# Trend of Continuous Auditing Research: A Bibliometric Analysis

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**Abstract**. The purpose of this study was to find out how the development of citations, publication trends, a collaboration of authors, trends in title terms, and trends in keyword terms in Continuous Auditing articles (2013-2022). Data collection using publish or perish (PoP) software in bibliographic search as the initial database on Scopus. The results showed that from 200 scopus papers, the number of citations 2,5781 citations, with an average annual citation of 2915 citations, 14.58 citations per paper, and an average h-index of 26. The highest citations with authors from various countries; C. Sarkar (115 cites, rank 1). The most frequently used term in the title is continuous auditing with 27 items. It can be concluded that the trend of continuous auditing research is that various aspects are developed in preventing company failures and financial statement errors in the future.

**Keywords**: Continuous Auditing; Bibliometric Analysis.

## 1. Introduction

In the modern era, the audit system is becoming increasingly sophisticated and beneficial for the growth of the Technical Implementation Units (UPT) of various government and private agencies [1]. One of them is the continuous auditing methodology which has data analysis features in carrying out the audit process [2]. It is different from the traditional audit methodology or also called conventional audit which has drawbacks because it can increase the possibility of errors by the auditors [3]. A large UPT is not always good and must be a concern for the auditor who needs to analyze the possibility of fraud. Therefore, Continuous Auditing (CA) is a must in the digitalization era, where the audit team must be able to take advantage of a more effective and efficient audit. If the UPT has used the application, the Audit Team can use data analysis with the continuous auditing approach to improving the auditor's capability in analyzing the available data. If aspects of the results of data analysis are not met or are suspicious, then the internal auditor can conduct an on-site audit [4].

The literature reveals that continuous auditing is very useful for auditors to be able to identify and analyze trends by reviewing trends and testing controls over business activities if there are anomalies in business behavior or transactions represented in the data [5]. It should be understood that the continuous auditing approach can minimize the possibility of fraud because it is based on technology that allows auditors to carry out on going supervision.

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However, the risk of auditing fraud cannot be eliminated. For example in sectors that have high transactions such as banking where continuous audit activities are combined with data mining applications. The continuous auditing approach will only mitigate the wrong sampling that is often done by auditors [6]. Implementing continuous auditing requires support from internal management. The reason is that the management has authority over the database, understands the risks and obligations in internal control, and can explain the auditee application work process flow [7]. According to Ariston & Handoko (2006), policies related to the legal aspects of the implementation of the continuous auditing model are also needed as the legal basis for electronic data transaction mechanisms. So that audit findings have binding legal force.

The large prospect of continuous auditing in companies and government agencies increases the amount of research around the world. Previous studies reveal that the role of continuous auditing theory can act as a framework for a continuous transaction verification process that is in line with the times. Current literature study opportunities and future directions of continuous auditing research with different conceptual approaches will support an examination of the status of knowledge about continuous auditing. So that more modern continuous auditing models can be used for better organizational performance in the future [9]. Experts investigate various fundamental aspects and impacts of using continuous auditing in business processes where many of them lose large sums of money and face ethical consequences due to fraud (Hazar, 2020). Likewise with government agencies in the context of preventing and eradicating corruption, collusion, and nepotism [11]. It is very important to know the progress of research on continuous auditing in the past 10 (ten) years. The goal is to enable the development of a continuous auditing that is more effective in supporting the needs of auditors and minimizing the occurrence of fraud that can harm the organization.

## 2. Literature Review

Continuous Auditing (CA) allows all transaction records to be analyzed easily and quickly which is stored in big data in a relatively short time compared to conventional methods. The Continuous Auditing (CA) also enables remote access so that auditors can perform remote audit activities through the continuous auditing system. For this reason, the audit process creates time efficiency and lowers audit costs (Hazar, 2020). Three different continuous auditing models can be used by auditors within a company. The choice of the three forms of the right continuous auditing model depends on the cost and time aspects. First, embedded audit modules (EAM) were developed by Groomer & Murthy (1989). Its working principle is to embed the programming code created by the auditor and included it in the structure of the audit system program. EAM can monitor transactions that occur in audit applications based on criteria that have been created in the programming code.

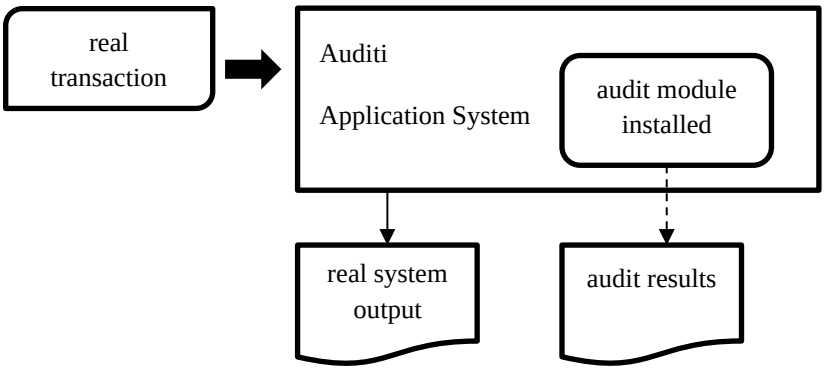


**Figure 1.** Embedded Audit Modules Work Process Flow (EAM)
Source: Groomer & Murthy (1989)

From Figure 1, it can be explained that the EAM flow starts from the real transaction and then continues on the auditee computer application system using the audit model that has been installed which ultimately produces the real output of the system. The processing time of automatic data analysis can coincide with the work of the auditee application. Second, the monitoring and control layer (MCL) which in its working system extracts data according to the auditor's criteria, and the results of data analysis are then used as audit material. EAM can help provide continuous monitoring and control of accounting information systems [13].

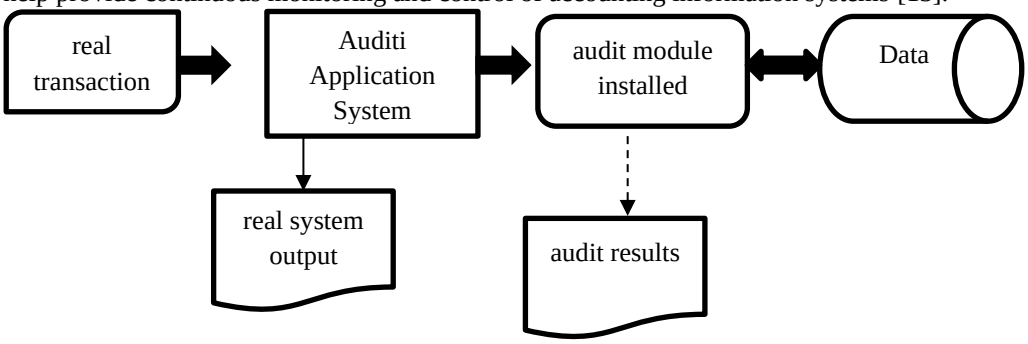


**Fig. 2.** Monitoring and Control Layer Work Process Flow (MCL)
Source: Sigvaldason & Warren (2004)

Figure 2 explains that the MCL flow starts from real transactions that are inputted into the audit application system using MCL to process data. This audit application system will produce a real output system, while the MCL will produce an auditor's report form [12]. In contrast to EAM, in the MCL model, the data processing is semi-automatic where the data analysis processing time can wait for the auditee application to finish. Third, audit data warehouse (ADW) in its working process can extract and analyze transaction data [15]. What distinguishes it from the other two models is that ADM has a data mart that acts as data analysis with data control and time intervals.

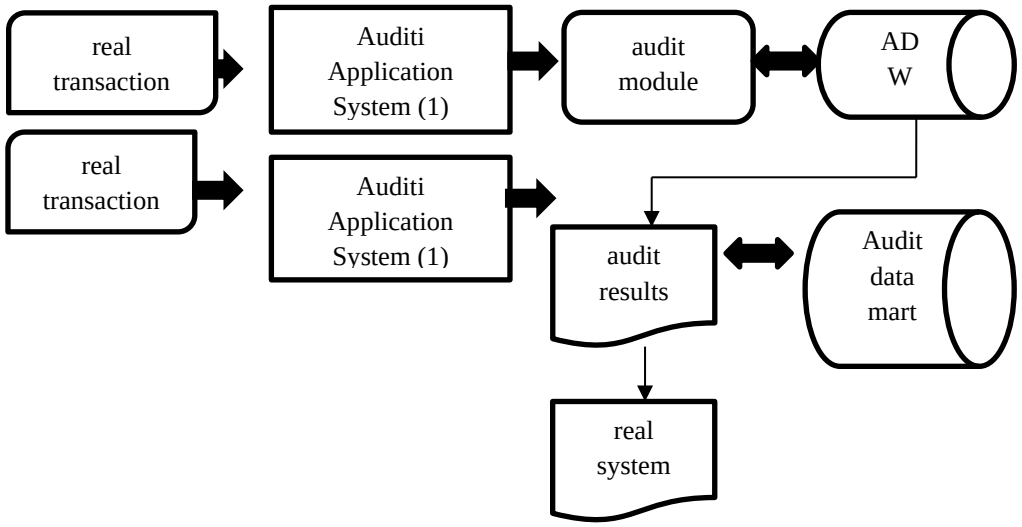


**Figure 3.** Data Warehouse Audit Workflow (ADW)
Source: David & Steinbart (1999)

From Figure 3, it can be seen that ADW has an interface application where reporting can be done at any time according to audit purposes. Similar to the MCL work model, the data analysis process time can wait for the completion of the audit, only the advantages are that it uses a semi-automatic and automatic system but with high costs and a larger IT infrastructure than the EAM and MCL models.

## 3. Research Methods

This research uses a literature study method. A literature study is a series of research activities by collecting library data relevant to the research objectives [16]. The purpose of this research is to conduct a systematic mapping on the topic of the continuous auditing study. The data analysis used is bibliometric analysis [17] to find out how the development of citations, publication trends, a collaboration of authors, trends in title terms, and trends in keyword terms [18] in continuous auditing articles during the last ten years 2013-2022. There are six stages of data analysis carried out in the literature study using this bibliometric analysis. First, choose the source of the library obtained with the help of the publish or perish application. Publish or perish makes it easy to find a variety of previous literature accurately. A total of 200 previous studies in the search consisted of articles indexed by Scopus. Second, tracing the literature sources that have been obtained from the publish or perish software. Third, read literature sources that are relevant to the research theme, namely those related to the fundamental aspects of continuous auditing. Fourth, record the data that has been obtained in the form of RIS data. Fifth, is the presentation of literature data where the researcher uses the

help of VOSviewer software. Vosviewer makes it easy for researchers to present data in three forms (Network Visualization, Overlay Visualization, and Density visualization). Sixth, make conclusions and suggestions from the findings. The results of the research conclusions contain a brief statement about the results of the descriptive analysis and discussion and end by providing suggestions for further studies[19][20].

## 4. Result and Discussion

The findings reveal that from the citation metrics displayed by publishing or perish, 500 research articles which in the period 2013-2022 have several citations reached 25,781 citations. Citation is an important thing in writing scientific papers because with citations the author shows the reader the existence of writings on scientific works that are sourced from other people's scientific works. The high citation of the Continuous Auditing (CA) phenomenon globally gives an understanding that the quality of scientific work is sufficiently qualified to later be implemented in companies or government agencies according to their needs.

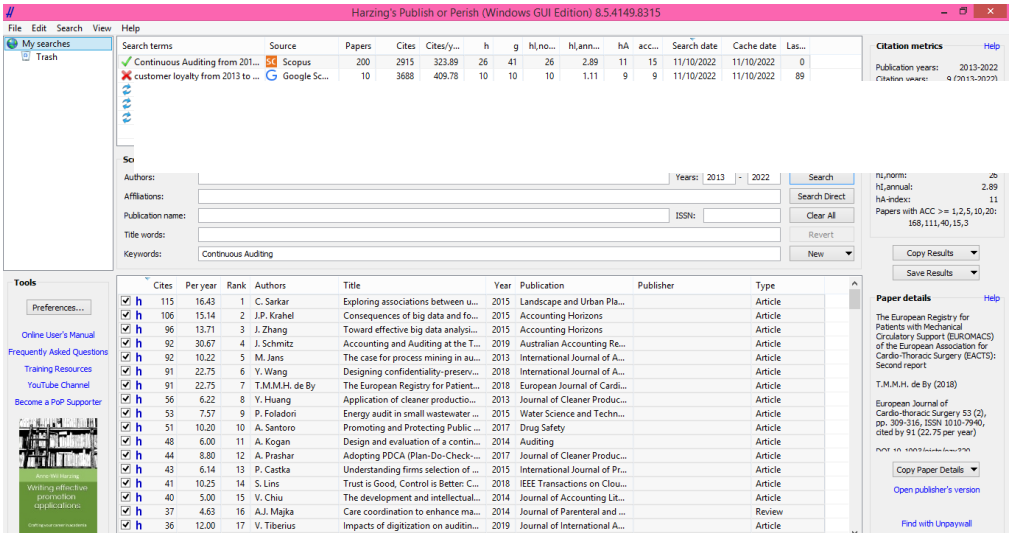


**Figure 4.** Harzing's Publish or Perish Search Data Version 8.5

From Figure 4, it can be explained that research on Continuous Auditing (CA) over the last 10 (ten) years obtained citations per year reaching 2915 citations, while the average citation per paper that discusses continuous auditing is 14.58 citations. In addition, it is shown in Figure 4 that h-index 26, g-index 41, hi-norm 26, hI, annual 2.89, hA-index 11. Next 15 (fifteen) research articles with the highest citations from 2013-2022.

**Table 1.** Continuous Auditing Research with the Highest Citation 2013-2022

| Cites | Per Year | Rank | Authors | Title | Year | Publication |
|---|---|---|---|---|---|---|
| 115 | 16.43 | 1 | C. Sarkar | Exploring associations between urban green, street design and walking: Results from the Greater London boroughs | 2015 | Landscape and Urban Planning |
| 106 | 15.14 | 2 | J.P. Krahel | Consequences of big data and formalization on accounting and auditing standards | 2015 | Accounting Horizons |
| 96 | 13.71 | 3 | J. Zhang | Toward effective big data analysis in continuous auditing | 2015 | Accounting Horizons |
| 92 | 30.67 | 4 | J. Schmitz | Accounting and Auditing at the Time of Blockchain Technology: A Research Agenda | 2019 | Australian Accounting Review |
| 92 | 10.22 | 5 | M. Jans | The case for process mining in auditing: Sources of value added and areas of application | 2013 | International Journal of Accounting Information Systems |
| 91 | 22.75 | 6 | Y. Wang | Designing confidentiality-preserving Blockchain-based transaction processing systems | 2018 | International Journal of Accounting Information Systems |
| 91 | 22.75 | 7 | T.M.M.H. de By | The European Registry for Patients with Mechanical Circulatory Support (EUROMACS) of the European Association for Cardio-Thoracic Surgery (EACTS): Second report | 2018 | European Journal of Cardio-thoracic Surgery |
| 56 | 6.22 | 8 | Y. Huang | Application of cleaner production as an important sustainable strategy in the ceramic tile plant-a case study in Guangzhou, China | 2013 | Journal of Cleaner Production |
| 53 | 7.57 | 9 | P. Foladori | Energy audit in small wastewater treatment plants: Methodology, energy consumption indicators, and lessons learned | 2015 | Water Science and Technology |
| 51 | 10.20 | 10 | A. Santoro | Promoting and Protecting Public Health: How the European Union Pharmacovigilance System Works | 2017 | Drug Safety |
| 48 | 6.00 | 11 | A. Kogan | Design and evaluation of a | 2014 | Auditing |

| Cites | Per Year | Rank | Authors | Title | Year | Publication |
|---|---|---|---|---|---|---|
| | | | | continuous data level auditing system | | |
| 44 | 8.80 | 12 | A. Prashar | Adopting PDCA (Plan-Do-Check-Act) cycle for energy optimization in energy-intensive SMEs | 2017 | Journal of Cleaner Production |
| 43 | 6.14 | 13 | P. Castka | Understanding firms selection of their ISO 9000 third-party certifiers | 2015 | International Journal of Production Economics |
| 41 | 10.25 | 14 | S. Lins | Trust is Good, Control is Better: Creating Secure Clouds by Continuous Auditing | 2018 | IEEE Transactions on Cloud Computing |
| 40 | 5.00 | 15 | V. Chiu | The development and intellectual structure of continuous auditing research | 2014 | Journal of Accounting Literature |

N= 200 paper scopus
Source: Processed data with PoP 8.5, 2022

Table 1 shows that there are fifteen citations with authors from various countries collaborating, are; C. Sarkar (115 cites, rank 1) Landscape and Urban Planning publishing, J.P. Krahel (106 cites, rank 2) Accounting Horizons publishing, J. Zhang (cites 96, rank 3) Accounting Horizons publishing. These three top citations were published in the same year, 2015. The next is J. Schmitz (cites 92, rank 4) Australian Accounting Review publishing, M. Jans (cites 92, rank 5), Y. Wang (cites 91, rank 6), T.M. M. H. De By (cites 91, rank 7) European Journal of Cardio-thoracic Surgery publishing. These four Scopus articles have citations over 9.0. Citation with a score of 92 was published in the same journal, namely the International Journal of Accounting Information Systems. The author of the article on Continuous Auditing (CA) with the most citations (rank 8, cites 56, year 2013) is Y. Huang. Then, P. Folador (cites 53, year 2015, rank 9) Water Science and Technology publishing. In positions 10-15 with the most citations are as follows; A. Santoro (cites 51, year 2017, rank 10) Drug Safety publishing, K. Kogan (cites 48, year 2014, rank 11) Auditing publishing, A. Prashar (cites 44, year 2017, rank 12) Journal of Cleaner Production publishing, P. Castka (cites 43, year, 2015, rank 13) International Journal of Production Economics publishing, S. Lins (cites 41, year 2018, rank 14) IEEE Transactions on Cloud Computing publishing, and V. Chiu (cites 40, year 2014, rank 15) Journal of Accounting Literature publishing. The most frequently used term in the title is Continuous Auditing (CA) with 20 items.

**Table 2.** Number of Continuous Auditing Research Publications in 2013-2022

| Year | Paper |
|---|---|
| 2022 | 1 |
| 2021 | 18 |
| 2020 | 29 |

| | |
|---|---|
| 2019 | 26 |
| 2018 | 22 |
| 2017 | 20 |
| 2016 | 22 |
| 2015 | 26 |
| 2014 | 15 |
| 2013 | 21 |

N= 200 paper

Source: Processed data with PoP 8.5, 2022

Table 2 explains the number of publications on Continuous Auditing (CA) Research in 2013-2022. The highest number of publications was shown in 2020 with a total of 29 papers. In 2019 and 2015 with a total of 26 papers, and third place in 2018 and 2016 there were 22 papers. The lowest number of Continuous Auditing (CA) research publications in 2022 is 1 papers. The number of papers in 2022 is still low, but most likely it will continue to grow until the end of the year considering the trend of research on Continuous Auditing (CA) is still high.

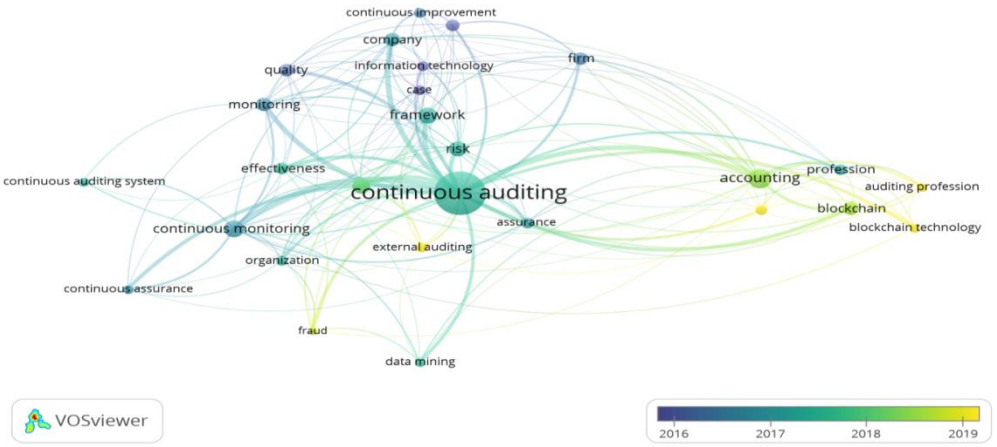


**Fig. 5.** Overlay Visualization

Figure 5 shows the trend of Continuous Auditing (CA) research keywords from 2013-2022. The dark blue color shows research keywords that have existed for a long time until 2016 (dark blue) including monitoring, firm, quality, company, and continuous improvement. In 2017-2018 (light blue to green) the most frequently appearing keywords were about risk, accounting, and blockchain. In 2019-present (yellow), fraud, blockchain technology, external auditing, and the auditing profession are the focus of CA's current keywords. Further, the findings reveal that the results of the analysis using VOSviewer for keywords of 500 papers on Continuous Auditing (CA) contained 27 items grouped into 5 clusters appearing on the Continuous Auditing (CA) theme with 155 links and 815 total link strength.

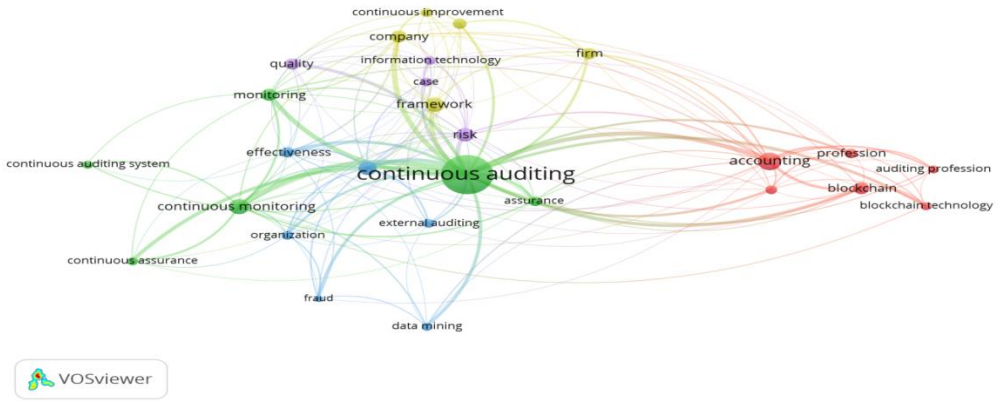


**Fig. 6.** Network Visualization

From Figure 6, Cluster 1 (5 items) which is most frequently studied is accounting, artificial intellegence, auditing profession, blockchain, profession. Cluster 2 (6 items), topics that have not been found much are assurance, continous assurance, continous auditing, continous auditing systems, continous monitoring, monitoring. Cluster 3 has 6 items, namely data mining, effectiveness, external auditing, fraud, internal auditing, organization. Cluster 4 consists of 5 items, namely company, compliance, continuous improvement, firm, and framework. Cluster 5 consists of 4 items consisting of case, information technology, quality, risk.

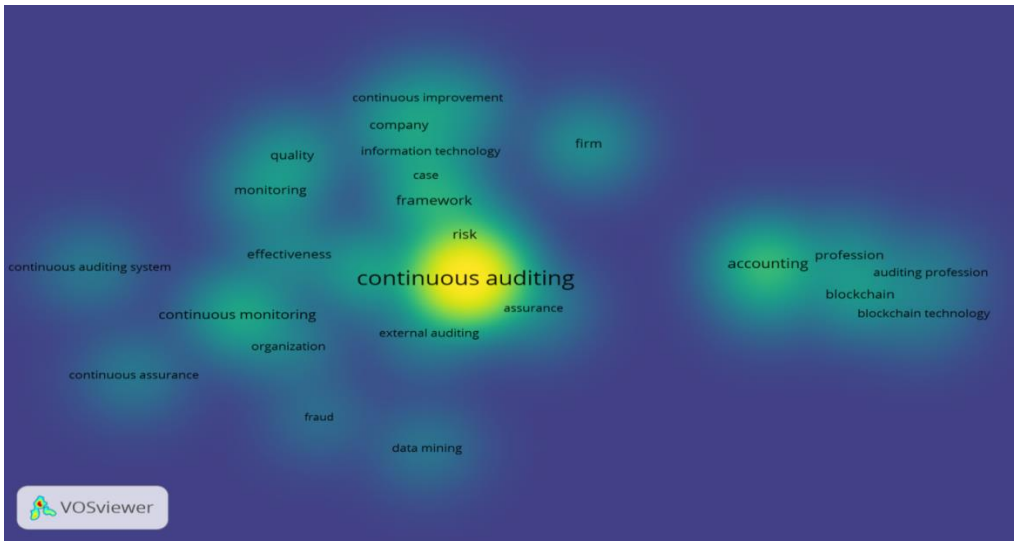


**Fig. 7.** Density Visualization

From Figure 7, this research illustrates providing information on keyword density visualization about Continuous Auditing (CA). Keywords that stand out can be seen from the size of the lighter and clearer yellow color. The VOSviewer research keywords are used to visualize the bibliography to find various keywords that still have the opportunity to be researched. This means that these findings can be an important reference for further research in improving the shortcomings of the continuous auditing model. So that more effective continuous auditing models will be born in the future. Continuous Auditing (CA) has tremendous benefits for business [5]. The role of internal management in understanding risk [7] and continuous auditing model implementation policies are also needed to support continuous auditing development [7], [8]. Hazar (2020) and Dewi (2022) explain that the use of continuous auditing in business processes and agencies is useful for protecting companies from losses due to fraud. The high prospect of continuous auditing in companies and government agencies has been proven to have increased the number of research around the world as shown by the number of citations for 10 (ten) years. last year. These findings support previous studies on the role of continuous auditing theory that can act as a framework for a continuous transaction verification process that is in line with the times. The opportunity for bibliographic analysis can be an important part of the development of current research and future directions [9]. In the end, Continuous Auditing (CA) research opportunities are still wide open. Continuous Auditing (CA) research opportunities enable the development of various fundamental aspects to improve the effectiveness of better internal control in the future.

## 5. Conclusion

This study has revealed a systematic mapping of Continuous Auditing (CA) based on bibliometric analysis. The findings reveal the development of citations, publication trends, a collaboration of authors, trends in title terms, and trends in keyword terms in Continuous Auditing (CA) articles during the last ten years 2013-2022. The results of the study put 15 (fifteen) research articles with the most citations written by various researchers around the world, the top three are; C. Sarkar (115 cites, rank 1) Landscape and Urban Planning publishing; J.P. Krahel (106 cites, rank 2) Accounting Horizons publishing, J. Zhang (cites 96, rank 3) Accounting Horizons publishing. The findings also reveal that the terms most frequently used in conceptual and empirical research on continuous auditing are divided into 27 keyword items which are divided into 5 clusters covering factors, impacts, and current topics. There are at least 1 recent articles in 2022 that have been published in international journals. From the findings, it can be concluded that various studies on continuous auditing continue to increase throughout the year. These studies can support the need for a useful conceptual framework for the development of a more effective and modern continuous auditing model. Which in the end is beneficial for businesses, especially auditors, and minimizes the occurrence of fraud that can harm the organization. This study is the initial stage for further studies of continuous auditing. Future studies can use these findings in the

context of developing continuous analysis by investigating more deeply the various factors that exist in the 5 clusters.

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