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Computational Bibliometric using VOSviewer: Analysis of the Development of Internet Financial Reporting Research

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ABSTRACT

This study seeks to investigate and analyse several scientific data about Internet Financial Reporting research advancement. This research is also anticipated to serve as a resource for researchers in determining financial literacy-related VOSviewer-based research topics. In this investigation, data from articles indexed by Google Scholar were utilized. Data collection through Internet Financial Reporting, Web Disclosure, and Financial Disclosure keyword searches. Data was collected from 2013 to 2022. The results demonstrated that a decade of research data yielded 982 articles. Based on the collected data, it can be seen that the number of publications has been increasing every year. Nine clusters were identified after conducting a keyword analysis of online financial reporting publications with VOSviewer. The study that employs bibliometric analysis advances the status of Internet financial reporting, a research field, precisely through visualizing trending topics and emergent trends. The analysis results have also suggested some variables that can be used in future research, which is very useful for identifying the knowledge base and future research directions in this area.

Keywords:
Bibliometric; VOSviewer; Internet financial reporting

1. Introduction

Corporate governance requires companies to operate ethically, healthily, and transparently [1]. Implementing Good Corporate Governance (GCG) requires companies to provide relevant information, easy access and understanding by stakeholders, and disclose sufficient knowledge not only on issues required by laws and regulations but also on matters important for decision-making by shareholders, creditors, and other stakeholders [2]. High reporting quality can assist management and investors in making decisions. The higher the quality of financial reporting, the better the company's information is reflected in the financial statements. High-quality financial reporting can reduce information asymmetry in agency relationships [3,4].

Disclosure of financial reports is essential in the era of information discovery because that is one of the good corporate governance programs [5-12]. Disclosure of financial reports is a form of good

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relationship and accountability from the company to its stakeholders [13]. Completeness of financial statement disclosure is a provision that requires companies to disclose the information contained in financial reports relevant to the aim of producing quality reporting so that the information contained in financial statements makes accurate information and creates efficient capital market conditions [14]. Good-quality financial reports correlate positively with corporate integrity [15]. Reliable and quality financial statements can increase information transparency for users of financial information [16].

The era of the industrial revolution 4.0, a generation with very rapid internet development, has a vital role in business communication worldwide. Still, companies are not obligated to report their financial information regularly through internet use, so this reporting is still voluntary [17]. The purpose of Internet financial reporting is to provide accurate and timely information about the performance of financial companies to multiple users via the entity's website [18].

Disclosure of financial information through this website is commonly referred to as Internet Financial Reporting (IFR). IFR is a mechanism for disclosing company financial statements via the Internet or through websites owned by companies [19]. Companies classified as implementing IFR report financial information, interim financial reports, and complete annual reports through the company's website [20]. Carrying out IFR in a business entity, namely the inclusion of company financial information via the Internet on the company's official website, supports the Internet as the primary means of financial reporting and closing the period of the paper-based reporting system to become a paper-less reporting system [21].

Therefore, this study aims to explore and analyse several scientific data related to Internet Financial Reporting research development. This research is also expected to be a reference for researchers to determine research topics within the scope of financial literacy to be carried out. It is hoped that the level of disclosure of financial reports will continue to be increased as an effort to public transparency; along with this, investors continue to demand timely and reliable disclosures. Because of this demand, the government has made regulations regarding complete and fair disclosure and continues to increase supervision of disclosure practices. This research is expected to provide a comprehensive picture by exploring outputs related to financial reporting via the Internet based on existing research results. The results of this study make it possible to find critical points in developing publications about Internet Financial Reporting while understanding and manipulating historical networks and patterns for further research.

2. Methodology

In this study, researchers used data from articles indexed by Google Scholar. Data collection through searches with keywords: Internet Financial Reporting, Web Disclosure, and Financial Disclosure. Google Scholar is used to search for bibliographies as the database source. Google Scholar is one of the largest databases that provide peer-reviewed literature and publications. The data analysis method used is bibliometric analysis. Bibliometric analysis is increasingly popular as an approach used to uncover research patterns [22,23]. It requires that the researcher chooses studies based on the authentic relationships they wish to explore [24]. In addition, a methodological approach to carrying out a bibliometric analysis might uncover more comprehensive details related to the publication, including author, keyword frequency, and citations [25]. Bibliometric analysis can provide descriptive patterns of publications based on a domain, region, country, and period. In bibliographical research, various metrics, such as publishing outlet, publication type, authorship, affiliation, country, h-index, and g-index, are the most frequently examined [22].

The bibliography selected and used is the article title, abstract, keywords, article, or review type. The initial data search yielded 982 bibliographies. The following data were obtained (see Table 1).

Table 1
Development of Internet Financial Reporting

Year of Publications	Number of Publications
2013	68
2014	84
2015	73
2016	94
2017	88
2018	119
2019	113
2020	115
2021	101
2022	127
Total	982
Average	98.20

The VOSviewer application is used to assist bibliometric analysis by visualizing the analysis results. VOSviewer is a computer program used to visualize bibliometric maps. The text-mining function visualizes networks or co-relationships in an article excerpt. VOSviewer can present and visualize specific information about bibliometric chart maps, making it easier to interpret a relationship or network. Detailed information regarding bibliometric is shown elsewhere [26,27]. Bibliometric is effective to show current research trend. Table 2 shows examples for the previous studies on bibliometric published in 2023.

Table 2
Previous studies on bibliometric

No	Title	Author	Ref.
1	Introducing ASEAN Journal for Science and Engineering in Materials: Bibliometric Analysis	Nandiyanto, A. B. D., Al Husaeni, D. F., & Al Husaeni, D. N.	[28]
2	Involving Particle Technology in Computational Fluid Dynamics Research: A Bibliometric Analysis	Nandiyanto, A. B. D., Ragadhita, R., & Aziz, M.	[29]
3	Particulate Matter Emission from Combustion and Non-Combustion Automotive Engine Process: Review and Computational Bibliometric Analysis on Its Source, Sizes, and Health and Lung Impact	Nandiyanto, A. B. D., Ragadhita, R., Setiyo, M., Al Obaidi, A. S. M., & Hidayat, A.	[30]
4	Social Impact and Internationalization of "Indonesian Journal of Science and Technology" the Best Journal in Indonesia: A Bibliometric Analysis	Nandiyanto, A. B. D., Al Husaeni, D. F., & Al Husaeni, D. N.	[31]
5	Introducing ASEAN Journal of Science and Engineering: A Bibliometric Analysis Study	Nandiyanto, A. B. D., Al Husaeni, D. N., & Al Husaeni, D. F.	[32]
6	Concept of Computational Fluid Dynamics Design and Analysis Tool for Food Industry: A Bibliometric	Muktiarni, M., Rahayu, N. I., Nurhayati, A., Bachari, A. D., & Ismail, A.	[33]
7	Concept of Computational Fluid Dynamics and Its Application in Sport Science: Bibliometric Analysis of Modelling Thermal Comfort in Sport Hall	Rachmat, B., Agust, K., Rahayu, N. I., & Muktiarni, M.	[34]
8	Bibliometric Computational Mapping Analysis of Trend Metaverse in Education using VOSviewer	Muktiarni, M., Rahayu, N. I., Ismail, A., & Wardani, A. K.	[35]
9	Phytochemical Profile and Biological Activities of Ethylacetate Extract of Peanut (Arachis hypogaea L.) Stems: In-Vitro and In-Silico Studies with Bibliometric Analysis	Sahidin, I., Nohong, N., Manggau, M.A., Arfan, A., Wahyuni, W., Meylani, I., Malaka, M.H., Rahmatika, N.S., Yodha, A.W., Masrik, N.U.E. and Kamaluddin, A.	[36]

10	Information and communication technology (ICT) intervention targeting physical activity and diet behaviours in people with disabilities: VOSviewer mapping analysis	Rahayu, N. I., Bachari, A. D., Muktiarni, M., & Maryanti, R.	[37]
11	Computational bibliometric analysis of English research in science education for students with special needs using VOSviewer	Sukyadi, D. I. D. I., Maryanti, R., Rahayu, N. I., & Muktiarni, M.	[38]
12	Orange and strawberry skins for eco-enzyme: experiment and bibliometric analysis	Muktiarni, M., Rahayu, N., & Maryanti, R.	[39]
13	Counselling guidance in science education: definition, literature review, and bibliometric analysis	Solehuddin, M., Muktiarni, M., Rahayu, N.I. and Maryanti, R.	[40]
14	A bibliometric analysis of management bioenergy research using VOSviewer application.	Soegoto, H., Soegoto, E.S., Luckyardi, S., and Rafdhi, A.A.	[41]
15	Oil palm empty fruit bunch waste pretreatment with benzotriazolium-based ionic liquids for cellulose conversion to glucose: Experiments with computational bibliometric analysis.	Mudzakir, A., Rizky, K.M., Munawaroh, H.S.H., and Puspitasari, D.	[42]
16	Research mapping in the use of technology for fake news detection: Bibliometric analysis from 2011 to 2021.	Gunawan, B., Ratmono, B.M., Abdullah, A.G., Sadida, N., and Kaprisma, H.	[43]
17	Management information systems: bibliometric analysis and its effect on decision making.	Santoso, B., Hikmawan, T., and Imaniyati, N.	[44]
18	Sustainable Production-inventory model with multi-material, quality degradation, and probabilistic demand: From bibliometric analysis to a robust model.	Utama, D.M., Santoso, I., Hendrawan, Y., and Dania, W.A.P.	[45]
19	Biomass-based supercapacitors electrodes for electrical energy storage systems activated using chemical activation method: A literature review and bibliometric analysis.	Hamidah, I., Ramdhani, R., Wiyono, A., Mulyanti, B., Pawinanto, E.E., Hasanah, L., Diantoro, M., Yuliarto, B., Yunas, J., and Rusydi, A.	[46]
20	Antiangiogenesis activity of Indonesian local black garlic (Allium Sativum 'Solo): Experiments and bibliometric analysis.	Arianingrum, R., Aznam, N., Atun, S., Senam, S., Irwan, A.R., Juhara, N.Q., Anisa, N.F., and Devani, L.K.	[47]
21	Characteristics of tamarind seed biochar at different pyrolysis temperatures as waste management strategy: experiments and bibliometric analysis.	Rahmat, A., Sutiharni, S., Elfina, Y., Yusnaini, Y., Latuponu, H., Minah, F.N., Sulistyowati, Y., and Mutolib, A.	[48]
22	The complete lextutor application tool for academic and technological lexical learning: Review and bibliometric approach.	Abduh, A., Mulyanah, A., Darmawati, B., Zabadi, F., Sidik, U., Handoko, W., Jayadi, K., and Rosmaladewi, R.	[49]
23	How eyes and brain see colour: Definition of colour, literature review with bibliometric analysis, and inquiry learning strategy for teaching colour changes to student with mild intelligence barriers.	Juhanaini, J., Bela, M.R.W.A.T., and Rizqita, A.J.	[50]
24	Bibliometric analysis of nano metal-organic frameworks synthesis research in medical science using VOSviewer.	Shidiq, A.P.A.	[51]
25	Use of blockchain technology for the exchange and secure transmission of medical images in the cloud: Systematic review with bibliometric analysis.	Lizama, M.G., Huesa, J., and Claudio, B.M	[52]

3. Results and Discussion

In analysing these academic trends, the number of publications over the years in Internet financial reporting is summarized and displayed in Figure 1.

Nine hundred eighty-two documents containing scientific publications on internet financial reporting were published on Google Scholar with open access over 10 years, from 2013 to 2022. Based on the data collected, it can be seen that every year there has been an increasing trend in the number of publications where in 2022 there have been achieved the highest number of publications

over the last 10 years. The expanding trend also shows that these topics have been receiving attention from academics today and for years. This study has started to increase since 2015. Research about IFR is developing with various categories, themes, descriptive studies, association studies, and dimensions of financial reporting via the Internet [53].

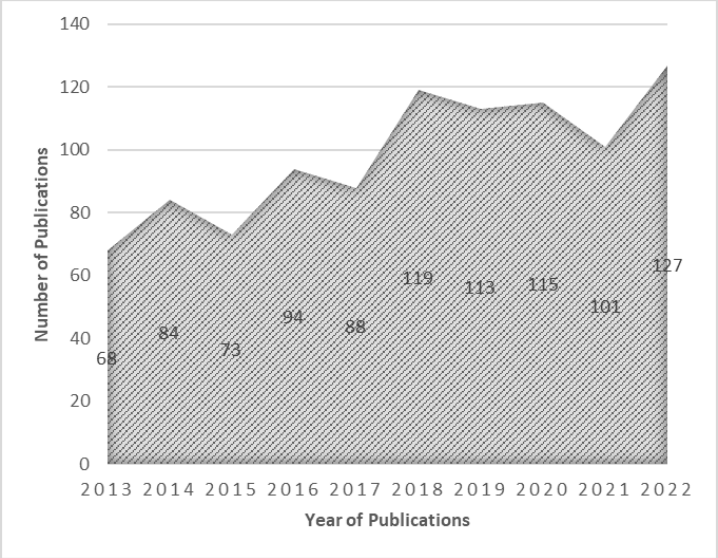

Fig. 1. Level of Development in Internet Financial Reporting

Authors and explicit articles can be used to measure whether distribution and examination influenced writing. Repetition of references can be found using the VOSviewer software with a similar method. Still, in this case, the node type is changed to "Author Cited" to check the relationship of shared references in the dataset [54,55]. The top twenty authors cited are listed in Table 3 as follows.

Table 3
Top 20 citation in internet financial reporting publication

No	Authors	Title	Year	Cites	Ref
1	D Dhaliwal, OZ Li, A Tsang, YG Yang	Corporate social responsibility disclosure and the cost of equity capital: The roles of stakeholder orientation and financial transparency	2014	788	[56]
2	A Lawrence	Individual investors and financial disclosure	2013	612	[57]
3	J Martínez-Ferrero, IM Garcia-Sanchez…	Effect of financial reporting quality on sustainability information disclosure	2015	330	[58]
4	OAG Hassan, C Marston	Corporate financial disclosure measurement in the empirical accounting literature: A review article	2019	320	[59]
5	G Jackson, J Bartosch, E Avetisyan…	Mandatory non-financial disclosure and its influence on CSR: An international comparison	2020	274	[60]
6	F Manes-Rossi, A Tiron-Tudor, G Nicolò, G Zanellato	Ensuring more sustainable reporting in Europe using non-financial disclosure—De facto and de jure evidence	2018	242	[61]
7	F Gao, Y Dong, C Ni, R Fu	Determinants and economic consequences of non-financial disclosure quality	2016	192	[62]
8	GD Saxton, DG Neely, C Guo	Web disclosure and the market for charitable contributions	2014	177	[63]
9	K Omair Alotaibi, K Hussainey	Determinants of CSR disclosure quantity and quality: Evidence from non-financial listed firms in Saudi Arabia	2016	177	[64]
10	A Hassanein, K Hussainey	Is forward-looking financial disclosure really informative? Evidence from U.K. narrative statements	2015	126	[65]

11	MA Hofmann, D McSwain	Financial disclosure management in the nonprofit sector: A framework for past and future research	2013	123	[66]
12	MS Malik, L Kanwal	Impact of corporate social responsibility disclosure on financial performance: a case study of listed pharmaceutical firms of Pakistan	2018	123	[67]
13	A Venturelli, F Caputo, R Leopizzi…	The state of art of corporate social disclosure before the introduction of non-financial reporting directive: A cross country analysis	2018	123	[68]
14	B Downar, J Ernstberger, S Reichelstein…	The impact of carbon disclosure mandates on emissions and financial operating performance	2021	120	[69]
15	F Doni, S Bianchi Martini, A Corvino…	Voluntary versus mandatory non-financial disclosure: E.U. Directive 95/2014 and sustainability reporting practices based on empirical evidence from Italy	2020	117	[70]
16	P Velte, M Stawinoga, R Lueg	Carbon performance and disclosure: A systematic review of governance-related determinants and financial consequences	2020	116	[71]
17	Z Rezaee, L Tuo	Voluntary disclosure of non-financial information and its association with sustainability performance	2017	115	[72]
18	S Bose, A Saha, HZ Khan, S Islam	Non-financial disclosure and market-based firm performance: The initiation of financial inclusion	2017	105	[73]
19	A Skouloudis, N Jones, C Malesios…	Trends and determinants of corporate non-financial disclosure in Greece	2014	102	[74]
20	D Hess	The transparency trap: Non-financial disclosure and the responsibility of business to respect human rights	2019	101	[75]

D Dhaliwal, OZ Li, A Tsang, and YG Yang have the highest number of references, 788 published in 2014 among all distributions on Internet financial reporting. A Lawrence followed that number of citations at a quoted frequency of 613 times, which appeared in 2013.

Bibliometric analysis in this study uses VOSviewer software based on keywords or co-occurrence analysis related to Internet financial reporting. After analysing keywords in internet financial reporting publications using VOSviewer, 9 clusters were obtained. Each cluster is marked with a different colour on the visualization map, along with the keywords included in that cluster. Clustering result data can be seen in Figure 2.

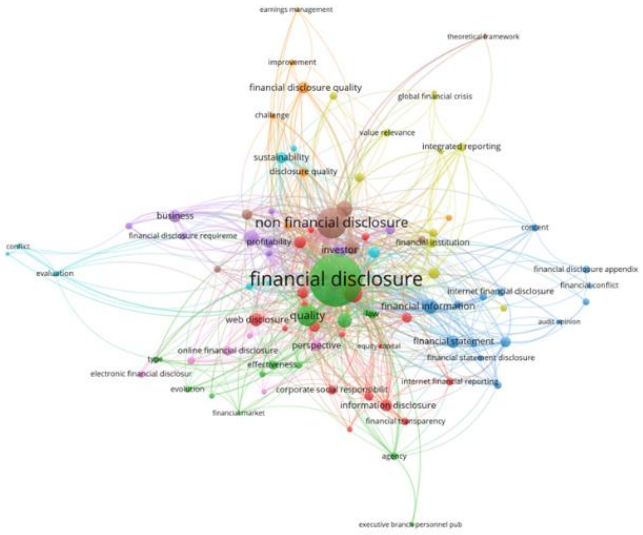

Fig. 2. Network visualization of internet financial reporting (source: processed data (2023))

Network Visualization, showing the connection between terms in financial reporting research via the Internet. Based on the existing network visualization, 98 items were found to be appropriate and divided into 9 clusters (see in Table 4).

Table 4
Keywords clustering

Cluster	Keywords
Cluster 1	Shown in red with 18 items: company size, contribution, corporate financial performance, corporate social response, equity capital, financial disclosure practice, financial information disclosure, financial performance, financial transparency, information disclosure, internet financial disclosure, voluntary non-financial, web disclosure, and web disclosure practice.
Cluster 2	Shown in yellow with 14 items: agency, consumer, effectiveness, efficiency, evolution, executive branch personnel, financial disclosure, financial disclosure system, financial market, financial reporting, investment law, quality, and type.
Cluster 3	Shown in green with 14 items: audit opinion, content, disclosure requirements, financial conflict, financial disclosure applications, financial disclosure statements, financial information, financial statements, financial disclosure financial statements, local government, mandatory disclosure, moderating effects, and websites.
Cluster 4	Shown in blue with 11 items: disclosure practice, empirical analysis, financial crisis, financial disclosure regulation, financial institution, global financial crisis, integrated capital disclosure, mandatory non-financial, market value, and value relevance.
Cluster 5	Shown in purple with 10 items: accounting, business, comments, corporate government disclosure, environmental, financial disclosure requirements, investors, profitability, regulation, and social.
Cluster 6	Shown in orange with 8 items: conflict, corporate disclosure, evaluation, financial disclosure form, financial report, security, sustainability, and sustainable development.
Cluster 7	Shown in pink with 8 items: challenges, commercial banks, corporate governance, disclosure quality, earnings management, financial disclosure quality, financial risk disclosure, and improvement.
Cluster 8	Shown in cyan with 8 items: environmental disclosure, information assessment, non-financial disclosure, non-financial disclosure, non-financial information, non-financial information disclosure, non-financial disclosure, performance, and theoretical framework.
Cluster 9	Shown in brown with 7 items: corporate financial disclosure, electronic financial disclosure, financial disclosure items, Islamic, banking, online financial disclosure, perspective, and social disclosure.

Grouping is used here. Based on the titles that have been published, it can also be seen which topics have been written the most. VOSviewer can also map based on text data. This research uses bibliographical data from 2013 to 2022. Then, VOSviewer maps the topics most written about and their correlation with other issues. There are 9 known clusters (groups), as shown in Figure 3. Details of the subject of the article can be seen in Table 3, which explains the formation of clusters below automatically based on the processed results of VOSviewer item analysis so that the follow in Figure 3.

Financial disclosure has the highest occurrence rate, which appears 407 times. The highest occurrence rate indicates many discussions about financial disclosure on the Internet Financial Reporting research theme. Several factors affect or relate to financial disclosure, based on the picture besides, namely: Business, Evolution, Challenge, Earnings Management, Improve meet, Financial disclosure quality, Integrated reporting, Sustainability, Disclosure quality, Financial disclosure appendix, Financial conflicts, Internet financial disclosure, Audit opinions, Financial statements, Local government, Information disclosure, Financial transparency, Agencis, Executive brand of pub personnel, Financial markets, Quality, Investors, On financial disclosure, Online financial disclosure, and Effectiveness .

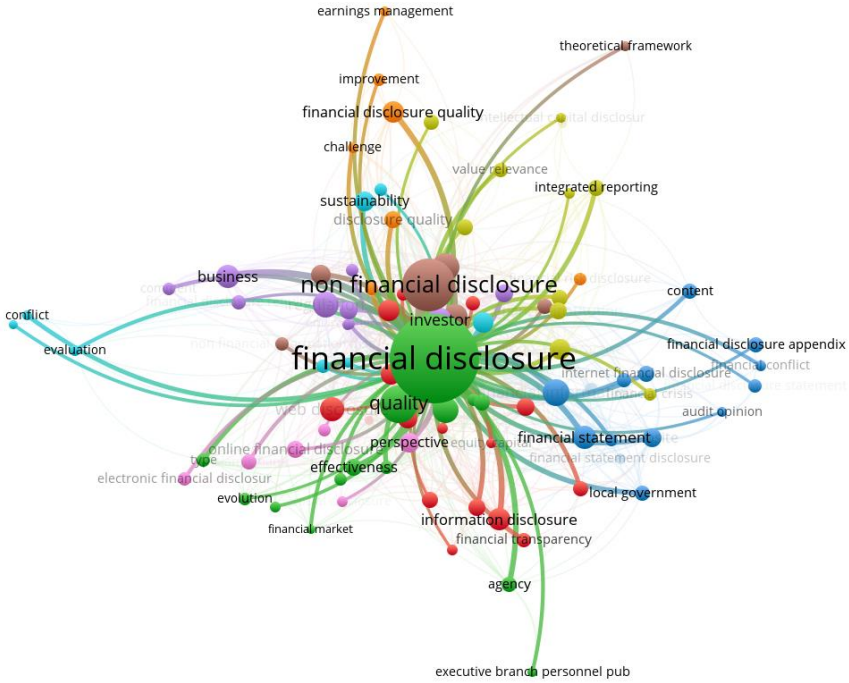

Fig. 3. Network visualization of financial disclosure (source: processed data (2023))

The results of VOS viewer's analysis of internet financial reporting produce a co-occurrence visualization map that describes the relationship between keywords as shown in Figure 4 as follows:

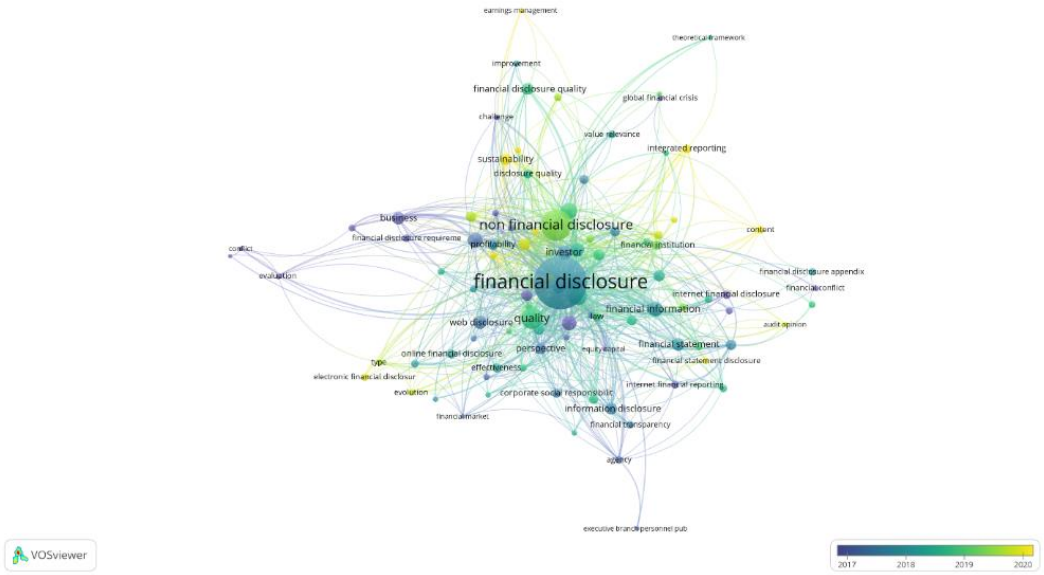

Fig. 4. Overlay visualization of internet financial disclosure (source: processed data (2023))

More oversized round shapes represent high frequencies; more connected lines mean the relationship is more significant or closer. Figure 3 shows that the most popular results from Internet financial reporting to the last are Financial Disclosures, Non-Financial Disclosures, Financial information, Web Disclosures, and Financial Statements. The visualization overlay shows the years that have researched the most research on financial information disclosure on websites. Based on the image below, it can be seen that this research was spread from 2017 to 2020. In the overlay

visualization, node colours represent keywords, while node colours indicate the year the article containing the keyword was published. The darker the colour of the nodes, the longer the topic is covered in research.

Density visualization shows the emergence of each item/keyword/term from previous studies regarding Internet financial reporting. Can be seen in Figure 5.

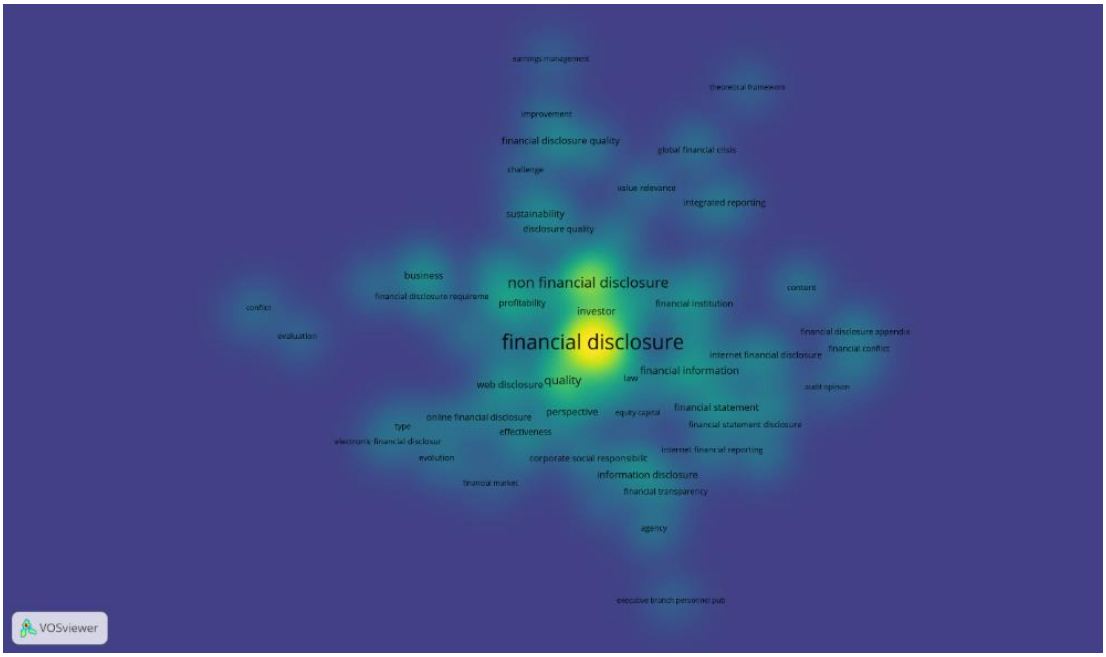

Fig. 5. Density visualization of financial disclosure (source: processed data (2023))

It was stated that, based on the total of articles and author keyword occurrences, the study found a positive relationship between the output of the sub-theme and the central search theme. The cluster density view shown in Figure 5 is the item (label) marked the same as the visible item. Each item has a colour depending on the item's density at that time. It identifies that the colour of the points on the map depends on the number of items associated with other items. This section is handy for getting an overview of the general structure of the map. Based on the density visualization image, it is known that financial disclosure is the most discussed item by researchers.

As accounting principles, accounting rules must be utilized when preparing financial reports. According to this study, implementing accounting standards improves the quality of financial reports. As a result, users' confidence in financial statements in the financial data used as a tool for decision-making is increasing. When local government financial reports are high quality, it increases public trust in local government leaders. It makes it easier for the government to collect the funds entrusted to it by the public (via taxes or other means). According to previous research, adherence to accounting standards in the presentation of financial reports could considerably enhance the quality of financial reports [76-78].

Choosing the appropriate organizational structure, techniques, and metrics, accuracy, and reliability, promoting efficiency, and compliance as measurement tools for the internal control system significantly impact the quality of financial reports. Particularly, management must pay attention so that employees can consciously and effectively comply with existing regulations and encourage employees to perform their duties efficiently. It was communicated because these two factors have the maximum loading factor, which plays a more significant role in determining the effectiveness of an internal control system. This finding is consistent with prior research, which

demonstrated that adequate internal controls are necessary to enhance the quality of financial reports [79-80].

4. Conclusions

This study aims to explore and analyse several scientific data related to Internet Financial Reporting research development. The study results show that Internet Financial Reporting research development has increased during 2013-2022. Nine hundred eighty-two studies examine Internet Financial Reporting, with the highest number of citations obtained from research conducted in 2014, totalling 778. Nine clusters of each term are often researched and associated with Internet Financial Reporting, where the terms that appear more frequently are company size, contribution, corporate financial performance, corporate social response, equity capital, financial disclosure practice, financial information disclosure, financial performance, financial transparency, information disclosure, internet financial disclosure, voluntary non-financial, web disclosure, and web disclosure practice.

Based on our review and findings in this study, this paper may suggest several potential avenues for future research. We know that Internet financial reporting publications are essential for registered companies, and every sustainability report must be produced and published on the company's website. Although several Internet financial reporting publications support sustainability reports in publicly traded companies and the academic field, the connection is still tenuous.

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