



## Review article

# The development of internet financial reporting publications: A concise of bibliometric analysis

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## ABSTRACT

This paper identifies the main areas and the development of the field of internet financial reporting publications and to suggest future research directions. Internet use for corporate financial reporting represents a voluntary approach to consolidate printed sustainability reports which have increasingly been published by large companies in recent years. Using a bibliometric analysis, this paper examined a sample of 246 studies from Web of Science, Scopus, Emerald, Springer, Proquest, Ebsco, and Science Direct databases and only accepted articles and review paper were published in open access to identify research activity on internet financial reporting between 1998 until 2020. This review provides the most influential articles and authors based on their citations and publications as well as their importance within the network through network visualization, overlay visualization, and density visualization. The co-authorship analysis shows 208 authors who have connected each other, the co-organization analysis resulted 76 organizations which write article about internet financial reporting and co-occurrence analysis of keywords, the results found that 669 keywords divided into 11 clusters. The analysis which uses bibliometric analysis develops the status of internet financial reporting, this is a research field in a precise way through the visualization of emerging trend and currently focused on topics. The results of analysis also have recommended some variables which can be used in further research, and it is very helpful to find knowledge basis and detect the future research directions in this area.

## 1. Introduction

The emergence of the 4.0 industrial revolution created a new face in the phase of advancement in information technology. The government currently makes quick steps towards a superior business strategy by creating an integrated roadmap to implement the business strategy. The industrial revolution 4.0 has had a huge impact in all sectors of the world economy, especially the manufacturing industry which has begun to enter automatic trends and data exchange. The scope of the 4.0 industrial revolution includes cyber systems, Internet of Things (IoT), cloud and cognitive computing. Currently, the birth of digital technology in the 4.0 industrial revolution has an impact in human life around the world. To carry out this 4.0 industrial revolution properly, collaborative steps are needed that involve all of the stakeholders, such as from governance institutions, foundations and industries, and academicians.

The industrial revolution 4.0, which is considered to have potential to degrade the role of humans, and it made Japan give birth a concept, namely Society 5.0. Through this concept, it is hoped that intellectual reproduction will transfer a big data that collected to the internet in a life

into new wisdom. It is hope that growing people is capable to open new prospects. The concept of revolution 4.0 and society 5.0 does not have much difference. It is just the concept of society 5.0 which focuses on community context. Through the combination of industry revolution 4.0 and society 5.0, companies from various sectors must be able to compete and develop rapidly by utilizing technology-based human resource competencies, utilizing IoT (internet of things), utilizing virtual or augmented reality and utilizing AI (artificial intelligence).

Currently, rapid development of digital technology causes the flow of information runs so fast, the sophistication of the use of internet technology has changed the view of every human being in obtaining information, including in the world of business accounting (Martić et al., 2017). The development of technology changes the business, making it as the limitation in human resource skills needed in business, including accounting staff. The global system provides the objective of accountability for social and environmental values, provides a need for the government, private and social sectors to meet development goals and the consequences of accountability. Business entities or corporations are not only required to present financial reports that are limited to provide

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financial information. More than that, it turns out that the digitalization demands a more comprehensive reporting. The role of accountants as gatekeepers for financial statements has begun to shift along with the increasingly broad and complex demands of corporate reporting. Companies in the modern era cannot deny investors' requests for various non-financial reports that have an increasingly important role in assessing business continuity.

The development of digital technology has an impact on every company that tries hard to use it and changes the business flow in company operation so that reporting requirements become more complex as businesses grow. The usefulness from the companies' website to distribute materials about its economics performance is known as internet financial reporting (IFR). In comparing the internet-based financial reporting with traditional financial reporting, IFR is preferred by investors and stakeholders because of the benefits of IFR, such as cost savings and time efficiency (Bananuka et al., 2019; Mokhtar, 2017).

Companies must be motivated due to the demands in this globalization era by providing timely and accurate information in publishing company information transparently and openly, both financial information and non-financial information to stakeholders, which is outlined in an integrated report. Therefore, companies must be able to face the challenges that will come by publishing detailed, timely, and accurate company information with the reliability of internet use. Based on this, it will be an acknowledgment of the standard of corporate reporting (Salaudeen and Alayemi, 2020). With the need for higher quality financial reports, this means that the use of internet financial reporting is a tool in helping companies to dialogue with stakeholders and reduce the problem of information asymmetry (Pour and Imanzadeh, 2017).

The use of internet in corporate sustainability reporting is a complementary approach to the printed consolidated sustainability reports which have been increasingly published in particular by large companies in recent years; Even the issue of internet financial reporting is still voluntary to be disclosed. This allows a company to overcome the limitations on the sustainability report regarding the extent of information, accessibility, and comprehensiveness and the interactivity and involvement of stakeholders in sustainable dialogue through the company's website (Khan, 2015; Windarti, 2020). The purpose of this internet financial reporting is an important tool in achieving the company's future performance in all dimensional aspects and at all levels that drive the company's sustainability. In addition, a number of studies on internet financial reporting show that there are still some problems regarding to the comparability in information disclosure. This is due to the use of disclosures as a separate purpose and not intended to produce goals of an organization in generating capabilities that involve some aspects, like decision making, governance, and business planning processes. Furthermore, the existence of this Internet Financial Reporting can guide adjustments to company strategy and pay attention to corporate sustainability issues for the benefit of stakeholders (Di Vaio et al., 2020).

This article is a development article from research, especially with the theme of bibliometric studies on Internet Financial Reporting. This article is expected to provide a comprehensive picture by exploring outputs related to the internet financial reporting based on existing research results. In achieving the research objectives, a software tool is needed, namely VOSviewer software, which aims to visualize and analyse trends and patterns in scientific literature based on the Web of Science, Scopus, Emerald, Springer, Proquest, Ebsco, and Science Direct. In this way, it is possible to find a tipping point in developing publications on Internet Financial Reporting while understanding and interpreting historical network and patterns. This article is organized as follows: first, this study describes the details of the data collected and the use of the software described in detail in the methodology section. Then, statistical analysis of data will be presented together with co-authors and co-events based on keyword analysis. Furthermore, it is also based on the co-citation analysis, bibliographic coupling analysis, and analysis of evolutionary trends. Finally, this study concludes the main findings by outlining the conclusions, limitations of the current research, and future

research recommendations (Di Vaio et al., 2020; Ganem, 2018; Merigó and Yang, 2017; Prashar and Sunder, 2020; Ye et al., 2020).

## 2. Literature review

The industrial revolution 4.0 era, which is an era with very rapid internet development, has an important role in business communication around the world. This development is due to the need for widespread use of the internet in all business sectors, especially for companies to be able to publish their financial reports. At this time, an obligation has not been implemented that requires companies to report their financial information periodically through the use of the internet, so this reporting is still voluntary. Various companies still face obstacles in producing good quality financial reporting, especially on internet financial reporting (IFR), which influences providing financial information that is recorded, stored, and processed. As a result, the goal of internet financial reporting is to provide accurate and timely information about a company's financial performance to diverse users through the entity's website (Bananuka et al., 2019). Moreover, The use of technology to transmit financial and non-financial information to stakeholders is known as internet financial reporting (Salaudeen and Alayemi, 2020).

The web, known as the Internet, is a communication tool used by companies to publish their reports. It is one of the most powerful media in the business world. The purpose of using the Internet is to assist companies in disseminating their information to shareholders, management, and other users of company information. With the Internet or web media, anyone with a digital network terminal can access information that is connected to the network. Therefore, it provides stakeholders with the much-needed convenience, flexibility, and ability to obtain information for their intended purposes (Salaudeen and Alayemi, 2020). As a tool for public accountability, financial statements presented through the internet will bring regional financial management in a more transparent direction. These advantages make the IFR an increasingly preferred means of corporate communication. It also helps companies to overcome issues, such as significant maintenance costs, overload information as well as trust and IFR security, it plays an important role in showing the transparency and accountability of management in conducting business (Ariff et al., 2018; Khan et al., 2017; Waromi et al., 2019; Windarti, 2020). Realizing the significant development of IFR, regulators and standard setters worldwide have required companies to disclose corporate information on companies' websites (Keliwon et al., 2017). Such development has affected companies' conventional form of information disclosure (Ahmed et al., 2015; Sadalia et al., 2017). This internet financial reporting content includes financial information, such as balance sheets, profit, loss statements, cash flows, changes in financial position, and company sustainability reports (Suryanto, 2019).

Corporate information disclosed through the Internet users, especially small or foreign investors who do not directly and immediately access the company's financial information. In other words, corporate internet reporting can be defined as a voluntary disclosure tool that enables companies to disclose all or a proportion of its financial and non-financial information on the internet, presented in multiple formats and languages by using the most advanced and interactive electronic features to facilitate the communication through and usage of the website (Alebrahem, 2018). Corporate internet reporting (CIR) refers to the financial disclosure through the internet of historical and financial data and the exposition of the current situation and future plans. It provides the financial information to the principals and stakeholders in regards to the investment decision-making and market efficiency state that CIR provides financial performance and the company's branding and market position (Bin-Ghanem and Ariff, 2016; Sia et al., 2018).

## 3. Methodology

The methodology is divided into two stages: extraction of the study of relevant paper and bibliometric analysis of selected paper. The research

methodology of this study was qualitative approach by focusing on the content of paper in developing publication on Internet Financial Reporting. The content analysis which used here was an investigative system that aims to analyze and systematize data in a way that can be replicated; Therefore, it is very important to decide which documents to be surveyed and analyzed.

### 3.1. Collecting data method

Using the search terms "internet financial reporting," data was retrieved from Web of Science, Scopus, Emerald, Springer, Proquest, Ebsco, and Science Direct for this stud. For this keyword search, software was used to help find relevant results. The keywords in this study were searched based on the availability of databases that can be accessed on the Web of Science, Scopus, Emerald, Springer, Proquest, Ebsco, and Science Direct and were chosen because of the excellent coverage of publications in the academic field and the most significant number of repositories from 1900 to the present. This database also contains all bibliographic data on authors, citations, journals, and other resources that could be used in the analysis. This study is confined to searching for ["Internet Financial Reporting"] as keywords for the academic period 1990–2020, based on previous research, to ensure that the obtained data is low and appropriately reflects the academic field of internet financial reporting. The search field is limited to "themes" (which includes searches in "titles," "abstracts," and "keywords"), and there is no chronological filter to include all publications that are connected to the search term. Only scientific articles written in English are taken into consideration.

This study limits the data to scientific articles published in accounting, business, finance, and economics journals by excluding conference paper, book reviews, meetings, editorials, books that do not focus on this study. In addition, this study aims to extract the Internet Financial Reporting publication from each database, the researchers employed search string of title Internet Financial Reporting to all titles and abstract of articles available. The categories can be arranged as follows:

1. Emerald searched by searching " (content-type:article) AND (internet financial reporting AND (accounting) AND (business) – (education))" obtained 126 all open access articles.
2. Ebscohost searched by searching the keyword "internet financial reporting" with full text and academic journals source type obtained 24 all open access articles.
3. Proquest searched by using keyword "internet financial reporting", "accounting" and Proquest Dissertations &Thesis Global:Business on source type obtained 118 all open access articles.
4. Springer searched using keyword "internet financial reporting" obtained 39 all open access articles.
5. Web of Science searched using topic "internet financial reporting" obtained 228 all open access articles.
6. Scopus traced with TITLE-ABS-KEY (internet AND financial AND reporting) AND (LIMIT- TO (OA, "all")) AND (LIMIT-TO (LANGUAGE, "English")) obtained 105 all open access articles.
7. Science Direct is traced by terms "internet financial reporting", refine by "subscribed journals", subject area "business, management and accounting", article type "review and research articles", publication type "journal of business research", "international journal of information management", "journal of business venturing", "information & management", "decision support systems", "journal of corporate finance" and "technovation" obtained 59 all open access articles.

The data mining result revealed that the Internet Financial Reporting articles available from databases began in 1998 and ended in 2020, totaling 246 articles, with those articles resulting from the merger of seven databases and the elimination of articles with the same title. Cites, Authors, Title, Year, Source, Publisher, Article URL, Cites URL, GS Rank, Query Date, Type, DOI, ISSN, Citation URL, Volume, Issue, Start Page,

End Page, ECC, cites per Year, cites per Author, Age, and Abstract were all used to analyze the data. A total of 246 publications from the years 1998–2020 were collected for this study, which was completed on January 26, 2021.

### 3.2. Analysis data method

VOSviewer, the analytical tool which used in this study was Java application for visualizing and analyzing trends and patterns in the scientific literature. The software is chosen to analyze the potential knowledge structure in the literature by integrating network visualization and automatic cluster labeling for further analysis in this study. Visualization of development maps or research trends depicting bibliometric analysis maps can be done using several computer programs, including SPSS, Pajek, and VOSviewer. VOSviewer is also a computer program developed to construct and draw bibliometric maps and can be obtained free of charge by downloading on the page: [www.vosviewer.com](http://www.vosviewer.com). It consists of various visual analytic and functions that boost the interpretability of the visualized knowledge domain. The most important point is that it can be used to identify intellectual basis, hot-spots, emerging trends, and knowledge network of various papers in a similar academic field. This software can also analyze the network from different aspects of the collected data, such as authors, institutions, countries, keywords, categories, cited authors, cited references, and cited journals. In other words, VOSviewer can be used to display author or journal visualization map images based on co-citation data or keyword maps based on highly detailed co-occurrence data. Detailed display on the screen can be done by carrying out the zooming, scrolling, and searching functions. The visualization map display can be seen in various forms such as label form, density, cluster, and sketch, completed with different colors for each data cluster (Di Vaio et al., 2020; Fusco and Ricci, 2019; Lafont et al., 2020; Prashar and Sunder, 2020; Tupan and Rachmawati, 2017). In obtaining a map of research developments, the data is exported into the Comma Separated Values (CSV) or Research Information Systems (RIS) file format. The exported data is then processed and analyzed using Vosviewer application program to find out bibliometric map of research development in the field of internet financial reporting.

Some of the benefits obtained by using this bibliometric technique are findings based on quantitative statistical analysis and reliable datasets generally consisting of a lot of peer-reviewed publications that can cover most areas and disciplines. Furthermore, visualization network analysis in this bibliometric method can be used to classify the scope and structure of disciplines by finding influential authors or papers and the main groups of current research. These data are critical in defining the flash-points and development of the subject field and providing insight into emerging research areas. Finally, this research method is very useful and appropriate for the academic field with many publications compared to research methods through qualitative analysis approaches, which links various internal literature into a study. In other words, Bibliometrics is a mathematical and statistical tool for studying books and other types of communication (Di Vaio et al., 2020; José de Oliveira et al., 2019; Tupan and Rachmawati, 2017) (see Figure 1).

## 4. Results

### 4.1. Numbers of publication years

In analyzing this academic trend, the number of publications over the years in internet financial reporting is summarized and displayed in Table 1. There were 246 documents containing scientific publications on internet financial reporting indexed on the Web of Science, Scopus, Emerald, Springer, Proquest, Ebsco, and Science Direct and published in business, accounting, finance, and economic journals with open access for a span of 23 years, from 1998 to 2020 are listed in Table 1. According to the data collected, it can be seen that the first article in This field was

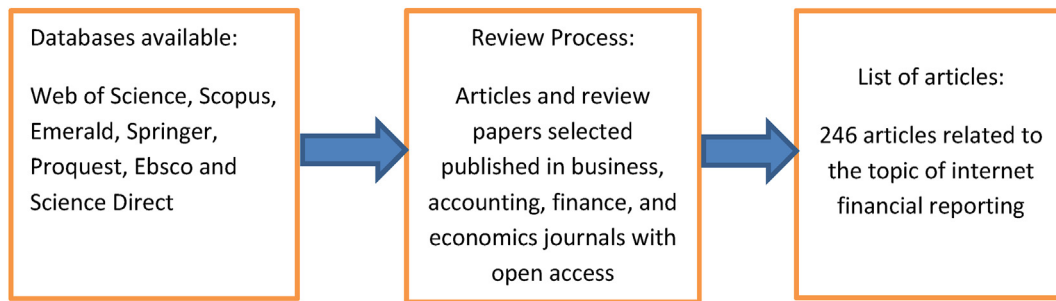


Figure 1. Process of collecting data of internet financial reporting publications.

Table 1. Numbers of publication years from 1998-2020.

Year	Publication Years	Year	Publication Years
1998	1	2010	18
1999	5	2011	8
2000	4	2012	21
2001	8	2013	8
2002	6	2014	12
2003	5	2015	9
2004	9	2016	18
2005	6	2017	22
2006	6	2018	15
2007	8	2019	24
2008	4	2020	17
2009	12		

published in 1998, and every year there is an increase in the number of publication trends where in 2019. It has reached the highest number of publications for 23 years. The increasing trend also shows that these topics are receiving attention from the current academic field and for the years to come. This shows the novelty of research on internet financial reporting. The number of publications in 2019 were 24, which was relatively high compared to the previous year, and the lowest was in 1998, which was only one publication. The reason was the data collection date of this paper which is in 1998. It because of still a new publication. Research on internet financial reporting has been conducted since 1996, and the majority of internet financial reporting research is related to the analysis of financial information contained on websites. Then this research develops with various categories, themes, descriptive studies, association studies, and dimensions of internet financial reporting (Khan, 2015).

The results of search term for articles on internet financial reporting that have been identified are 246. This can be seen in Figure 2 above,

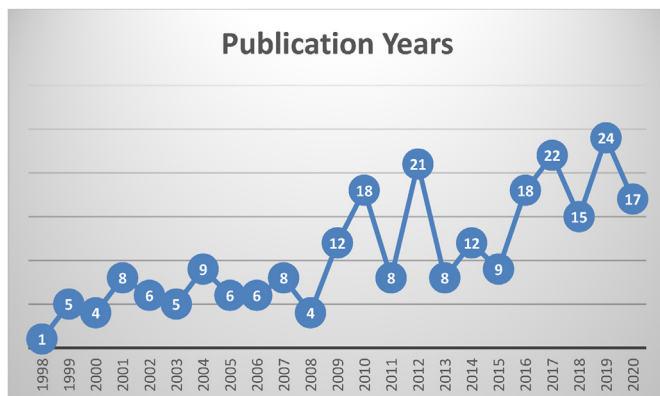


Figure 2. Numbers of IFR publication.

with movements that fluctuate up and down from 2010 to 2020. In 2019 with 24 articles, 17 articles in 2020. However, there was a significant increase in 2011 from 8 articles to 21 articles in 2012. It directly shows that internet financial reporting research tends to experience an increasing movement despite decreases between years. The number of its growth was still low from 1998 to 2008. However, since 2009, a significant increase has been seen until 2010. Some publications in internet financial reporting have been selected which have publications with open access in order to facilitate data search with easy viewing of the contents of the publication.

The first publication on internet financial reporting in the search for this publication in 1998 was the work of R. Hussey, J Gulliford with the title "Regulating financial reporting on the internet" published in the Journal of Financial Regulation and Compliance. It was described in 1998 that Hussey and Gulliford's research concluded the sufficiency of the current monetary detailing administrative framework to manage corporate monetary data revealed on the internet. The Consequences of an examination study made on the FTSE 100 organizations of internet locales are utilized to talk about organization rehearses and the emerging issues and give outlines about the fundamental problems and suggests alternative approaches to regulate this new frontier for financial reporting (Hussey and Gulliford, 1998).

The most recent publication was in 2020, with 17 articles on average articles were published in Emerald Publishing Limited. This paper also contains an average of the relationship between internet financial reporting in supporting its sustainability report and achieving sustainable development goals (Krah and Mertens, 2020; Rendtorff, 2020; Rosa Portella and Borba, 2020).

#### 4.2. Author analysis

This section will discuss the year of authors and some titles of articles in each year. In Table 2, it can be seen that the authors presented in the table about the most cited articles on internet financial reporting from 1998 to 2020 especially for 1998, this is the beginning of the formation of internet financial reporting research which based on obtaining data from databases. Table 2, it also discusses the authors who contribute articles each year (Shi and Li, 2019). Based on the data that has been collected, there are 25 active authors. Table 2 discusses authors who contribute articles every year by looking at the GS (Google Scholar) rank. GS rank is a citation analysis that has access to download papers for free with the advantage that the data provided by GS provides more opportunities for transparency in reviews of tenure, funding, and other science policy issues, where possible calculation and analysis based on theory can be duplicated by anyone using an internet connection (Harzing and van der Wal, 2008).

#### 4.3. Citation analysis

The recurrence of references to explicit authors and articles can be utilized to quantify whether distributions and examination affect the writing. This can be discovered by utilizing the VOSviewer programming

**Table 2.** Active publication per year from 1998-2020.

	Author's Name	Title	GS Rank
1	Hussey and Gulliford (1998)	Regulating Financial Reporting on The Internet	168
2	Ashbaugh et al. (1999)	Corporate Reporting on The Internet	191
3	Richard Baker and Wallage (2000)	The Future of Financial Reporting in Europe: Its Role in Corporate Governance	166
4	Debreceeny and Gray (2001)	The Production and Use of Semantically Rich Accounting Reports on The Internet: XML and XBRL	144
5	Debreceeny et al. (2002)	The Determinants of Internet Financial Reporting	124
6	Oyelere et al., 2003	Determinants of Internet Financial Reporting by New Zealand Companies	182
7	Xiao et al. (2004)	The Determinants and Characteristics of Voluntary Internet-Based Disclosures by Listed Chinese Companies	128
8	Laswad et al. (2005)	Determinants of Voluntary Internet Financial Reporting by Local Government Authorities	167
9	Bollen et al. (2006)	Measuring and Explaining the Quality of Internet Investor Relations Activities: a Multinational Empirical Analysis	145
10	Adams and McNicholas (2007)	Making A Difference: Sustainability Reporting, Accountability and Organisational Change	150
11	Kelton and Yang (2008)	The Impact of Corporate Governance on Internet Financial Reporting	180
12	Tagesson et al. (2009)	What Explains the Extent and Content of Social and Environmental Disclosures on Corporate Websites: A Study of Social and Environmental Reporting in Swedish Listed Corporations	132
13	Pina et al. (2010)	Is E-Government Promoting Convergence Towards More Accountable Local Governments?	119
14	Boubaker et al. (2011)	The Determinants of Web-Based Corporate Reporting In France	117
15	Samaha et al. (2012)	Propensity and Comprehensiveness of Corporate Internet Reporting in Egypt: Do Board Composition and Ownership Structure Matter?	151
16	Dunne et al. (2013)	Stakeholder Engagement in Internet Financial Reporting: The Diffusion of XBRL In The UK	72
17	Rensburg (2014)	Is Integrated Reporting the Silver Bullet of Financial Communication? a Stakeholder Perspective from South Africa	94
18	Ferguson and Pündrich (2015)	Does Industry Specialist Assurance of Non-Financial Information Matter to Investors?	81
19	Khan (2016)	Disclosure Items of Internet Financial Reporting: Malaysian Users Perceptions	68
20	Montecchia et al. (2016)	Communicating CSR: Integrated Approach or Selfie? Evidence from The Milan Stock Exchange	156
21	Khan et al. (2017)	Empirical Research of Users' Opinions on Selected Aspects In Internet Financial Reporting	3
22	Sadalia et al. (2017)	The Significance of Internet Based Financial Information Disclosure on Corporates' Shares in Indonesia	108
23	Nassir Zadeh et al. (2018)	Applying an Ontology-Augmenting XBRL Model to Accounting Information System for Business Integration	91
24	Al-Sartawi and Reyad (2019)	Sustainability Risk Disclosure Practices of Listed Companies in Australia	62
25	Mishchenko (2020)	The Development of a New Digital Business Reporting Standard - Inline XBRL	213

with a comparable strategy, yet for this situation, the node type is changed to "Cited Author" to check for co-reference relations in the dataset (Hamidah et al., 2021; Shi and Li, 2019). The top 25 authors cited

to are recorded in Table 3, and visualized cluster relationships are shown in Figure 3. Xiao, Yang, and Chow had the highest number of references of 257 times in 2004 among all distributions in the topic of internet financial reporting. This is then followed by Debreceeny, Gray, and Rahman at cited frequencies from 254 out of 2002 and different authors who show significant commitments in the space of internet financial reporting research from 1998 - 2020. From Table 3, it is known that the average authors cited more and published their articles in the publishers of the Journal of Accounting and Public Policy and also the International Journal of Accounting Information Systems while the rest of the publishers did not cite many articles related to the internet financial reporting (see Figure 4).

#### 4.4. Bibliometric analysis

Mapping is a process that allows a person to recognize elements of knowledge and their configuration, dynamics, interdependencies, and interactions. Knowledge mapping is used for technology management

**Table 3.** Top 25 authors and articles cited in internet financial reporting publication.

	Authors	Publisher	Cited Frequency
1	Xiao et al. (2004)	Journal of Accounting and Public Policy	257
2	Debreceeny et al. (2002)	Journal of Accounting and Public Policy	254
3	Adams and McNicholas (2007)	Accounting, Auditing and Accountability Journal	253
4	Ashbaugh et al. (1999)	Accounting Horizons	240
5	Tagesson et al. (2009)	Corporate Social Responsibility and Environmental Management	223
6	Craven and Marston (1999)	European Accounting Review	191
7	Marston and Polei (2004)	International Journal of Accounting Information Systems	179
8	Kelton and Yang (2008)	Journal of Accounting and Public Policy	178
9	Laswad et al. (2005)	Journal of Accounting and Public Policy	167
10	Ettredge et al. (2002)	Journal of Accounting and Public Policy	159
11	Debreceeny and Gray (2001)	International Journal of Accounting Information Systems	158
12	Oyelere et al. (2003)	Journal of International Financial Management and Accounting	149
13	Ettredge et al. (2001)	International Journal of Accounting Information Systems	139
14	Pina et al., 2010	International Public Management Journal	94
15	Gowthorpe and Amat (1999)	European Accounting Review	81
16	Marston (2003)	Corporate Communications: An International Journal	71
17	Bollen et al. (2006)	International Journal of Accounting Information Systems	69
18	Bolívar et al. (2007)	American Review of Public Administration	69
19	Bonsón and Escobar (2006)	International Journal of Accounting Information Systems	69
20	Ezat and El-Masry (2008)	Managerial Finance	67
21	Dilla et al. (2010)	Journal of Information Systems	66
22	Aly et al. (2010)	Managerial Auditing Journal	66
23	Bonsón et al. (2009)	International Journal of Accounting Information Systems	64
24	Orens et al. (2010)	Journal of Business Finance and Accounting	62
25	Boritz and No (2005)	Journal of Accounting and Public Policy	62

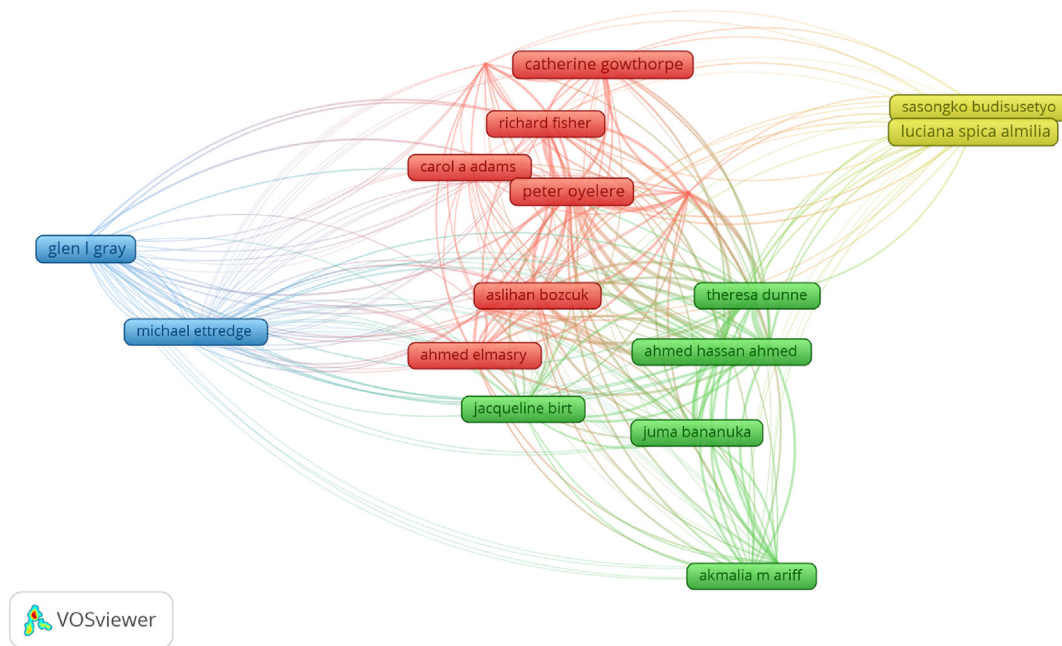


Figure 3. Author's network.

purposes, including the definition of research programs, decisions related to technology activities, the design of knowledge base structures, and the creation of educational and training programs. Related to bibliometrics with the use of VOSviewer software, science mapping is a method of visualizing a field of science. This visualization is done by creating a landscape map that can display topics from science. Bibliometric methods involve the use of several tools that can help researchers to identify a relevant and current research problem, thus making clear the potential impact of the research in case of it being developed (José de Oliveira et al., 2019; Tupan and Rachmawati, 2017).

4.4.1. Co-authorship analysis

Authors network and overlay visualization meet 208 authors with minimum number of documents per author are 2, so it will meet 26 thresholds shown in this Figure 3.

In order to visualize the author network, the VOSviewer software showed the collected data sets in 1998–2020. "Author" was selected as the node type while choosing the top 26 from the most quoted. VOSviewer is then used to get Figure 3 which shows the creator's collaboration network. The size of the author's name and the node indicating the number of publications by the author and the strength of the collaboration is indicated by the thickness of the links between them. The author's network provides a clearer view of each cluster's core keywords while showing the most cited authors in each sub-domain of internet financial reporting.

In other words, number 3 shows a map of the author's network (co-authorship) formed with the criteria that an author publishes at least two articles. In the network visualization, there are 26 connected writers who visualize connected lines between the points of the author's name and the points of the other authors. The co-authorship shown in Figure 3 forms

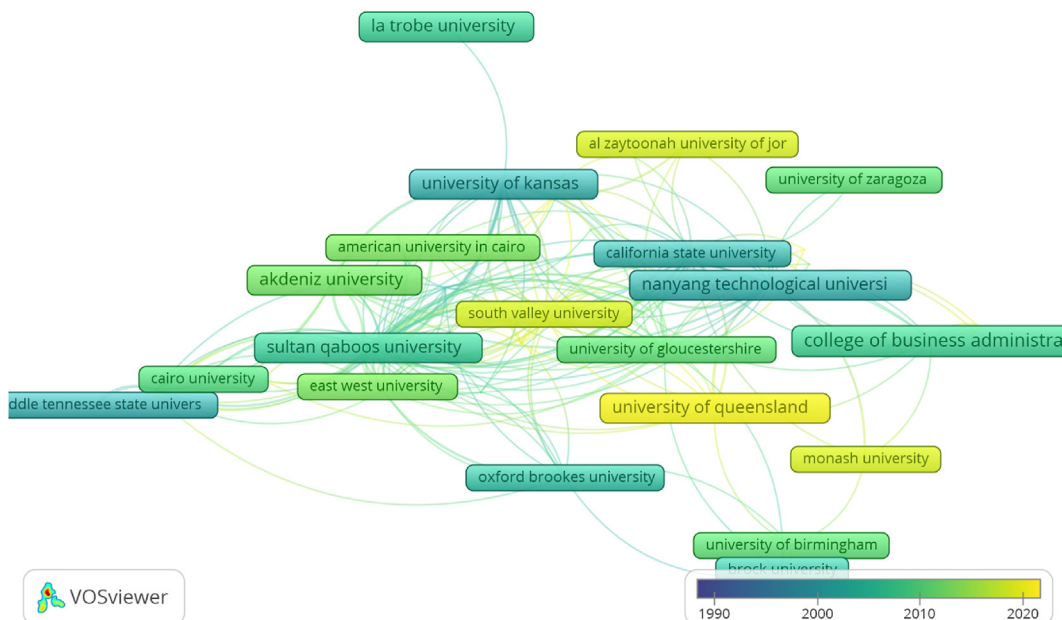


Figure 4. Overlay visualization organization.

four clusters. Clusters can be seen in plain view based on the color of the line connecting the dots of the author's name, namely pink, green, blue, and yellow. Based on the data collected, there are 208 authors who have connected each other (collaborating on the article). The most significant relationship consisted of only six authors visualized with the VOSviewer application. From Figure 3, it can be seen from the collaboration of the author of the article on internet financial reporting, and it also can be seen the year of the color difference in the link between the authors.

#### 4.4.2. Co-organizations analysis

The organization that has the most-strong links in publishing the internet financial reporting is Sultan Qaboos University with a total of 2 documents and a total link strength of 764, while the one that has the lowest rank is state University of Tiddle Tennessee with only has one total document and 4 of its total of strength link. From 1998 to 2020, it is known that 76 organizations/institutions have written about internet financial reporting. However, these organizations are not all connected each other. However only 20 have a total strength link between organizations, consisting of Sultan Qaboos University, Akdeniz University, South Valley University, East West University, University of Queensland, University of Gloucestershire, American University in Cairo, Nanyang Technological University, Cairo University, Al Zaytoonah university of Jordan, Brock University, Oxford Brookes University, La Trobe University, California State University, Monash University, College of Business Administration, University of Kansas, University of Zaragoza, University of Birmingham and Middle Tennessee State University.

#### 4.4.3. Network visualization analysis

Bibliometric Analysis uses Vosviewer software based on keywords or analysis co-occurrences and it is based on keywords which found 669 keywords related to internet financial reporting. This study used a minimum number of occurrences 2 so that there are 123 keywords divided into 11 clusters. After analyzing the keywords on the internet financial reporting publication using VOSviewer, it obtained 669 keywords consisting of 11 clusters. In the visualization map, each cluster is marked with a different color along with the keywords included in that cluster. The clustering result data can be seen in Table 4 below.

Clustering was used here. Based on the title that had been published, it can also be seen which topics were mostly written. VOSviewer can also map based on the text data. This study used bibliographic data from 1998 to 2020. Then, through VOSviewer, the most written topics were mapped and their correlation with other topics. There are 11 clusters (groups) known as shown in Figure 5. Details of the topic of the article can be seen in Table 4 which explains about the formation of clusters below automatically based on the results of processed Vosviewer items analysis so that the following keywords are detected:

From Figure 5, it can be seen that the most popular topics that have relevance to other outcomes in writing internet financial reporting articles are "financial reporting", "accounting", "corporate governance", and "voluntary disclosure". Figure 5 shows that some research on companies listed on related exchanges which related with the internet financial reporting is analyzing the factors of a voluntary disclosure based on Internet financial reporting. In addition, theories about innovation and voluntary diffusion disclosures are also used, such as types of auditors, foreign listings, different classes of share ownership, and government regulations. The publication of internet financial reporting continues to experience development until 2020 with a more in-depth discussion, namely the use of the internet and allows much corporate information to be instantly accessed from anywhere at any time. To better inform that the more diverse stakeholders of companies have used their websites as another tool to disclosure. Even the publication of internet financial reporting contributes to environmental accounting by examining whether companies in various countries, sectors, stages of development and regulatory environments present different levels of environmental disclosure and explain the environmental disclosure extension on corporate websites of companies using corporate characteristics. This

**Table 4.** Keywords clustering.

Cluster	Keywords
Cluster 1	Audit committees, Corporate governance, Corporate internet reporting, GCC, Information disclosure, Internet financial reporting, Investor Relations, Ownership Concentrations, Ownership Structure, Voluntary Disclosure
Cluster 2	Accounting, Accounting information, Decision making, Earning announcement, Financial analysis, Investor, Revenue, Valuation, Value relevance
Cluster 3	Accounting information systems, Extensible business reporting language, Financial information, Information integrity, International finance, Transparency, XBRL
Cluster 4	Audit, Corporate reporting, Disclosure index, Financial, Firm characteristics, Size
Cluster 5	Auditing, Chief Financial Officers, Continuous auditing, Perceptions Stock prices
Cluster 6	Digital reporting, Finance, Financial planning, Financial reports, Investments
Cluster 7	Accountability, Financial accounting standards, Financial statements, Fraud, Information systems
Cluster 8	Accounting standards, Financial disclosure, Information asymmetry, Stakeholders
Cluster 9	Corporate communications, Corporate social responsibility, Earnings management, Quality control
Cluster 10	Agency theory, Information disseminations, Social responsibility, Web-based reporting
Cluster 11	Financial reporting, Voluntary disclosures

supports sustainability reporting (SR), which brings together financial, social, environmental, and corporate governance reporting into a single package for stakeholders (Lako, 2018; Rosa Portella and Borba, 2020).

#### 4.4.4. Overlay visualization analysis

The results of the VOSviewer analysis of internet financial reporting produce a co-occurrence visualization map that describes the relationship between keywords as shown in Figure 6. The larger round shape illustrates that the frequency is high, and the more lines connected means the linkage is getting bigger or closer. According to Figure 6, it showed that the most popular outcome of internet financial reporting until the last outcome is "financial reporting", "voluntary disclosure", "corporate governance", "accounting", "extensible business reporting language (XBRL)", "Finance" and "auditing".

This mapping is necessary because it requires a process that allows researchers to recognize elements of knowledge and their configurations, dynamics, interdependencies, and interactions. Knowledge mapping is used for technology management purposes, which includes the definition of research programs, decisions related to technology activities, the design of knowledge base structures, and the creation of education and training programs. Related to bibliometrics, scientific mapping is a method of visualizing a field of science. This visualization is done by creating a landscape map that can display topics from science (Tupan and Rachmawati, 2017).

In the overlay visualization, the color of a node represents the keyword, while the color of the node indicates the year the article containing the keyword was published. The darker the color on the nodes, the longer the topic is discussed in research.

#### 4.4.5. Density visualization analysis

It was stated that, based on the total of articles and author keyword occurrences, the study found that there was positive relation between output of the sub theme and main search theme. The cluster density view as shown in Figure 7 is the item (label) which is marked the same as the visible item. Each item has a colour depending on the density of the item 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 very useful for getting an overview of the general structure of the map.



Figure 5. Network visualization in internet financial reporting publications.

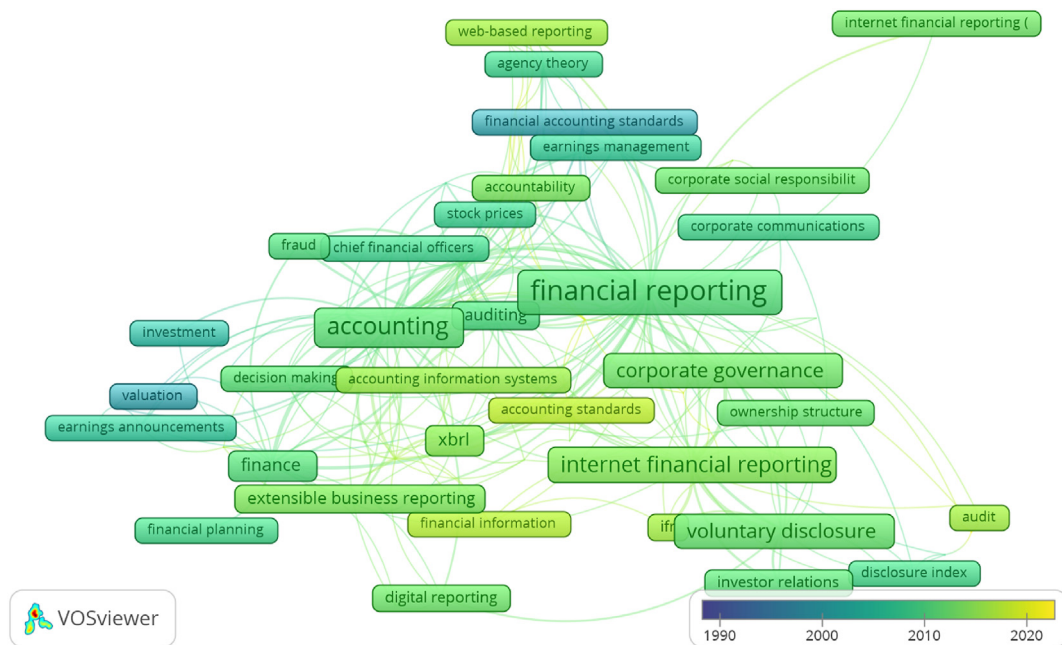


Figure 6. Overlay visualization in IFR publications.

VOSviewer uses a red-green-blue (RGB) base colour from each visualization it produces. From the results of the density visualization, it can be identified that dense areas are displayed from the number of nodes that are close to each other. In addition, the level of saturation indicated by the number of keywords that often appear and can be marked in yellow. In other words, this area is a topic that has been analyzed a lot.

In contrast to the topics covered in green meaning, these topics have not been analyzed much. This indicates a current research gap so that the opportunity to conduct research on this topic is still very wide (Di Vaio et al., 2020). The visualization map of density research of internet financial reporting in Figure 7 illustrates the results of analysis using all articles on the development of internet financial reporting research, both related and unrelated articles. The redder the denser, and the greener the rarer. However, from Figure 7, it can be seen that there is a yellow color,

which means that the outcome is the most widely used, namely "financial reporting", "accounting", "corporate governance", and "voluntary disclosure". This provides information that these topics are the main topics of study in research on internet financial reporting. From density visualization, there are some variables that are still rare to discuss, namely "financial disclosure", "information asymmetry", "stakeholders", "investor relations", "ownership concentrations", "ownership structure", "earning announcement", "investors", "Value relevance", "firm characteristics", "stock prices", "chief financial officers" and "agency theory".

### 5. Discussion

The objective of this study was to present a holistic picture of the internet financial reporting publications in companies and to figure out





Figure 7. Density visualization in IFR publications.

the knowledge map. In other words, financial reporting must be reported and announced to public which contains the economic, financial, social and environmental performance of a financial service institution, Issuer, and Public Company in carrying out a sustainable business, where all of these reports must be published through the company's website (Caesaria and Basuki, 2017; Kurniawan et al., 2018; Lako, 2018). So that by analyzing the development of internet financial reporting publications is very helpful for practitioners and academics regarding the sustainability of company finance. In analyzing the data, bibliometric analysis method mainly to conduct co-author analysis, co-citation analysis of authors and articles, co-word analysis, keyword cluster analysis on the internet financial reporting related scientific literature in Web of Science, Scopus, Emerald, Springer, Proquest, Ebsco and Science Direct database from 1998 to 2020. The VOSviewer software is used to this quantitatively analysis and visualizing the knowledge map of the internet financial reporting scientific research. Followed by further interpretation and analysis, the developing status, research hotspot and frontier evolution were identified.

Based on the results of the visualization map on the bibliometric analysis, a map of literature review which is divided into several outcomes based on the keyword analysis by comparing keywords from previous studies as well as overlay visualization map analysis and density visualization. It can be seen in Figure 8 combining the processed results of bibliometric analysis based on divisions on each cluster (11 clusters) with several variables recommendations from previous research that can be used for further research, namely "stakeholder engagement", "managerial entrenchment", "earnings management" and "agency cost" can elaborate on the rationale of IFR in accordance with the principle of signal theory (Sia et al., 2018), "value relevance" explain that IFR has an impact on the value of companies as relevant information about companies seeking international finance will be more accessible to global investors (Ahmed et al., 2015), "IT committee" with good IT expertise in board of directors and audit committee can improve IFR disclosure of quality (Bin-Ghanem and Ariff, 2016), "cost of capital" based on economic theory links increased liquidity to the cost of capital through information asymmetry (Nel et al., 2017), "voluntary disclosure" because IFR is one of the instruments that contribute in distributing disclosure that focuses on lowering misconnection of financial information between

the management and their stakeholders (AlMatrooshi et al., 2016), "integrated reporting" intends to build on recent reporting advances to present a more comprehensive view of a company's value creation by taking non-financial resources into account such as human, social and intellectual capitals, as well as financial capital (Dolinšek and Lutar-Skerbinjek, 2018), "CSR disclosure" useful to establish efficient means of meeting stakeholders' needs and crucial significance to institution' image and reputation (Sánchez et al., 2015), "environmental reporting", "financial disclosure", "risk management" and "social reporting" means with the greater disclosure of information owned by the company it will add more credibility and reliability to companies' web-sites (Alebrahim, 2018).

## 6. Conclusions

Publication of internet financial reporting that has been published since 1996 and continues to experience an increase in publication development until now. The main findings are as follows: Firstly, the annual publication trend of internet financial reporting publications shows a significant increasing trend after 2008 and a far more fluctuate in years from 2011, which suggests such research is getting more extensive attention in the academic field. Secondly, based on co-authorship analysis, it shows that there are 208 authors who have connected each other (collaborating on the article). The most significant relationship consisted of only six authors visualized with the VOSviewer application. Thirdly, co-organization analysis gives result from 1998 to 2020, it is known that 76 organizations/institutions have written about internet financial reporting. The organization that has the most-strong links in publishing internet financial reporting is Sultan Qaboos University with a total of 2 documents and a total link strength of 764, while the one with the lowest rank is Middle Tennessee State University with only has one of total document and 4 total link strengths. Fourthly, bibliometric analysis which uses VOSviewer software based on keywords or analysis co-occurrences based on keywords had found 669 keywords related to internet financial reporting. This study uses a minimum number of occurrences 2 so that there are 123 keywords divided into 11 clusters. Next, it showed that the most popular outcomes of internet financial reporting until the last outcome are

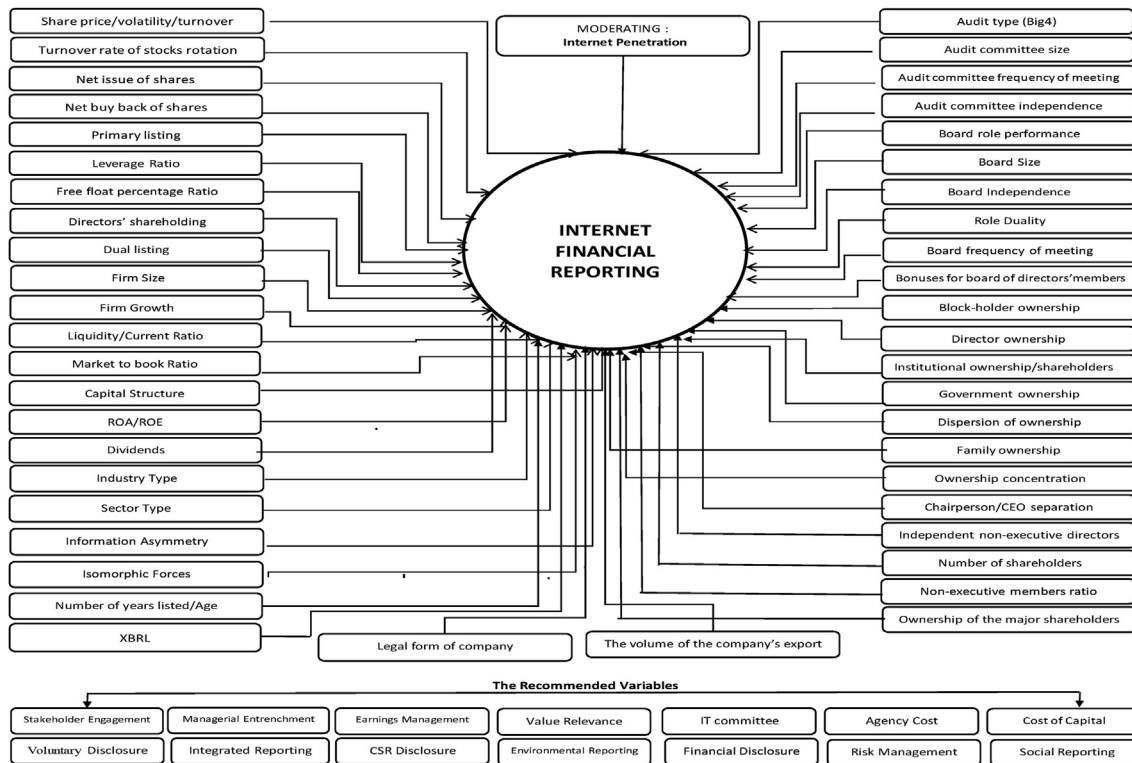


Figure 8. Map of literature review.

“financial reporting”, “voluntary disclosure”, “corporate governance”, “accounting”, “extensible business reporting language (XBRL)”, “finance” and “auditing”. Finally, from the density visualization, there are some variables that still rare to discuss, namely “financial disclosure”, “information asymmetry”, “stakeholders”, “investor relations”, “ownership concentrations”, “ownership structure”, “earning announcement”, “investor”, “value relevance”, “firm characteristics”, “stock prices”, “chief financial officers” and “agency theory”. In addition, the analysis using bibliometric analysis will help reflecting the development status of internet financial reporting research field in a precise way through the visualization of emerging trend and currently focused topics.

Even so, based on our review and findings in this present study, this paper could suggest that several prospective opportunities for future research. As we know that the role of internet financial reporting publications has a very important value for registered companies, that every sustainability report has been prepared by the company and must be published on the company's website. Although it seems that there are some publications in internet financial reporting which used to support sustainability report in listed companies and for the academic field, the in-depth connection is still very weak. However, several variables recommendations that can be used for further research have been found, namely "stakeholder engagement", "managerial entrenchment", "earnings management", "value relevance", "IT committee", "agency cost", "cost of capital", "voluntary disclosure", "integrated reporting", "CSR disclosure", "environmental reporting", "financial disclosure", "risk management" and "social reporting". It is also helpful to find the knowledge base and detect the future research directions in this area.

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*Declaration of interests statement*

The authors declare no conflict of interest.

*Additional information*

No additional information is available for this paper.

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