



Halal blockchain: Bibliometric analysis for mapping research

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Article Info

Article History

Received : 2022-05-15

Revised : 2022-07-17

Accepted : 2022-07-26

Published : 2022-08-15

Keywords:

Bibliometric, halal blockchain,
halal supply chain, VOSviewer

DOI:

<https://doi.org/10.20885/AJIM.vol4.iss1.art6>

JEL Classification:

O30, Z12

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Paper type:

Research paper



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Abstract

Purpose – The main purpose of this study is to identify patterns and directions of halal blockchain research and find out the development of halal blockchain research trends.

Methodology – This study used data from various articles in the Google Scholar database with the publication year limited from 2011 to 2022. Data collection used Harzing's Publish or Perish software. There were 353 articles that matched the keyword and they were processed by bibliometric analysis.

Findings – This study found the basic pattern in halal blockchain research, trends in halal blockchain research, the relationship among research, research gaps, researchers who research a lot on halal Blockchain and the most published publications.

Implications – This study contributes an overview of bibliometric studies in the halal blockchain literature, which can widen the previous literature and show more focused study topics by examining the abstracts and content of published articles. Findings related to evaluative and relational techniques can be helpful information for researchers, especially those new to this field of study. This bibliometric approach can be invaluable, especially for graduate students in supply chain management, logistics management, and industrial engineering.

Originality – The originality offered by this research is to process research documents based on halal blockchain journals on Google Scholar. Thus, a lot of information and knowledge about halal Blockchain over the last 10th years can be useful for further research.

Cite this article:

Yanti, R., Febrianti, M. A., Qurtubi, & Sulistio, J. (2022). Halal blockchain: bibliometric analysis for mapping research. *Asian Journal of Islamic Management (AJIM)*, 4(1), 72-85. <https://doi.org/10.20885/AJIM.vol4.iss1.art6>

Introduction

Research on the halal supply chain (HSC) has received much attention from management scholars (Indarti et al., 2020). Halal is a term of the Koran, derived from Arabic, which means permitted, allowed, halal, or legal (Ab Talib et al., 2016). Halal Supply Chain Management (HSCM) emphasizes halal integrity, usually due to raw materials and international outsourcing with many supplier partners globally (Sumarliyah, 2021). Tan et al. (2022) stated that there are concerns over the complete integrity of Halal food and its traceability as the supply chain becomes global. Traceability is the ability of a system to track and document the origin and history of food products, starting from the farm to the final consumer (Bahrudin et al., 2011). The presence of HSCM will lead to customer satisfaction, which will contribute to the development of the halal food industry (Rani et al., 2020).

The development of the halal supply chain continues to increase in line with consumer enthusiasm for halal products. Halal product market size is growing worldwide, including in Muslim minority countries. A study shows that the overall customer base of halal products is spread across 112 countries and more than 1.9 billion. The market rate of halal food products in 2018 was 1.37 trillion and is expected to reach \$2.0 trillion by 2024 (Khan et al., 2021). Tieman (2011) stated that there are four phases of the evolution of the halal supply chain namely, (1) Muslim companies, the halal supply chain is purely based on trust; (2) Halal products, an essential basis for trust is Halal certification (symbol); (3) Halal supply chain, the entire supply chain complies with certified Sharia; (4) Halal value chain, Halal covers the entire value chain.

In its operation, HSCM requires assurance that the entire process of procurement, distribution, handling, and processing of materials, spare parts, livestock, goods in process, or finished product inventory must be appropriately documented and carried out in a Halal and *Tayyib* manner (Surjandari et al., 2021). In addition, several problems must be resolved in the halal supply chain, including (1) trustworthiness, consumer's ability to validate halal product integrity; (2) chain integrity, automatic alignment of market requirements for supply chain scenarios; (3) transparency, halal supply chain audits, and adequate isolation from halal issues, and; (4) halal performance optimization, measuring the performance of supply chain partners (Tieman, 2011).

Blockchain technology is one of the alternative solutions that can improve the Halal Supply Chain (Letourneau & Whelan, 2017) because it integrates technology to exchange information. Blockchain has complete information about the supply chain path from the source to the point of purchase of the final consumer (Tieman & Williams, 2019). In the halal supply chain, the blockchain system will represent physical assets in the form of digital identities. Ownership of these identities, which smart contracts can later control, becomes a rule (Abeyratne & Monfared, 2016). For example, making a digital halal certificate, where the certificate will automatically print when the payment for the halal certificate process has been received (Novianti et al., 2020). Adopting Blockchain in the supply chain can increase the legitimacy, authenticity, and traceability of a product (Sumarlah et al., 2022).

Implementing blockchain technology in the halal industry is desirable to achieve more reliability in supply chain data and increase trust in supply chain processes (Abidin & Perdana, 2020). All parties in the supply chain must be responsible for protecting halal products from being cross-contaminated, either intentionally or unintentionally. One party cannot oversee this considerable responsibility. Blockchain technology allows the tracking of components of halal products in detail (Ahianindiasdri & Bergmans, 2021).

Blockchain technology provides confidentiality and non-manipulation of data to all participants in the same network because it has elements of intelligent contracts and distributed ledgers. Each 'block' of data cannot be changed and distributed to the network of users (Abdul Hafaz et al., 2014). Halal Blockchain can provide complete transparency in all halal supply chain transactions (Tieman & Williams, 2019), where transparency in the supply chain is a necessity. Good transparency will create high trust from consumers toward the product (Zakaria et al., 2015). The future directions listed represent many opportunities to explore the field's multidisciplinary aspects, including technology, processes, and people (Katuk, 2019).

So far, research related to halal Blockchain has generally focused on Manufacturing Supply Chain, Halal Industry, and Finance. There is very little research on halal Blockchain from a bibliometric perspective, so bibliometric research on halal Blockchain is vital. Bibliometrics is a quantitative technique to identify the authorship pattern of publications, citations used for the subject, collaboration pattern, research constituents, and explore the intellectual structure of a particular domain in the existing literature (Donthu, et al., 2021; Mathankar, 2018). Bibliometrics is becoming popular for identifying major journal trends regarding topics, widely cited papers, authors, institutions, and countries (Mas-Tur et al., 2020). Bibliometrics is also the most widely practiced approach to track the anatomy of research field knowledge and it is used to analyze research topics (Blanco-Mesa et al., 2017). By using the bibliometric method, this study aims to identify patterns and directions of halal blockchain research and discover the development of halal blockchain research trends.

Literature Review

Halal Blockchain

Blockchain is a technology disruption part of the fourth industrial revolution, which is expected to change how we work and live (Tieman & Williams, 2019). Blockchain was designed in 2008 and implemented a year later (Wang et al., 2018). Blockchain applications have often been discussed in supply chain management and logistics (Wong et al., 2020). Blockchain, a technology that can ensure security and transparency (Ahianindiasdri & Bergmans, 2021; Duan et al., 2020; Novianti et al., 2020), resembles a voice solution (Letourneau & Whelan, 2017). While Halal Blockchain is a combination of distributed ledger technology with smart contracts, so it has the potential to create a high-performance of halal network. Halal Blockchain includes an operational supply chain system to automatically communicate halal logistics instructions in the supply chain based on market needs, a vehicle for collaboration in the halal supply chain, creating synergy advantages, and tools for industry and halal authorities to audit and promptly investigate halal issues in the supply chain (Tieman, 2011).

Bibliometric Analysis

Bibliometrics relates to the terms of "info metrics" and "scientometric." Bibliometric analysis is a library and information sciences research field that studies bibliography using the quantitative or qualitative method (Mathankar, 2018). Recently, Bibliometrics has become an established part of information research and a quantitative approach to document description (Kannan & Thanuskodi, 2019). Bibliometric analysis can be helpful for both library and information science (LIS) scholars or people interested in bibliometric studies. Therefore, they can use it as a pattern to review other journals (Saber et al., 2019).

Bibliometric methods or "analyses" are now firmly established as scientific specialties and are integral to research evaluation methodologies, especially in the scientific and applied fields (Ellegaard & Wallin, 2015). Bibliometric indicators appear as a complementary, cheaper, and more objective way to assess complex academic scenarios resulting from this growing professionalization (Ortega, 2018). Bibliometrics has achieved significance in recent years due to its practical application in various library operations and services. It is estimated that the total periodical literature published in libraries and information sciences at the global level is 25% in bibliometric studies (Mathankar, 2018). The popularity of bibliometrics is also related to the advancement, availability, and accessibility of bibliometric software such as Gephi, Leximancer, VOSviewer, and scientific databases such as Scopus, Google Scholar, and web of science, as well as the cross-disciplinary pollination of bibliometric methodologies from information science to business research (Donthu, et al., 2021).

Mapping Research

Mapping is a review that seeks to identify not results but relationships. Mapping research is also a review but does not discuss the findings. Mapping focuses on characteristics such as where the activity occurs, where the funds come from, and what journal or media it is presented (Diane, 2016). Mapping research aims to reveal the structure and dynamics of scientific publication studies (Yildiz, 2019). Mapping, however, can be performed at some level of granularity. In mapping research, the researcher's ability to recognize and justify the interrelated choices representing the research design is essential (Peffer et al., 2007).

Research Methods

This study used data from various articles in the Google Scholar database with publication years limited from 2011 to 2022. Google Scholar was chosen because it had a much higher indicator score of 30% than Web of Science (Cabezas-Clavijo & Delgado-López-Cózar, 2013; Franceschet, 2010) and about 15% higher than Scopus. Therefore, Google Scholar is a powerful tool for

researchers searching for information and literature calculation of bibliometric indicators (Cabezas-Clavijo & Delgado-López-Cózar, 2013). Data collection used Harzing's Publish or Perish (PoP) software. Alvesson and Sandberg (2013) stated that PoP software could help researchers to publish top journals. PoP can also be a measure of how scholarliness is defined and evaluated. In this study, the publication name used "journal," and the keyword used "halal blockchain." Based on the specified criteria, the PoP software tracked the Google Scholar database and showed tracking results. Afterward, the PoP tracking results data were used for processing and analyzing halal blockchain topics. The results obtained 353 articles that matched the keyword and they were processed to the next stage, as shown in Figure 1.

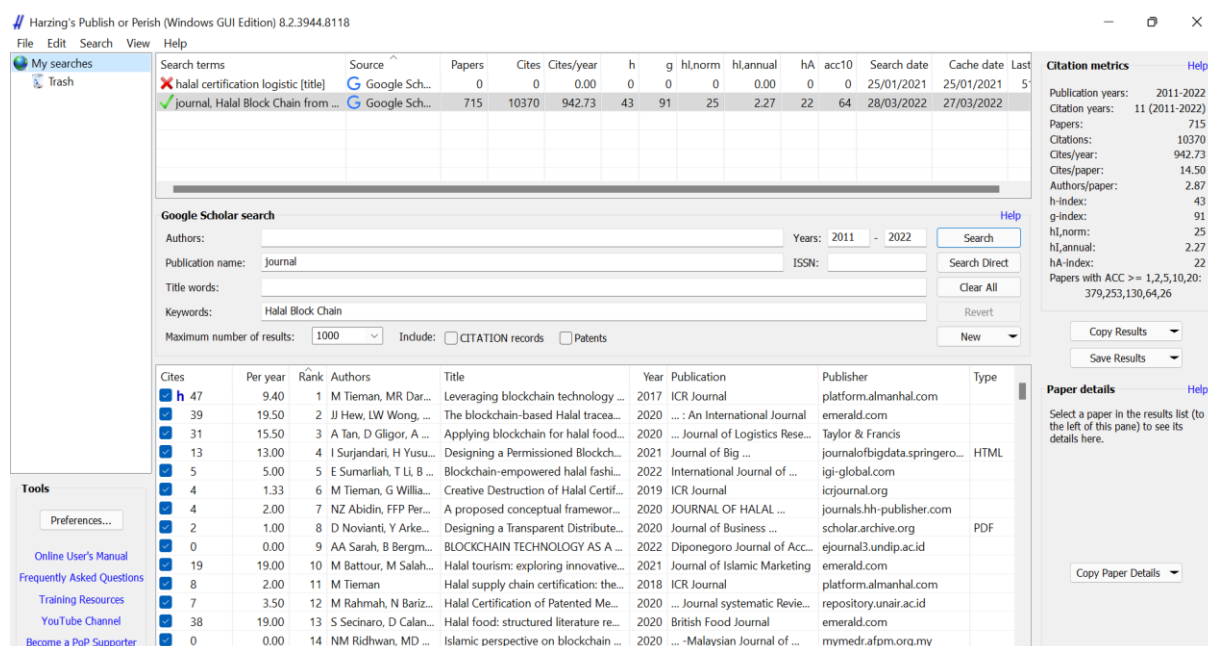


Figure 1. Visualization of PoP Software by Keyword

Nevertheless, only 11 articles had the keyword "halal blockchain" in the title, as shown in Figure 2. Bibliometric analysis was carried out using VOSviewer software, which could visualize the development of publication trends related to halal Blockchain into a bibliometric map.

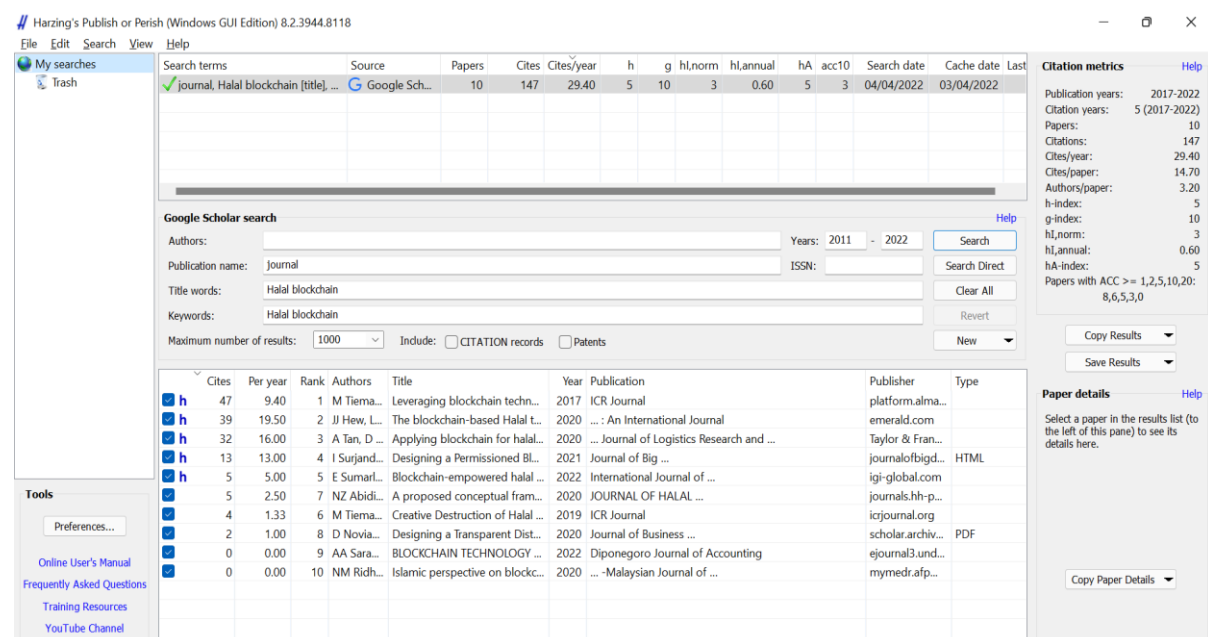


Figure 2. Visualization of PoP Software by Title

Results and Discussion

Bibliometric analysis is a powerful mapping instrument used to quantitatively assess scientific production (Du et al., 2021). Bibliometric analysis through science mapping provides in-depth analysis, highlights intellectual structures, and identifies hot topics using landscape maps (Andersen & Swami, 2021). This section displays a graph of mapping results from 353 halal blockchain articles to find the meta-analysis results. Keywords are used in mapping to group important or unique terms in the publication of halal blockchain topics. These results and discussions can represent research regarding the development and trend of the halal blockchain topic, which can be an opportunity for further research.

Publication Output

In searching the Google Scholar database, 353 publications related to halal Blockchain were found, which were published in 2011-2022 with different publication sources. The year 2022 was chosen, although when this study was conducted, it was only entering the 2nd quarter of 2022, and it was not over yet, but the researcher wanted to know how the latest development of halal Blockchain when entering the new normal era after the Covid-19 pandemic which turned out to affect increasing research related to halal Blockchain. Figure 3 shows the distribution of the year of publication. Figure 4 shows the sources of publication.

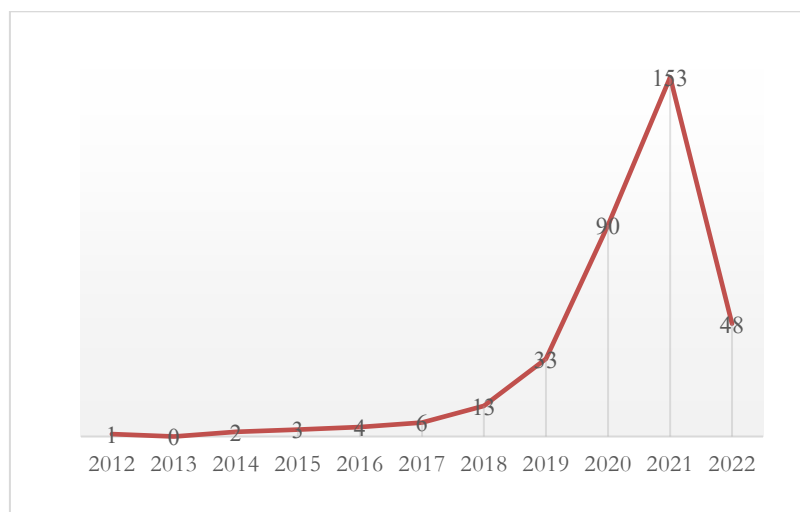


Figure 3. Publication by Year

Of the 353 publications identified on Google Scholar, the most publications on halal Blockchain were in 2021, with 153 articles published. In addition, from the last ten years, halal Blockchain had begun to experience rapid development in 2019, when the covid-19 virus began to appear worldwide and required changes in almost all lines of life, from offline to online. The limitations and fragility of global supply chain resilience occur; thus, potential transition and evolution opportunities are highlighted, mainly social and technological transformation (Sarkis, 2021). Sharma (2022) proposed a blockchain platform to combat the pandemic. Blockchain applications have great potential for the Covid-19 pandemic (Ahmad et al., 2020).

Publisher distribution in Figure 4 was taken from most publishers. Other publishers were the group of publishers that only contributed less than 1% for studies related to halal Blockchain. In addition, the four publishers, including Emerald, Springer, Elsevier, and Taylor & Francis, were famous among researchers. Many literature reviews and bibliometric studies, such as Franceschini et al. (2014); Ortega (2018); Julia et al. (2020), used some of these publishers as material for their analysis. In this study, these four publishers contributed more publications than the others. However, Springer only contributed 2% publications, as well as Academia and Koreascience, while MDPI contributed up to 4%. Details on the frequency and percentage are shown in Table 1.

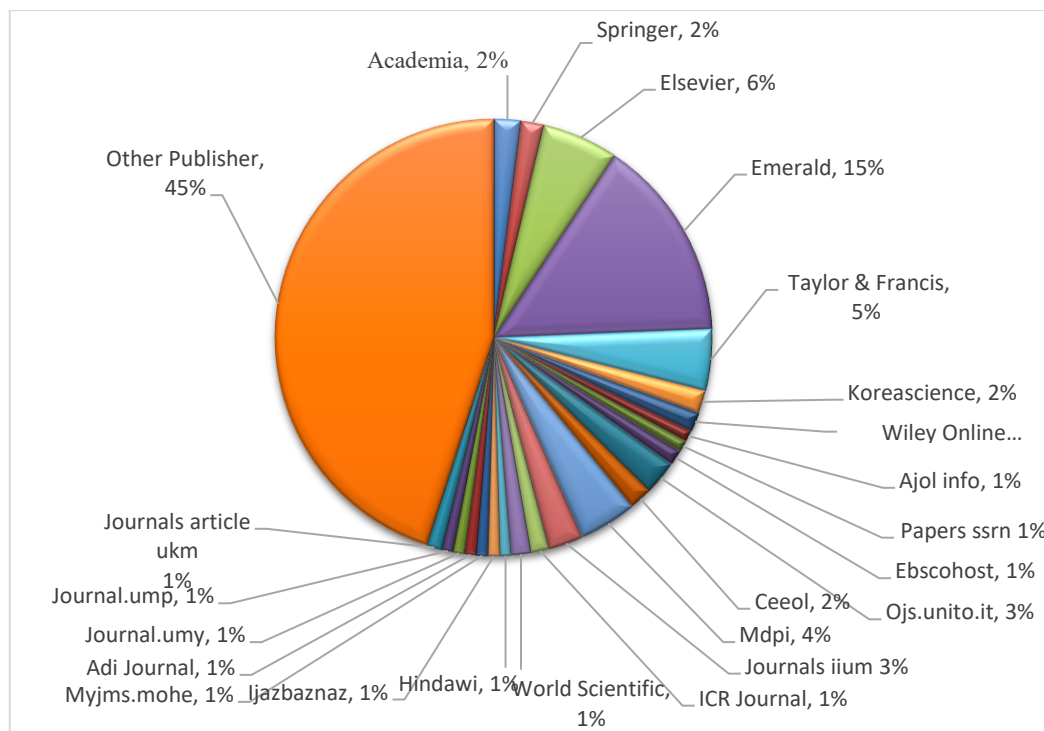


Figure 4. Publication by Publisher

Table 1. Detailed Frequent and Percentage of the Publisher

Publisher	Frequent	Percentage
Academia.edu	7	2%
Ceeol	6	2%
Elsevier	20	6%
Emerald	53	15%
Taylor & francis	16	5%
Springer	6	2%
Icr journal	5	1%
Ijazbaznaz	3	1%
Journal umy	3	1%
Journal article ukm	4	1%
Journals iium	9	3%
Koreascience	6	2%
Mdpi	15	5%
Ojs unito it	9	3%
Wiley online library	5	1%
World scientific	5	1%
Journal ump	3	1%
Hindawi	3	1%
Ajol info	3	1%
Adi journal	3	1%
Myjms mohe	3	1%
Papers ssrn	3	1%
Ebscohost	4	1%
Other publisher	159	45%

Bibliometric Analysis Based on Quotation Marks

The results of searching documents using PoP obtained 353 publications. It was known that the total citations reached 9986 citations, with the number of citations per paper of 28.21 citations and

the average number of authors per paper of 2.94. The most cited publication was an article written by Allcott & Gentzkow entitled "social media and fake news in the 2016 election" in the journal of economic perspectives in 2017 (Allcott & Gentzkow, 2017). Since being published in 2017 until now, 5839 articles had been cited, with an annual average of 1167.80. Of the 353 documents, the most published articles were from the ICR Journal and the Journal of Islamic Marketing, with six articles each.

Author and Co-authorship

The author's bibliometric mapping using VOSviewer software is shown in Figure 5. The brighter the yellow color and the larger the shape, the more authors published articles related to halal Blockchain. Meanwhile, the density indicated collaboration between one academician and another, where authors with a high density published more research related to halal Blockchain in collaboration.

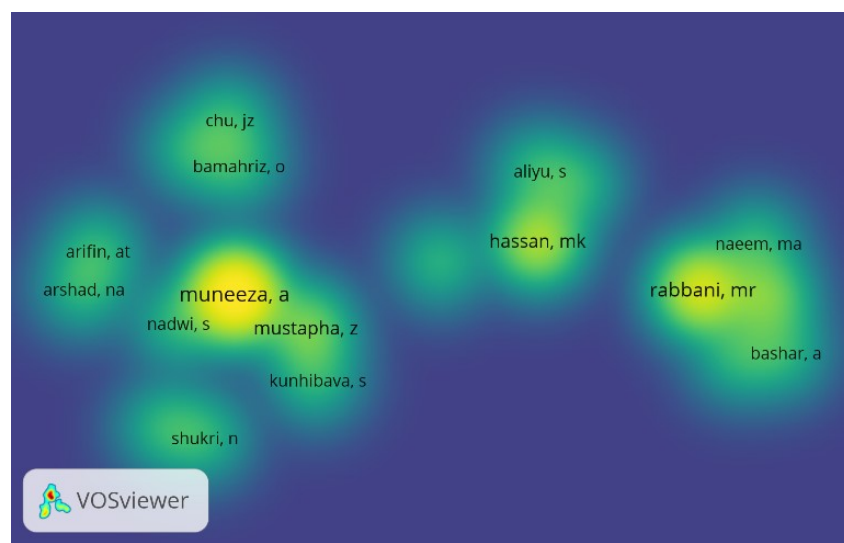


Figure 5. Co-authorship Map

Mapping based on co-authorship can be used to find which authors published the most articles or writings related to halal Blockchain and provided important information about the collaborative pattern of authors. Kumar (2015) mentioned that an essential feature of co-authorship network analysis is identifying the primary author. Of the 353 documents, 70 (19.8%) articles were written by one author, while others were written in collaboration. The results of mapping the authors of the most published articles can be seen in Table 2.

Table 2. Authors with Most Documents

No	Author	Document	Total Link Strength
1	A, Muneeza	7	7
2	S, Khan	6	5
3	Y, Fernando	5	5
4	A, Haleem	5	5
5	E, Sumarliah	5	4
6	M.I, Khan	4	4
7	Y, Arkeman	4	4
8	M.R, Rabbani	4	3
9	M, Tieman	4	3

Based on Table 2, it can be seen the order of the researchers who researched the most regarding halal Blockchain, amount of publications, and frequency of collaboration, as indicated by the total link strength. In this case, the academician who published the most halal blockchain

publications was Muneeza, with seven publications, and all research on halal Blockchain was done in collaboration. However, Khan and Sumarliah had conducted one study individually while others collaborated. This co-authorship relationship provided information about a group of people who work closely together.

Bibliometrics Based on Topics

Bibliometric analysis based on trending topics is fascinating in the research world because it is beneficial for further research to help find unique and engaging topics that may be rarely studied. This stage can identify content, patterns, and trends through the power of keywords.

Title and abstract

From the document titles related to halal Blockchain from 353 documents, 2306 keywords were found, divided into 95 thresholds. Thus, the limitation was done by taking 5 of the 95 thresholds so that 57 items were obtained that correspond to the 6 clusters where distribution is visualized in Figure 6. The clarity of keywords in the 6 clusters can be seen in Table 2.

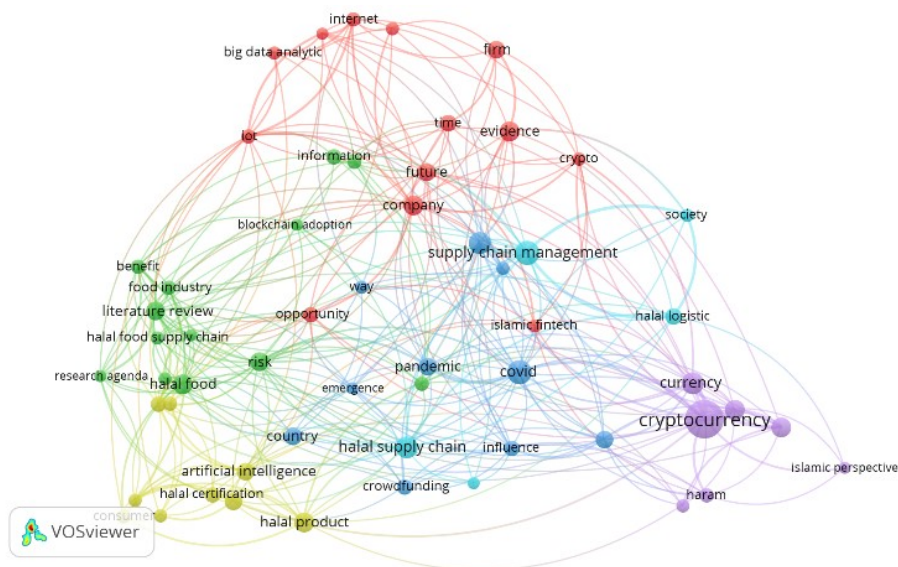


Figure 6. Co-Occurrence Map on Title and Abstract

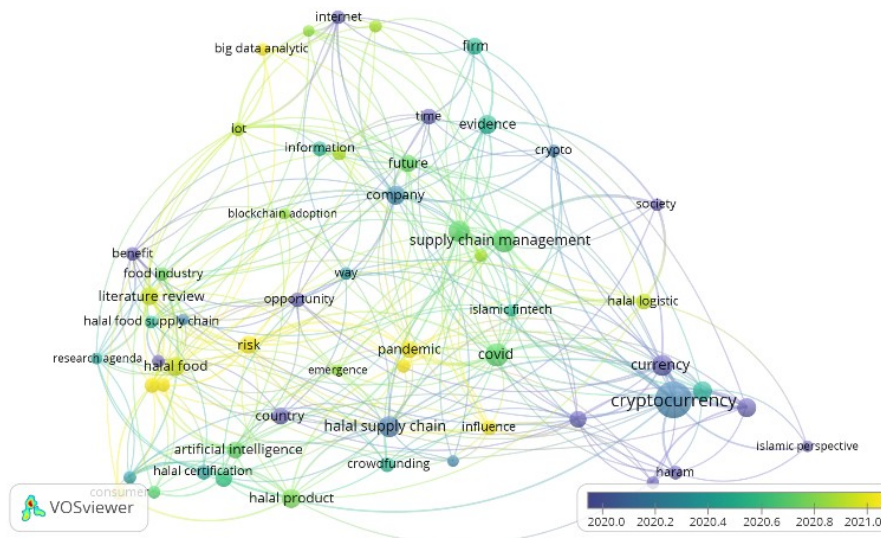


Figure 7. Overlay Visualization for Title and Abstract

The color in Figure 6 denotes the cluster that is formed. Different colors mean different

clusters: cluster 1 is red, cluster 2 is green, cluster 3 is violet-blue, cluster 4 is green-yellow, cluster 5 is purple, and cluster 6 is blue. Furthermore, the term in Figure 6, which has a larger shape, is widely included in the titles and abstracts of publications related to halal Blockchain. In addition, a line indicates the connection among terms that appear together in the publication's title and abstract. In addition, a line indicates the connection between terms that appear together in the publication's title and abstract. Terms that often appear were "cryptocurrency" with a frequency of 45 times, "covid," and "halal supply chain," which appears 19 times. The distribution of the year of halal blockchain publication based on keywords can be seen in Figure 7.

Figure 7 represents the year distribution of keywords based on the year of publication, shown in different colors. The purple color indicated the publication year 2020 and below, and the yellow color indicated the publication year from 2021 to 2022. The map showed the keywords "pandemic," "influence," "risk," "halal food," "literature review," "big data analytic," and "halal logistics" in yellow color, which means that the keyword appears in articles published between 2021 and 2022. Keyword distribution in each cluster is shown in Table 3.

Table 3. Keyword Cluster

Cluster	Keywords
1	Big Data Analytic, Company, Crypto, Evidence, Firm, Future, Internet, IOT, Islamic Fintech, Opportunity, Relationship, Things, Time
2	Addition, Benefits, Blockchain Adoption, Challenges, Food Industry, Halal Food, Halal Food Supply Chain, Halal Standard, Information, Literature Review, Research Agenda, Risk, Transparency
3	Country, Covid, Crowdfunding, Customer, Effect, Emergency, Financial Technology, Influence, Pandemic, Way
4	Artificial Intelligent, Big data, Consumer, Food Supply Chain, Halal Certification, Halal Product, Literature, Systematic Literature Review, Systematic Review
5	Bitcoin, Cryptocurrency, Currency, Haram, Islamic Banking, Islamic Perspective, Transaction
6	Halal integrity, Halal supply chain, Halal logistics, Society, Supply Chain Management

Title field

Mapping terms based on publication titles are shown in Figure 8. There were 1020 terms obtained from mapping using VOSviewer. By using five thresholds, 34 terms were obtained, and for the relevant terms based on the VOSviewer software screening, only 20 (60%). The distribution of these terms is visualized in Figure 8.



Figure 8. Co-occurrence Map on the Publication Title

Keywords that had a more prominent form indicated that researchers widely used these keywords in the publication titles of halal blockchain topics. The keywords that appeared the most were "technology" 34 times, "supply chain" 21 times, and "covid" 18 times.

Abstract field

Based on abstracts of 353 documents, 1560 terms were found with 14 thresholds. Using five

thresholds, 58 terms were obtained and then screened again by VOSviewer, and only 35 relevant terms.

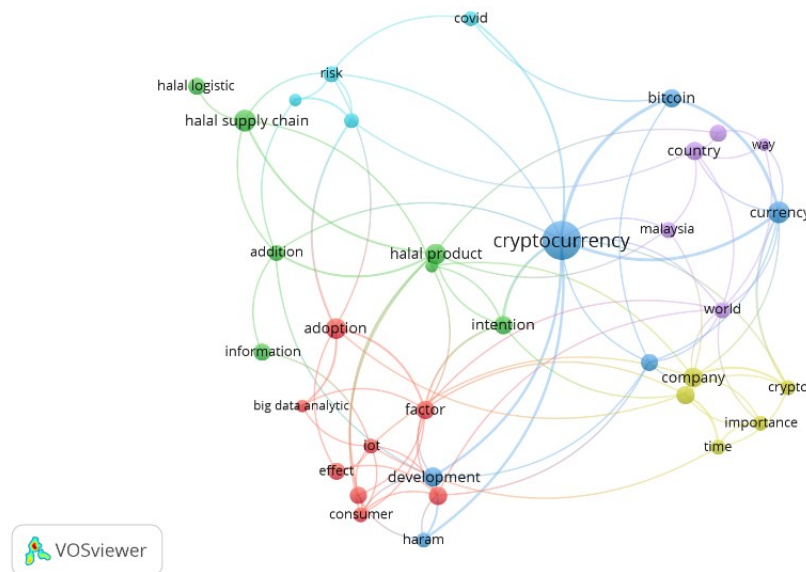


Figure 9. Co-occurrence Map on Keyword

Figure 9 shows that the terms that dominate or often appear in the abstract of halal blockchain publications were characterized by the magnitude of the form of the term. In this case, the terms that appear a lot include "Cryptocurrency" 43 times, "Currency" 14 times, and "Halal Supply Chain" 13 times. DiNizo, Jr (2018) stated that Blockchain was initially developed for the decentralized digital cryptocurrency Bitcoin causing significant disruption in the stock market. Moreover, Battour et al. (2022) stated that Halal blockchain-based cryptocurrencies are a powerful tool for Muslims. So it is natural that the term that appears the most in halal blockchain publications is cryptocurrency.

Conclusion

Bibliometric analysis with mapping research can identify hot and exciting research topics and be helpful in future research. In this research, 353 journals with the theme "halal blockchain" sourced from Google Scholar were used for analysis. The findings obtained 43% (153) of the total articles published in 2021. The publisher who published the most articles related to halal Blockchain is Emerald, the most published journal comes from the ICR Journal and the Journal of Islamic Marketing, and the researchers who published halal blockchain articles were Muneeza, as many as seven posts.

From 353 publications, there were 9986 quotes, and the most cited article entitled "social media and fake news in the 2016 election" written by Allcott and Gentzkow, published in 2017. In addition, several trending topics were also found by searching terms through titles, abstracts, as well as abstracts and titles. Some of these topics include: "Cryptocurrency", "Covid", "Technology", "Supply Chain", and "Currency". For further research, you can research related topic trends that can be combined with unique topics that are less prominent. In addition, in the last decade, research related to halal Blockchain amounted to 353 publications, which is minimal compared to research related to other topics. Therefore, this is an opportunity for further researchers.

Acknowledgments

Thanks to the Department of Industrial Engineering Universitas Islam Indonesia, who fully supports this article.

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 Investigation: Roaida Yanti
 Methodology: Melinska Ayu Febrianti
 Project administration: Melinska Ayu Febrianti
 Supervision: Joko Sulistio
 Validation: Joko Sulistio
 Visualization: Roaida Yanti
 Writing – original draft: Roaida Yanti
 Writing – review & editing: Roaida Yanti

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