local communities, and industry professionals. This inclusive approach promotes the co-creation of innovative solutions that address the specific needs and preferences of various stakeholders.
- The living lab framework supports the integration of cutting-edge technologies into sustainable tourism practices.
- They serve as testbeds for evaluating the impact of these practices on both environmental sustainability and economic viability.

Conclusion

Over the past two decades, there has been growing interest in using living labs as a productive methodology for the co-production of innovation, with significant contributions from the public sector and scientists. This study explores the relationship between living lab concepts and sustainable tourism, identifying the most productive authors, institutions, fields, journals, and countries. Notable authors include Anne L. Cohen, Benoit Goossens, and Carel P. van Schaik, with James Cook University in Australia, the University of Exeter, NOAA, and Cardiff University leading in article counts. The top journal is Sustainability (MDPI), with significant contributions from the UK and the USA, primarily in geography, political science, and business. Influential authors identified through citation analysis are M. Cerreta and S. Panaro.

Our research highlights the structure of publications on sustainable tourism living labs, examining ecological and social aspects related to animals and human behavior. Studies have focused on innovations, technology, risk, behavior, aging, gender aspects, health, and related issues. However, due to the reliance on machine text analysis, findings should be interpreted cautiously. The analysis used the Lens.org database, covering publications up to 2022, and may have excluded papers using alternative terminologies or different conceptual frameworks.

Overall, the findings indicate a growing interest in living lab approaches for sustainable tourism, focusing on both environmental and social aspects. Despite this interest, there is a need for more research to fully explore the potential of living labs, particularly regarding their long-term effectiveness, sustainability, and impact across different cultural, geographical, and economic contexts.

Acknowledgement

This research is funded by the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan (Grant No. AP13268872).

Authors contribution.

S.Nassanbekova – design of the study, data analysis, writing draft of the article.

G.Yeshenkulova – data collection, validation of the data, reviewing the paper.

N. Ibadiddin – literature review, data validation, review of the final version.

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Тұрақты туризмнің Living lab зерттеулеріндегі тенденциялар: библиометриялық талдау

Аннотация. Бұл зерттеудің негізгі мақсаты тұрақты туризмді дамытуда living lab тәсілді қолдану бойынша зерттеу тенденцияларын талдау болып табылады. Біз Lens.org дерекқорынан 2001-2022 жылдар аралығында жарияланған 796 ғылыми мақаланы библиометриялық параметрлерді пайдалана отырып талдадық. Деректерді талдау VOSviewer және Harzing's Publish or Perish сияқты құралдардың көмегімен жүргізілді. Біз деректерді авторлар, журналдар, мекемелер, елдер және дәйексөздер саны бойынша сұрыптадық. Сонымен қатар, біз рефераттардағы түйінді сөздер мен терминдер желісін талдадық, осы саладағы зерттеулерді ұйымдастыруды түсіну үшін оларды топтадық.

Біздің қорытындыларымыз нақты әлемде пайдаланушыға бағытталған, ашық инновацияларды бірлесіп жасауға бағытталған living lab әдіснамасы тұрақты дамуға оң әсер еткенін көрсетеді. Өзінің әлеуетіне қарамастан, бұл әдістеме туризмде әлі де толық пайдаланылмаған. Бұл зерттеу тұрақты туризмнің тірі зертханаларына қатысты жарияланымдар құрылымын көрсетеді. Қаралған ғылыми жұмыстар әртүрлі экологиялық және әлеуметтік аспектілерді, соның ішінде технологияны, мінез-құлық, жас және денсаулық мәселелерін қарастырады.

Түйін сөздер: living lab, тұрақты туризм, библиометриялық талдау, VOSviewer, тұрақты даму, Lens.org

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Тенденции в исследованиях living labs устойчивого туризма: библиометрический анализ

Аннотация. Основная цель этого исследования – изучить тенденции исследований, касающиеся применения подхода «living lab» в развитии устойчивого туризма. Мы проанализировали 796 научных работ, опубликованных в период с 2001 по 2022 год из базы данных Lens.org, используя библиометрические параметры. Анализ данных проводился с использованием таких инструментов, как VOSviewer и Harzing's Publish or Perish. Мы отсортировали данные по авторам, журналам, учреждениям, странам и количеству цитирований. Дополнительно мы проанализировали сеть ключевых слов и терминов из рефератов, сгруппировав их для понимания организации исследований в этой области.

Наши результаты показывают, что методология living lab, которая фокусируется на совместном создании ориентированных на пользователя открытых инноваций в реальных условиях, продемонстрировала положительное влияние на устойчивое развитие. Несмотря на свой потенциал, эта методология по-прежнему недостаточно используется в туризме. В этом исследовании подчеркивается структура публикаций, связанных с лабораториями устойчивого туризма. Рассмотренные научные работы затрагивают различные экологические и социальные аспекты, включая технологии, поведение, проблемы старения и здоровья.

Ключевые слова: living lab, устойчивый туризм, библиометрический анализ, VOSviewer, устойчивое развитие, Lens.org

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