

Mapping of the scientific production on maintenance management in hotels in Scopus

Mapeo de la producción científica sobre la gestión del mantenimiento en hoteles en Scopus

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ABSTRACT

Hotel maintenance is one of the most important factors in providing a quality experience to guests. In this research, a bibliometric study on hotel maintenance is carried out with the objective of mapping the scientific production in this field. The database for the search was Scopus. The bibliometric method was employed using the R package Bibliometrix to calculate productivity, impact and collaboration indicators. Keyword analysis was complemented with the use of VOSviewer software and SPSS and UCINET software were used to calculate the closeness and correlation of the main approaches. A total of 310 articles published in the period 1961-2022 were found. Lai JHK and Burnett J are the most prolix authors and their articles are among the most important contributions to the field. The most studied thematic lines are Benchmarking, Energy, facilities management, Hospitality, Costs and Sustainability. The results of the study were presented for use by maintenance managers. The following were identified as future lines of research: improvements in energy management. Perform a cost-benefit analysis of redundant systems, among others.

Keywords: bibliometrix, bibliometric, hotels, maintenance management.

RESUMEN

El mantenimiento de un hotel es uno de los factores más importantes para proporcionar una experiencia de calidad a los huéspedes. En esta investigación se realiza un estudio bibliométrico sobre el mantenimiento hotelero con el objetivo de mapear la producción científica en este ámbito. La base de datos para la búsqueda fue Scopus. Fue empleado el método bibliométrico utilizando el paquete de R Bibliometrix para calcular indicadores de productividad, impacto y colaboración. El análisis de las palabras clave se complementó con el uso del software VOSviewer y además se utilizaron los softwares SPSS y UCINET para calcular la cercanía y correlación de los principales enfoques. Se encontraron un total de 310 artículos publicados en el período de 1961-2022. Lai JHK y Burnett J resultan los autores más prolíficos y sus artículos son de los de mayor contribución al campo. Las líneas temáticas más estudiadas son: la evaluación comparativa, la energía, la gestión de instalaciones, la hospitalidad, los costos y la sostenibilidad. Los resultados del estudio fueron presentados para el aprovechamiento a los gestores de mantenimiento. Como futuras líneas de investigación se identificaron: mejoras en la gestión de la energía, realizar un análisis coste-beneficio de los sistemas redundantes, entre otras.

Palabras clave: bibliometrix, bibliometría, hoteles, gestión del mantenimiento.

INTRODUCTION

Hotels are a key point in the tourism sector. Customers stay in hotels with the highest expectations about the quality of service. The hotel sector today is highly technological, so the complexity of the engineering installations, the specific characteristics and requirements of the area constitute an enormous challenge for the actions of maintenance management (Silva et al., 2022).

Hotels are dynamic, complex and costly buildings to manage and maintain, with a variety of engineering systems (Chan et al., 2003). Maintenance in hotel installations is the basis of the services that are fulfilled thanks to the engineering infrastructures to keep customers satisfied. A malfunction of these technologies can damage the image and profitability of a hotel.

Generally, maintenance works carried out in hotel facilities are building maintenance actions such as flooring, structures and furnishings, and maintenance works of the facility's services such as electrical, air conditioning, plumbing, drainage and fire protection systems (Lai & Yik, 2012a).

Arenas and Colina (2010) raise the fact that hotel managers are not familiar with the practice of maintenance management, nor with the costs involved, nor with the impact it has on the operation of the business. This leads them to rely on periodic repairs (breakdown maintenance) rather than investing in planned preventive maintenance. The need to demonstrate that maintenance management strategies have an impact on overall business performance may convince hotel managers of the need to improve maintenance management practices and allocate budgets that better serve the purpose of improving maintenance management metrics and, consequently, business performance.

There are not many researches dedicated to maintenance management in hotel installations with review approaches, bibliometric studies and mappings of the state of the art of the literature.

Some of the bibliographies addressing this field include Ghazi and Management (2016) which investigates hotel maintenance management practices and the obstacles that hinder their implementation from the point of view of maintenance managers in Egyptian 5-star hotels. Mayouf and Hisham (2019) aim to develop a hotel maintenance

cost index, compare hotel maintenance costs and the distribution of these costs among different maintenance approaches and internal and external strategies of three, four and five star hotels.

In Longart's research (2020) main objective is to provide hotel managers with an overview and understanding of hotel maintenance, the research yielded important findings, including that planned preventive maintenance was the preferred maintenance strategy.

Only one research was found that uses bibliometric methods on the study of maintenance in hotel facilities, this is that of Laguardia et al. (2021) who analyze the management of maintenance oriented to infrastructures for the displacement of the disabled in the Hotel Complex Los Cactus Tuxpan, Varadero. For the search, ScienceDirect was used as a database, the time frame is limited to documents between the years 2017 and 2021 and "desplazamientos de discapacitados" was used as the search equation, with 821 articles found.

The software used in the research of Laguardia et al. (2021) is VOSviewer, so only a keyword co-occurrence map is presented.

For this reason, the need to analyze this field of research from a bibliometric point of view is justified with the intention of mapping the scientific production on maintenance management in hotel facilities. Taking into account the above, this article uses bibliometric indicators: collaborative network analysis, citation indexes, productivity indexes, impact indexes and an analysis of the literature to identify the general state of the art in the field of maintenance management in hotels.

In the research of Sanchez et al. (2020) it is stated that bibliometrics can be defined as a bibliological research technique that studies the size, growth and distribution of the literature in a given field and also studies the social structure of the groups that produce and use it. Bibliometric scores provide quantitative and objective information on the results of the research process.

The novelty of the present research, regardless of the breadth of the time frame, is that other bibliometric indicators are analyzed, such as productivity by authors, jour-

nals and countries, impact index of authors and journals to identify high quality articles; the number of citations per author and journals, which indicates the publication of higher quality articles in the field. Collaboration indicators, to determine the exchange of experiences between authors. The relationship between author countries and keywords, which reveals the research trends and research needs of the different regions with respect to this topic.

METHODOLOGY

The bibliometric analysis method was used for this study. In order to perform an in-depth literature review and mapping, the database must be of the highest possible quality, so Scopus was selected for the search, since it is the largest database of citations and abstracts of peer-reviewed literature (Cañedo Andalia et al., 2010). The search was performed on November 28, 2022, filtering the constructs "Maintenance AND Hotel" by title, keywords and abstract, only article-type documents were collected. In order to address the largest amount of research, the time frame was not restricted. References were downloaded in .ris and .csv format.

The data were stored in the EndNote bibliographic manager with the search results. The .csv file was processed by the R package bibliometrix showing the relationship between countries, authors and keywords and the bibliometric indicators of productivity by authors, journals and countries, citation of authors, journals and documents, impact index of journals and authors, collaboration between authors and co-citation of authors and documents were determined.

In this paper, local citations are measured, local citations are measured by the number of citations a document receives from the documents included in the data analyzed (Aria & Cuccurullo, 2017), thus focusing only on citations within a discipline under study (Agbo et al., 2021).

Three different metrics are evaluated to measure the impact factors of journals and authors, the h-index, the g-index and the m-index. The h-index takes into account the number of papers from each source and the number of citations of each paper. The g-index quantifies the scientific productivity based on the publication history of the authors, the calculation of this index is similar to the h-index but more complex and it allows distinguishing between authors with similar h-index. The m-index is defined as h/n , where h is the h-index and n is the number of years elapsed since the first publication of the scientist or jour-

nal (Oyewola & Dada, 2022).

VOSviewer, SPSS and UCINET software were also used to analyze the correlation of keywords, the closeness of the main approaches and their relationship with the documents and authors.

RESULTS AND DISCUSION

This section presents the results of the study by first presenting a table with the general results, then the bibliometric indicators organized by countries, affiliations, journals, authors, documents and the relationship of keywords with authors and countries.

Table 1. Overall results

General Information	Results
MAIN INFORMATION ABOUT DATA	
Timespan	1961:2022
Sources (Journals, Books, etc)	248
Documents	310
Annual Growth Rate %	4.95
Document Average Age	13.1
Average citations per doc	12.31
References	8845
DOCUMENT CONTENTS	
Keywords Plus (ID)*	1950
Author's Keywords (DE)	944
AUTHORS	
Authors	824
Authors of single-authored docs	91
AUTHORS COLLABORATION	
Single-authored docs	103
Co-Authors per Doc	2.79
International co-authorships %	11.94

*In the author's keyword cell, they refer to a list of terms that the authors have specified to describe what their study consists of. However, the keywords plus refer to extended phrases generated by the Scopus database, which are the keywords of the publications cited in the article.

The first article published on maintenance in hotel infrastructures in the Scopus database dates back to 1961; from this year until November 2022, 310 articles have been published on the subject.

Figure 1 shows an increasing trend in the number of articles published on this subject with a coefficient of determination of 0.69, so that the trend line fits the curve well.

The annual growth rate is 4.95%, which indicates a good acceptance in practice and the need for further research in this area of knowledge, taking into account the importance of the subject within the scientific field.

Figure 1. Productivity per year

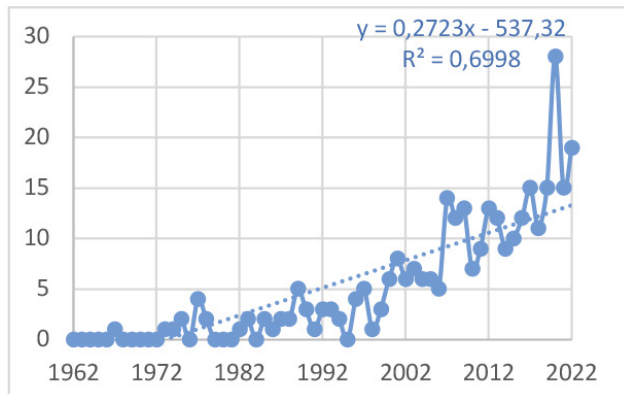


Table 2 shows the scientific productivity by country in descending order, in addition to the single country publications (SCP) and multiple country publications (MCP) indices, which refer to publications by authors from a single country and publications by authors from more than one country. The country with the highest productivity is the USA with 41 articles, 34 of them SCP and 7 MCP. It is evident that this country is a power in terms of the number of publications on the subject studied, suggesting a high applicability in this region.

Table 2. Productivity by countries

Productivity by countries				
Country	Articles	SCP	MCP	Freq
USA	41	34	7	0.132
CHINA	14	12	2	0.045
SPAIN	14	12	2	0.045
HONG KONG	12	10	2	0.039
ITALY	9	8	1	0.029
JAPAN	7	6	1	0.023
KOREA	7	6	1	0.023
CANADA	6	5	1	0.019
INDIA	6	6	0	0.019
PORTUGAL	6	4	2	0.019

Figure 2 shows the institutions with the highest productivity, the University of California with 14 publications, The Hong Kong Polytechnic University with 12 and Wannan Medical College with 10.

Figure 3 shows the most cited journals and Figure 4 shows the most productive ones. The International Journal of Hospitality Management had the highest productivity with 10 publications and it is also the one with the highest number of local citations with 111, another outstanding source is Hpac Heating, Piping, Air Conditioning with 4 publications. This data is of interest to researchers in the field, since these are journals that publish on these topics, as well as to follow new publications and keep updated on the subject.

Figure 2. Productivity by institution

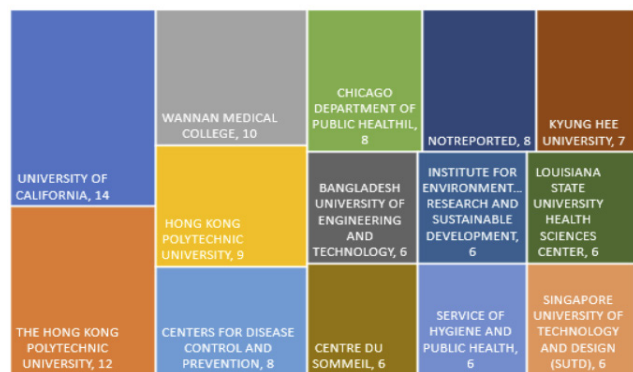


Figure 3. Local citations by Journals



The impact factor of a journal is closely linked to the number of citations. Table 3 shows the journals with the highest impact factor, International Journal of Hospitality Management is the journal with the highest h

and g Index, with 9 and 10, which means that it has at least 9 published articles with 9 citations each in this subject and with respect to the g index it corresponds

to the last position in which the number of accumulated citations is equal to or greater than the squared position.

Figure 4. Productivity per journal



Table 3. Journal Impact Index

Journals	h_index	g_index	m_index	Quartile in 2022
INTERNATIONAL JOURNAL OF HOSPITALITY MANAGEMENT	9	10	0.45	Q1
JOURNAL OF HOSPITALITY AND TOURISM RESEARCH	4	4	0.2	Q1
ENERGY CONVERSION AND MANAGEMENT	3	3	0.188	Q1
INTERNATIONAL JOURNAL OF CONTEMPORARY HOSPITALITY MANAGEMENT	3	3	0.143	Q1
JOURNAL OF QUALITY ASSURANCE IN HOSPITALITY AND TOURISM	3	3	0.2	Q2
SUSTAINABILITY (SWITZERLAND)	3	3	1	Q2
ASIA PACIFIC JOURNAL OF TOURISM RESEARCH	2	3	0.154	Q1
BUILDING SERVICES ENGINEERING RESEARCH AND TECHNOLOGY	2	2	0.077	Q2
BUILDINGS	2	2	1	Q1
CORNELL HOTEL AND RESTAURANT ADMINISTRATION QUARTERLY	2	2	0.074	Q2
DESALINATION	2	2	0.105	Q1

Figure 5 shows the most productive authors, with Lai JHK being the author with the most publications in this field with 5 articles. The analysis shows that 796 authors have only published 1 article, 26 authors published 2 articles, 3 published 3 and only 1 has published 5. Table 5 shows the productivity levels of the authors, 3.28% of the authors have published between 2 and 9 articles for a medium level of productivity. The 96.72% of the authors have a low level of productivity (1 published article), which shows that this topic has not yet been systematized by researchers, therefore, it is necessary to continue building knowledge on the subject.

Figure 5. Productivity by author

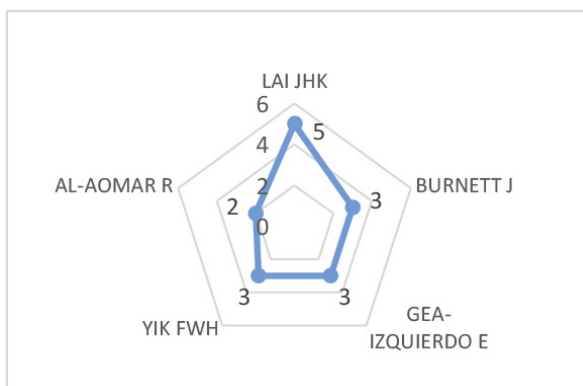


Table 4. Productivity levels

Ranking	Articles	Frequency	
		No	%
High level	≥ 10	0	0
Medium level	$\geq 2 \leq 9$	27	3.28
Low level	1	796	96.72
Total		823	100

Figure 6 shows the authors with the most local citations, with Ostrowska-Wawryniuk and Piątek ŁK being the most cited with 10 citations each.

Figure 6. Local citations by authors

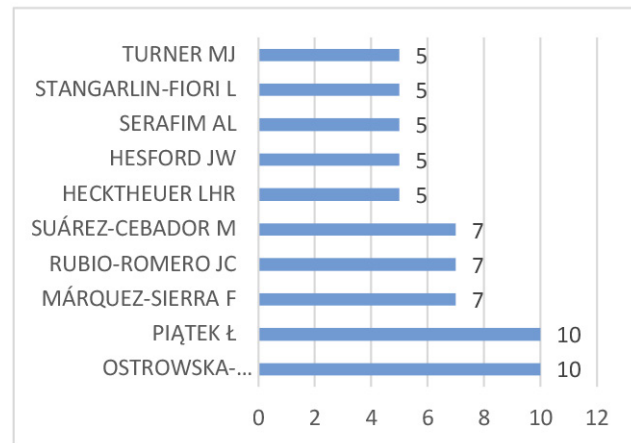
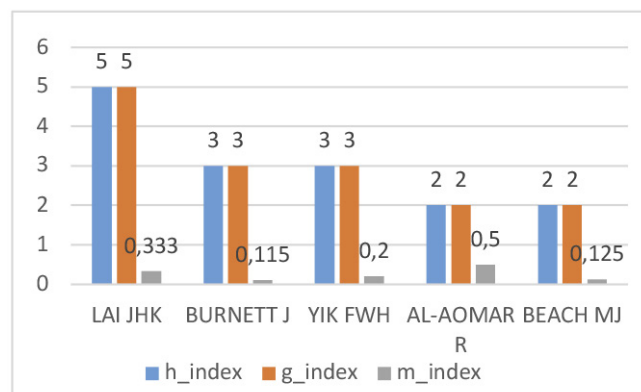


Figure 7 shows the impact factor by authors ("h", "g" and "m" indexes), Lai JHK, Burnett JY and YIK FWH are the authors with the highest h index so they have received the most citations, suggesting that they have the highest impact in the field of maintenance management in hotel infrastructure.

Figure 7. Impact index by authors



According to Song et al. (2019) user social networks, within a research topic, denotes the relationship between two or more authors, countries, or institutions with respect to collaboration. The relationships are shown in a network in

which the nodes represent authors and the links connecting the nodes represent the relationships. Figure 8 shows the map of the collaboration network between authors, the names of the authors belong to a circle, the larger the circle, the larger the collaboration network. Authors such as Lai JHK, Burnett J, Rachina SA have a well-defined collaboration network. The co-citation network of authors is shown in Figure 9, where 2 large groups are evident where the most central authors are Lee and Wang.

Figure 8. Collaboration between authors

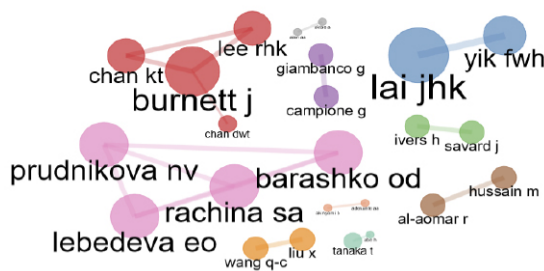
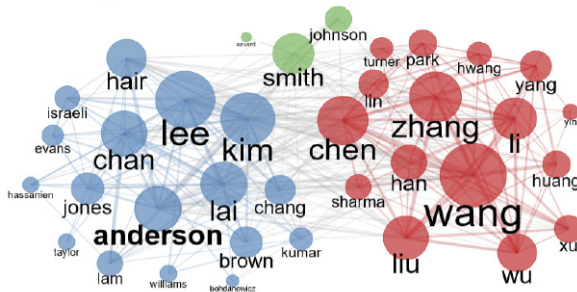
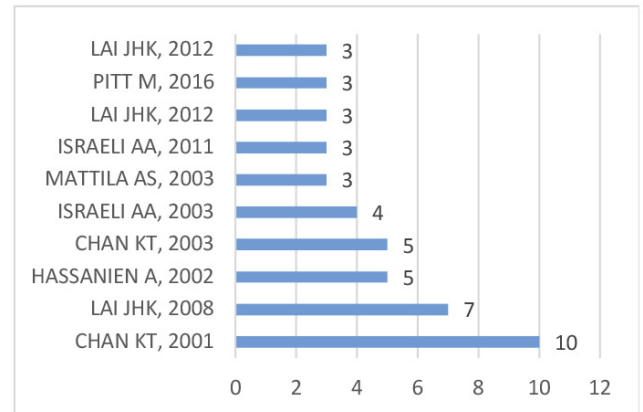


Figure 9. Co-citation between authors



Generally, the number of times an article is cited indicates the impact and quality of the article within the field of research. Figure 10 shows the articles with the most local citations. The article with the most local citations is written by Chan et al. (2001) with 10 citations, which addresses the practices, workload and resources required to maintain engineering systems and buildings. It examines internal and external maintenance, repair and modernization work. They describe the most common failure modes and incidence rates. Establish performance indicators to measure the effectiveness of maintenance of hospitality engineering systems.

Figure 10. Local Citations per documents



The total number of citations in the literature reflects the knowledge base of a discipline or research field (Chen, 2006). By analyzing the co-citation of articles, the knowledge bases of research fields can be determined. In Figure 11, the network, the size of the node represents the frequency with which the paper is cited, the larger the node the higher the citation frequency of the article. The most central nodes with the highest citation frequency represent important lines of research for the construction of knowledge in the scientific field.

Figure 11. Document co-citation

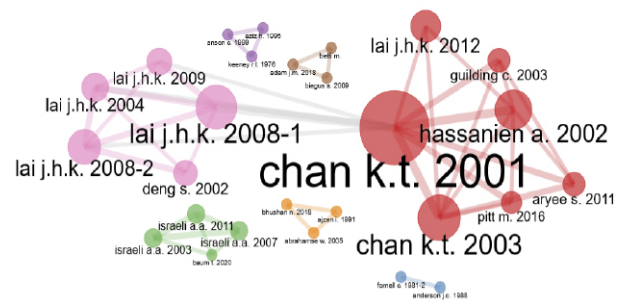
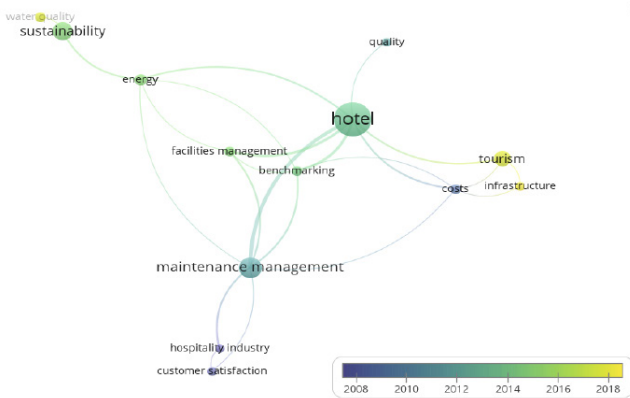


Figure 12 shows the co-citation network of the documents. Two large groups are shown where the most central documents are Maintenance performance: A case study of hospitality engineering systems by authors Chan et al. (2001) already mentioned as the document with the highest number of local citations and the article Benchmarking operation and maintenance costs of luxury hotels by Lai and Yik (2008) where a comparative study of ten

luxury hotels was conducted to identify the importance and performance of various elements of operation and maintenance (O&M) costs. Data and characteristics of the hotels were collected such as their maintenance and works expenditures, in-house labor and payrolls, contract maintenance costs, and utility costs and consumptions. It was shown that energy cost dominates (O&M) expenses. The keyword co-occurrence analysis analyzes the degree of connection between the terms with the highest occurrence. Keywords represent the core and essence of the article. Analyzing the co-occurrence of keywords specified by the authors represents an extremely useful tool to identify the evolution, direction and development of the research field (Shi, 2021).

Figure 12 shows the keyword co-occurrence network, processed in the VOSviewer software. The thicker and closer curves indicate a strong relationship between the terms, the size of the nodes indicates the number of terms with which it is correlated. For the analysis of the keywords of the researches dealing with maintenance management in hotel facilities, they were divided into two periods, in which certain research topics were trending.

Figure 12. Keyword co-occurrence



The first period is from 2001 one of the trends to investigate was customer satisfaction addressed by authors such as Hira et al. (2007), Bang and Kim (2013), Srilakshmi and Dadhabai (2018) and Meng and Gao (2019); hospitality Industry is another topic addressed by authors such as Chan et al. (2001), Lockyer (2002), McPhee (2006), Issac and Mani (2017); quality, studied by Calveras (2003), Ce-

sarotti and Spada (2009), Ferrer (2004) and Kim and Han (2020); costs studied by Ihsan and Alshibani (2018), Lai (2016) and Lai and Yik (2008).

The second stage starts from 2012 and the topics that tend to be investigated are benchmarking, addressed by Lai and Yik (2008), Lai and Yik (2012b), Lai and Yik (2012a) and Lai (2016); facilities management is another trend of this period, studied by Hassanien and Losekoot (2002), Lai and Yik (2012b), Longart (2020) and Priyangika et al. (2020). Energy, addressed by Chan et al. (2003), Lai (2016), Orynych and Tucki (2021); sustainability is another current trend, this has been investigated by authors such as Hus-sain et al. (2019), Ragodoo (2011) And water quality studied by Toyosada et al. (2017) and Van Hulle et al. (2012).

Figure 13 shows the relationship between countries, authors and keywords or their specific area of interest in the field. The left column shows the countries, the middle column shows the names of authors contributing from those countries, and the right column shows the keywords most used by the authors. Higher boxes indicate higher counts, so, in terms of countries, Hong Kong has the highest number of authors, then USA and third Italy.

Figure 13. Relationship between countries, authors and keywords

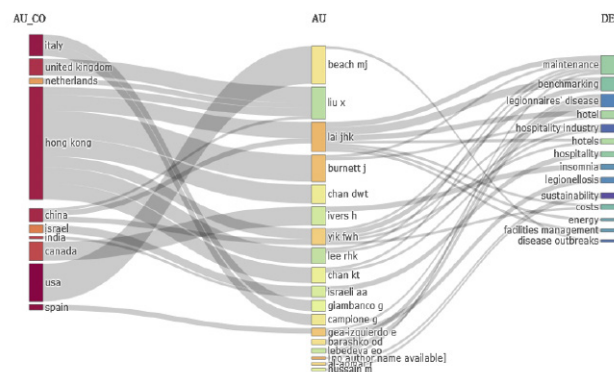


Figure 14 shows the degree of intermediation between the variables, in which the nodes with more input arcs represent a greater combination with the other variables and the colors represent the intermediation clusters. In this case, it can be seen that the nodes facilities management and benchmarking are the most integrated, not counting hotel and maintenance, which are the common denominator of this research.

Figure 14. Degree of intermediation between variables

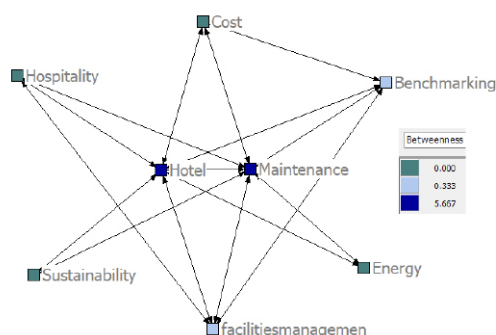
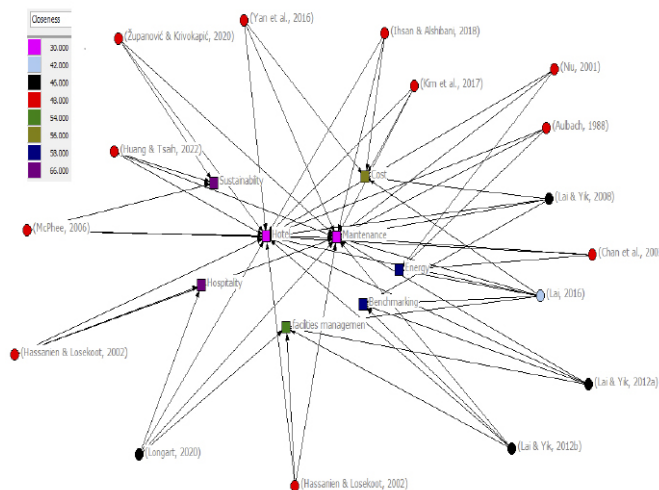


Figure 15 shows the correlation and closeness between variables and authors, being the authors the round figure nodes and the variables the square figure nodes, the closeness is represented by clusters and the variables treated by the different authors in the field are also represented. The variables most addressed by the authors other than maintenance in hotel facilities are facilities management and costs, with five occurrences, and then followed by benchmarking and energy. The author who addresses the most variables is Lai (2016).

Figure 15. Correlation and closeness between variables and authors



CONCLUSIONS

This article carried out a mapping of the scientific literature in Scopus in the field of hotel infrastructure maintenance from a bibliometric perspective. The R package

Bibliometrix and the software VOSviewer, SPSS and UCINET were used for this purpose. A series of bibliometric indicators were analyzed. Research trends were determined by analyzing the literature. The study provides useful information for academics, researchers and maintenance workers. The analysis of the bibliometric indicators and that of the articles led to the following conclusions:

The production per year indicates an increase in the interest of research development in this field. This is due to the exponential growth explained by Price's Law. This subject has been treated by many authors with different approaches, but the main trends and lines are: benchmarking, energy, facilities management, hospitality, costs and sustainability.

From the point of view of productivity, the USA, China and Spain have the highest number of publications. Among the most productive universities, the University of California and The Hong Kong Polytechnic University stand out. Therefore, a high applicability of the subject in these regions and entities can be inferred. This information may be of interest to researchers in terms of linking with these universities for collaboration, scholarship opportunities and project applications.

The sources that publish the most articles in this field are the International Journal of Hospitality Management, Hvac Heating, Piping, Air Conditioning, Journal of Hospitality and Tourism Research and Sustainability (Switzerland). These are journals that publish articles related to the topic, and it is recommended that researchers consult them for future publications, as well as to follow up on the topic and systematize it.

Although the same authors do not stand out in all the impact indexes, Lai JHK has been identified as the authors with the greatest impact on the field, taking into account productivity. By number of local citations: Ostrowska-Wawryniuk K and Piątek Ł. By highest "h", "g" and "m" indices: Lai JHK, Burnett J and Yik FWH. The co-citation analysis of papers reveals that in this field the knowledge bases are structured by authors such as: Chan et al. (2001) and Lai and Yik (2008).

Taking into account the above indicators, the most relevant authors are Lai JHK and Burnett J. The identification of the documents with the most local citations, co-cita-

tion and contributions serve as a theoretical reference framework for future research. Another aspect to take into account is that some variables that tend to be used in this type of studies are: benchmarking, energy, facilities management, hospitality, costs and sustainability. It is therefore recommended that future research should focus on or be based on these criteria. It was determined that the subject has not been systematized in its entirety, since the levels of productivity by authors are mostly intermediate and low, so this is a subject where there are still gaps that new research can fill through the construction of knowledge and systematization.

There are many areas for further research, as this is an area that has been insufficiently studied, and so these are proposed as future lines of research for researchers studying the subject:

The need to identify the factors that influence the hotel's decision on the appropriate mix of maintenance methods and maintenance outsourcing. Future research should identify and examine the knowledge and training required for hotel staff in maintenance management.

It is necessary to investigate the relationship between levels of maintenance management practices and hotel size, star category, brand and nationality. Specific policies and actions need to be implemented to maintain facilities, reduce energy waste and conserve these scarce resources. Future research in this area should examine energy management improvements in the hotel industries, as high volumes of energy consumption present the potential for significant cost benefits through energy management.

Perform a cost-benefit analysis of redundant systems. Investigate the culture and perception of the maintenance function by the General Manager, functional managers and staff of other departments within the hotel. It is necessary to investigate how the quality, age and occupancy rate of the hotels may affect the operating and maintenance costs of the facilities.

REFERENCES

Agbo, F. J., Oyelere, S. S., Suhonen, J., & Tukiainen, M. (2021). Scientific production and thematic breakthroughs in smart learning environments: a bibliometric analysis. *Smart Learning Environments*, 8(1), 1. <https://doi.org/10.1186/s40561-020-00145-4>

Arenas, E., & Colina, N. J. R. T. (2010). The planned preventive maintenance in hotel facilities: an undeferrable priority. 9(1), 45-47.

Aria, M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, 11(4), 959-975. <https://doi.org/10.1016/j.joi.2017.08.007>

Bang, J., & Kim, M. S. (2013). CRM fit and relationship quality in hotel industry [Article]. *International Journal of Smart Home*, 7(6), 11-22. <https://doi.org/10.14257/ijsh.2013.7.6.02>

Calveras, A. (2003). Incentives of international and local hotel chains to invest in environmental quality [Article]. *Tourism Economics*, 9(3), 297-306. <https://doi.org/10.1177/135481660300900304>

Cañedo Andalia, R., Rodríguez Labrada, R., & Montejó Castells, M. (2010). Scopus: la mayor base de datos de literatura científica arbitrada al alcance de los países subdesarrollados %J ACIMED. 21, 270-282. http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1024-94352010000300002&nrm=iso

Cesarotti, V., & Spada, C. (2009). A systemic approach to achieve operational excellence in hotel services [Article]. *International Journal of Quality and Service Sciences*, 1(1), 51-66. <https://doi.org/10.1108/17566690910945868>

Chan, K. T., Lee, R. H. K., & Burnett, J. (2001). Maintenance performance: A case study of hospitality engineering systems [Article]. *Facilities*, 19, 494-504. <https://doi.org/10.1108/02632770110409477>

Chan, K. T., Lee, R. H. K., & Burnett, J. (2003). Maintenance practices and energy performance of hotel buildings? [Article]. *Strategic Planning for Energy and the Environment*, 23(1), 6-28. <https://doi.org/10.1080/10485230309509628>

Chen, C. (2006). CiteSpace II: Detecting and visualizing emerging trends and transient patterns in scientific literature. *Journal of the American Society for Information Science and Technology*, 57, 359-377. <https://doi.org/10.1002/asi.20317>

Ferrer, M. A. (2004). Management control in hotel su-

pport processes [Article]. *Revista Venezolana de Gerencia*, 9(27), 490-507. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-6444240640&partnerID=40&md5=bf4a-0faa81168c428778ef4465860d62>

Ghazi, K. M. J. J. o. H., & Management, B. (2016). Hotel maintenance management practices. 5(1), 1-13.

Hassanien, A., & Losekoot, E. (2002). The application of facilities management expertise to the hotel renovation process [Article]. *Facilities*, 20, 230-238. <https://doi.org/10.1108/02632770210435143>

Hira, R., Diestet, O., Spanoudakis, G., Visaggios, G., Wirtzit, G., & Chang, S. K. (2007). It-outsourcing and it-offshoring: Trends and impacts on SE/KE curricula [Article]. *International Journal of Software Engineering and Knowledge Engineering*, 17(5), 663-685. <https://doi.org/10.1142/S0218194007003409>

Hussain, M., Al-Aomar, R., & Melhem, H. (2019). Assessment of lean-green practices on the sustainable performance of hotel supply chains [Article]. *International Journal of Contemporary Hospitality Management*, 31(6), 2448-2467. <https://doi.org/10.1108/IJCHM-05-2018-0380>

Ihsan, B., & Alshibani, A. (2018). Factors affecting operation and maintenance cost of hotels [Article]. *Property Management*, 36(3), 296-313. <https://doi.org/10.1108/PM-04-2017-0023>

Issac, S. S., & Mani, A. (2017). Revising the intention of indulging customer relationship and revenue management in next of kin with B2B and B2C [Article]. *International Journal of Mechanical Engineering and Technology*, 8(7), 1159-1167. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85026459708&partnerID=40&md5=2b-0b12101a360fe71a2368fe22fd3566>

Kim, J. J., & Han, H. (2020). Hotel of the future: exploring the attributes of a smart hotel adopting a mixed-methods approach [Article]. *Journal of Travel and Tourism Marketing*, 37(7), 804-822. <https://doi.org/10.1080/10548408.2020.1835788>

Laguardia, N. S., Castañeira, J. A. P., Cruz, R. A., Valero, B. J., & López, L. E. V. J. C. (2021). Análisis de la Gestión del Mantenimiento orientado a infraestructuras para el desplazamiento de discapacitados en el Complejo Hote-

lero los Cactus Tuxpan, Varadero. 4(2.1), 131-153. <https://doi.org/https://doi.org/10.33262/concienciadigital.v4i2.1.1716>

Lai, J. H. K. (2016). Energy use and maintenance costs of upmarket hotels [Article]. *International Journal of Hospitality Management*, 56, 33-43. <https://doi.org/10.1016/j.ijhm.2016.04.011>

Lai, J. H. K., & Yik, F. W. H. (2008). Benchmarking operation and maintenance costs of luxury hotels [Article]. *Journal of Facilities Management*, 6(4), 279-289. <https://doi.org/10.1108/14725960810908145>

Lai, J. H. K., & Yik, F. W. H. (2012a). Hotel engineering facilities: A case study of maintenance performance [Article]. *International Journal of Hospitality Management*, 31(1), 229-235. <https://doi.org/10.1016/j.ijhm.2011.05.002>

Lai, J. H. K., & Yik, F. W. H. (2012b). A probe into the facilities maintenance data of a hotel [Article]. *Building Services Engineering Research and Technology*, 33(2), 141-157. <https://doi.org/10.1177/0143624411401840>

Lockyer, T. (2002). Business guests' accommodation selection: The view from both sides [Article]. *International Journal of Contemporary Hospitality Management*, 14(6), 294-300. <https://doi.org/10.1108/09596110210436832>

Longart, P. (2020). Understanding Hotel Maintenance Management [Article]. *Journal of Quality Assurance in Hospitality and Tourism*, 21(3), 267-296. <https://doi.org/10.1080/1528008X.2019.1658148>

Mayouf, A.-A., & Hisham, E.-S. (2019). Maintenance Cost Index for Egyptian Hotels: An Exploratory Study. 13(2), 235-244.

McPhee, M. (2006). Sustainable resource management in the hospitality industry [Article]. *BioCycle*, 47(10). <https://www.scopus.com/inward/record.uri?eid=2-s2.0-33750819445&partnerID=40&md5=b-f91135058a8f39782f15aea4a37ff42>

Meng, Y., & Gao, Y. (2019). Research on online reservation preference of hotel consumers based on joint analysis method [Article]. *International Journal of Enterprise Information Systems*, 15(4), 75-86. <https://doi.org/10.4018/IJEIS.2019100105>

Orynycz, O., & Tucki, K. (2021). Total productive maintenance approach to an increase of the energy efficiency of a hotel facility and mitigation of water consumption [Article]. *Energies*, 14(6), Article 1706. <https://doi.org/10.3390/en14061706>

Oyewola, D. O., & Dada, E. G. (2022). Exploring machine learning: a scientometrics approach using bibliometrix and VOSviewer. *SN Applied Sciences*, 4(5), 143. <https://doi.org/10.1007/s42452-022-05027-7>

Priyangika, K. D. T., Perera, B. A. K. S., & Wickremanyake Karunaratne, T. L. (2020). Facilities Management Roles in the Hotel Industry: The Skills and Competencies Required [Article]. *Journal of Quality Assurance in Hospitality and Tourism*, 21(4), 454-473. <https://doi.org/10.1080/1528008X.2019.1679060>

Ragodoo, N. (2011). Social sustainability as a driver for integration and change at the community level: The case of the Mauritian Hotel Sector [Article]. *International Journal of Environmental, Cultural, Economic and Social Sustainability*, 7, 283-297. <https://doi.org/https://doi.org/10.18848/1832-2077/CGP/v07i04/54975>

Sanchez, E. B., Ricardo, E. d. C. P., & Leyva, B. S. (2020). Bibliometric study of tourism destination image in Science Direct. 16(1), 97-105. <https://doi.org/http://dx.doi.org/10.4067/S0718-235X2020000100097>

Shi, F. (2021). Bibliometric Analysis and Visualization of Bayesian Network Application in Safety Field. 7(6), 57-70. [https://doi.org/10.6919/ICJE.202106_7\(6\).0009](https://doi.org/10.6919/ICJE.202106_7(6).0009)

Silva, T. C., Ferreira, L. P., Costa, E., Silva, F. J. G., & Ávila, P. (2022). The Importance of the Maintenance Area in the Hotel Sector [Conference Paper]. *International Conference on Tourism, Technology and Systems, ICOTTS 2021*, 293, 13-24. https://doi.org/https://doi.org/10.1007/978-981-19-1040-1_2

Song, Y., Chen, X., Hao, T., Liu, Z., & Lan, Z. (2019). Exploring two decades of research on classroom dialogue by using bibliometric analysis. *Computers & Education*, 137, 12-31. <https://doi.org/https://doi.org/10.1016/j.compedu.2019.04.002>

Srilakshmi, B., & Dadhabai, S. (2018). Implications of HRM practices on employee commitment with special emphasis on hotel industry [Article]. *Journal of Advanced Research in Dynamical and Control Systems*, 10(8 Special Issue), 339-344. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85050993917&partnerID=40&md5=a438359be38df935e2f1e6d1c7adb6a1>

Toyosada, K., Otani, T., Shimizu, Y., & Managi, S. (2017). Water quality study on the hot and cold water supply systems at vietnamese hotels [Article]. *Water (Switzerland)*, 9(4), Article 251. <https://doi.org/10.3390/w9040251>

Van Hulle, S. W. H., Ghyselbrecht, N., Vermeiren, T. J. L., Depuydt, V., & Boeckaert, C. (2012). Individual treatment of hotel and restaurant waste water in rural areas [Article]. *Environmental Technology*, 33(6), 653-661. <https://doi.org/10.1080/09593330.2011.587025>