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Exploring the conceptual structure of the auditing discipline through co-word analysis: An international perspective

Abstract

The purpose of this study was to explore the conceptual structure of the auditing discipline between 2000 and 2016, by synthesizing keywords cited in 2,119 articles published in 24 accounting and auditing journals, using co-word analysis and social network analysis (SNA). We aimed to highlight dominant, fading, and emerging themes in the discipline across the periods and across continents. The main outputs of this study can be summarized as follows. The consistent decline in fragmentation, and the increase in connectedness, within the SNA showed that the auditing discipline became an increasingly tight and more cohesive network. While the generic keywords *auditing* and *auditor* were used far less frequently in the final period of the study, the keywords *audit quality*, *audit fees*, *internal control*, *financial reporting quality*, and *continuous auditing* were increasingly cited across the study periods. Moreover, regional analyzes unveiled similarities and differences between territories.

KEYWORDS auditing, conceptual structure, co-word analysis, bibliometric analysis, social network analysis (SNA), regions

1. INTRODUCTION

Auditing is a sub-discipline of accounting that has attracted considerable attention in recent publications and has become one of the most productive research streams (Linnenluecke et al., 2017). Corporate scandals, the global financial crisis of 2008, and the enactment of auditing-related laws have brought profound changes to the auditing profession and have given rise to many opportunities for auditing research (Hay, 2015). In addition, the established areas of auditing research (e.g., the demand for auditing, the supply of auditing, and corporate governance) have been studied for some time, and they have their foundations in other disciplines, especially economics and management (Hay, 2015). Over the past two decades, a substantial number of academic papers have been published regarding diverse auditing subjects (Humphrey, 2008), and it is likely to grow in the future (Linnenluecke et al., 2017).

The intellectual structure of each scientific field depends upon its conceptual framework (Khasseh et al., 2017). Bibliometric research is one method of mapping the relationship between concepts, ideas, and problems in science and the social sciences from a quantitative perspective

(Ding et al., 2001). Co-word analysis is an important subset of bibliometrics, providing an immediate picture of the content of research topics in a scientific field (Ding et al., 2001; Yang et al., 2012). The classical approach to reviewing the literature in particular research domains has mainly focused on two methods: qualitative methods, based on a structured review of the literature, and quantitative methods, mainly employing meta-analysis (Nájera-Sánchez et al., 2019). Traditional methods (i.e., structured literature reviews and meta-analysis) are still valuable for interpreting, understanding, and discussing complex subject areas (Li et al., 2017). Bibliometric methods (e.g., co-word analysis) complement traditional methods by increasing the objectivity and transparency of literature reviews (Zupic & Čater, 2015), revealing quantitative and accurate connections between various studies (Li et al., 2017), enabling the clear visualization and interpretation of the conceptual structure of a scientific field (Li et al., 2017), and identifying underlying research patterns (Qasim, 2017). Manual literature reviews focus mostly on researchers' opinions, based on content analysis, and may neglect a broader range of relevant topics (Li et al., 2017); furthermore, bibliometric methods can be applied to a wide range of studies (hundreds or even thousands), with a macro focus, while structured literature reviews and meta-analyses can analyze a limited number of studies (Zupic & Čater, 2015). Bibliometric analysis therefore facilitates quantitative, unbiased, and systematic screening of a wide range of papers and provides bibliographic data to support structured literature reviews (Giupponi & Biscaro, 2015). In this context, this research aimed to outline the conceptual structure of the field of auditing during the period from 2000 to 2016 through co-word analysis. In addition, it identified dominant, fading, and emerging themes in the field; examined the topological features (i.e., nodes, links, average degree, components, average distance, fragmentation, and so on) of the co-word network for the period; visualized critical keywords in the network; and determined temporal changes with respect to subject trends that have taken place over time. Additionally, a regional analysis was conducted to determine geographical trends in auditing research topics. Finally, promising research avenues in the auditing discipline were identified. For these purposes, this study used *author keywords*¹ that were cited in 2,119 articles published in 24 accounting and auditing journals. This study focused on the period between 2000 and 2016 as the analysis period, since academic journals in the pre-2000 period rarely provided keywords for their content.

This study makes several significant contributions to the literature. First, bibliometric research in accounting has mostly examined publishing patterns based on authorship, journals,

institutions, countries, and regions across time through content and/or citation analysis (Brown & Gardner, 1985; Heck & Bremser, 1986; Chung et al., 1992; Carmona et al., 1999; Anderson, 2002).² In particular, a significant number of studies have paid attention to analyses of co-authorship³ (Chan et al., 2009; Andrikopoulos & Kostaris, 2017; Kılıç et al., 2019) and co-citation⁴ networks (Bricker, 1989; Meyer et al., 2007; Uysal, 2010; Bisman, 2011; Linnenluecke et al., 2017). Although bibliometric techniques (i.e., co-authorship, co-citation) have provided useful insights into the literature, they could not demonstrate the conceptual structure of a scientific discipline (Ding et al., 2001). The current study therefore attempted to fill this gap in the literature and enhance our understanding of the conceptual structure of the auditing discipline by using co-word analysis and social network analysis (SNA). Second, this study complemented the subjective and qualitative evaluation of the auditing literature by examining published research in the discipline from a quantitative perspective. Third, most of prior review studies on auditing research focused on a specific auditing issue, such as auditor independence (Austin & Herath, 2014), audit quality (Knechel et al., 2013; Tepalagul & Lin, 2015), audit fees (Hay et al., 2006; Hay, 2013), auditor switching (Stefaniak et al., 2009), auditor risk assessment (Allen et al., 2006), or continuous auditing (Eulerich & Kalinichenko, 2018). This research enabled a more extensive review of auditing research without focusing on a specific issue or an individual topic. Fourth, this study provided regional-based mapping of the conceptual structure of auditing research, which may be helpful in understanding regional trends in auditing research. Fifth, this research painted a comprehensive picture of the current state of auditing and provided useful guidance for future studies by identifying important research gaps; therefore, it may help auditing researchers to understand emerging trends in the auditing discipline and adjust their future research approaches accordingly.

The remainder of this paper is structured as follows. The second section reviews the literature and presents the research questions of the study. The third section explains the research methodology, including the selection of the journals, determination of the sample articles, and collection of the data. The fourth section documents and discusses the research findings, using basic frequency analysis, SNA, and visualization maps. The final section concludes the paper by presenting implications, limitations, and suggestions for future research.

2. LITERATURE REVIEW

2.1 Co-word analysis

Co-word analysis is a content analysis method that combines bibliometrics and text mining technology to reveal the deep meaning of documents (i.e., articles, conference papers, books, patents, newspapers, etc.) (Callon et al., 1983; Feng et al., 2017) and to map the structure and development of scientific disciplines (Zupic & Čater, 2015). In fact, it is a technique that outlines the intellectual structure of a field by analyzing the relationship between words in various sections of a document (i.e., the title, abstract, keywords, etc.), using various indexes and mapping sub-domains (Callon et al., 1983; Whittaker, 1989; Hu & Zhang, 2015; Ravikumar et al., 2015).

Keywords enable the readers of papers to determine the conceptual structure of a discipline without consulting the full text of the papers (Romo-Fernández et al., 2013). The co-word analysis method is based upon two main assumptions: first, the keywords are carefully selected by the authors and accurately represent the articles' content; second, the co-occurrence of two themes in different articles indicates the correlation between them (Feng et al., 2017).

Co-word analysis directly links the conceptual content of research publications by comparing and classifying it based on the occurrence of similar word-pairs (i.e., the co-occurrence of keywords) (Bhattacharya & Basu, 1998). If two keywords expressing a particular research topic appear simultaneously in the same document, those two words have a certain semantic relationship (i.e., co-word or co-occurrence) (Yang et al., 2012; Hu & Zhang, 2015; Khasseh et al., 2017) and they correlate with each other (Cho, 2014). The frequency of the co-occurrence of keywords implies the strength of the relationship between them (Ding et al., 2001; Chen et al., 2016; Feng et al., 2017). In other words, the more frequently the co-occurrences between these keywords occur, the closer their relationship is (Yang et al., 2012). Using co-word analysis, a researcher can quantitatively determine the links between research themes in a scientific field (Ding et al., 2001; Ravikumar et al., 2015; Sedighi, 2016; Khasseh et al., 2017), detect its conceptual sub-domains (i.e., particular topics or themes) and its thematic evolution (Muñoz-Leiva et al., 2012b), and identify emerging and disappearing topics within the field (Bhattacharya & Basu, 1998; Chen et al., 2016; Khasseh et al., 2017).

2.2 Social network analysis (SNA)

SNA is a method used to providing a summary of previous research, revealing critical knowledge gaps in a domain and proposing new research avenues (Khan & Wood, 2015). It has been increasingly employed in co-word analysis to examine the latent content of a subject (Yang et al., 2012).

A *social network* can be defined as individuals or groups who have some kind of connection to some or all of the other individuals or groups (Abbasi et al., 2011). In a social network, the basic item is an *actor*, such as a keyword (Köseoglu et al., 2019). Connections between actors (i.e., keywords) are referred to as *ties* or *links*. SNA can demonstrate the networks graphically, going beyond producing descriptive statistics for the network (Yang et al., 2012). In this sense, it depicts the conceptual map or structure of the knowledge network between the themes and reflects the current status of a particular subject area (Yang et al., 2012).

2.3 Auditing research

Auditing is a rapidly expanding area of the accounting discipline (Andrikopoulos et al., 2016). Analyzing the research articles published in the *Accounting and Finance* from 1979 to 2012, Gaunt (2014) determined that the largest contribution to the field of accounting was in the area of financial accounting, followed by auditing. Auditing increasingly interacts with various other areas, such as risk assessment, money laundering, fraud detection, corporate governance, and so on (Andrikopoulos et al., 2016).

Although numerous studies have provided structured literature reviews concerning the field of auditing, using a qualitative approach (Allen et al., 2006; Humphrey, 2008; Stefaniak et al., 2009; Knechel et al., 2013; Austin & Herath, 2014; DeFond & Zhang, 2014; Hay, 2015; Tepalagul & Lin, 2015; Eulerich & Kalinichenko, 2018) or meta-analysis (Hay et al., 2006; Lin & Hwang, 2010; Hay, 2013), no previous study has examined the conceptual structure of the auditing discipline using bibliometric methods, such as co-word analysis. Examining the frontiers of auditing research, Hay (2015) asserted that, while the topics that were being studied extensively included auditor rotation, joint audits, and auditing firms providing non-auditing services, there was a need for further research concerning auditing and assurance services. Based on a review of archival auditing research, DeFond and Zhang (2014) determined that the primary focus of recent auditing research has been on audit quality. In particular, Lesage and Wechtler (2012) proposed an inductive typology of auditing research, analyzing abstracts of articles from a sample of auditing articles published in 25 journals, up to 2005, using content analysis. They determined that three different main periods have emerged in auditing research, based on the frequency of themes: the *education period*, the *statistics period*, and the *corporate governance period*.⁵ During the early 2000s, the research focus shifted to corporate scandals (e.g., Enron-Andersen), as well as to corporate governance-related topics (Lesage & Wechtler, 2012). Our analysis particularly covered

the period from 2000 to the present, thereby identifying recent trends and providing a snapshot of the conceptual evolution of the auditing discipline, using novel bibliometric methods. Andrikopoulos et al. (2016) analyzed a sample of auditing articles published in 12 auditing and accounting journals from 1997 to 2014, in order to explore patterns of international collaboration in auditing research. They detected a predominance of US scholars in auditing research, which might be attributable to the association between audit practices and important corporate events, such as the Enron scandal, the McKesson and Robbins scandal, etc. and institutional events, such as the Sarbanes-Oxley Act of 2002. To assess the recent conceptual evolution and research streams of auditing research, this study answered the following research questions through co-word analysis, SNA, and visualization maps:

Research question 1: What are the main research topics that structure the auditing discipline?

Research question 2: What are the dominant, fading, and emerging themes in the field of auditing?

Research question 3: Were there any changes concerning subject trends in auditing research in the years between 2000 and 2016?

Research question 4: Were there any differences in research patterns and trends in the auditing discipline across regions?

Research question 5: What direction should future auditing research take?

3. METHODOLOGY

3.1 Sample (database, journal and article identification)

Previous researchers have considered Web of Science (WoS) to be a reliable source of data for systematic literature review studies (Kumar & Jan, 2013; Benavides-Velasco et al., 2013; Khan & Wood, 2015; Zupic & Čater, 2015; Yan et al., 2015; Köseoglu et al., 2019); thus, following them, the selection of 22 accounting journals indexed in the Social Sciences Citation Index (SSCI) of WoS in 2016 was the initial step of sample determination for this research. We also included four additional prominent auditing journals (i.e., *International Journal of Auditing*, *Auditing: A Journal of Practice and Theory*, *Journal of International Accounting Auditing and Taxation*, and *Managerial Auditing Journal*), since the topic exclusively concerned the auditing field.⁶ In addition, we realized that two journals (i.e., *Australian Accounting Review* and *Journal of International Financial Management and Accounting*) did not include keywords for the published articles, so we excluded them from the sample, yielding 24 journals in total as presented in Table 1.

[Insert Table 1]

We selected peer-reviewed scholarly papers published in these 24 accounting and auditing journals for co-word analysis, and excluded editorials, commentaries, and book reviews, since this was the justified methodology of similar previous studies (Prather-Kinsey & Rueschhoff, 1999; Anderson, 2002; Chan et al., 2006; Andrikopoulos & Kostaris, 2017). We fixed 2000 as the start of the study, due to the availability of online content for some journals, and the introduction of keywords, from that year onwards (i.e., *The Accounting Review*, *Accounting Horizons*, *Journal of Accounting Research*, *International Journal of Accounting Information Systems*, and *Spanish Journal of Finance and Accounting*). We then divided the whole analysis period into the following three sub-periods to explore the changes in thematic structure of the auditing discipline over time; 2000–2005, 2006–2010, and 2011–2016. Subsequently, we selected 8,858 articles that included keywords, out of which we identified 2,119 articles with auditing-related keywords. Following this step, we synchronized keywords which had the same meaning, such as *IFRS* and *International Financial Reporting Standards*, *analyst expectations* and *analysts' expectations*, etc. Table 2 provides a sample list of 20 such synchronizations. After this step, we obtained 9,609 keywords in total, yielding 3,636 unique keywords.

[Insert Table 2]

4. RESULTS AND DISCUSSIONS

We started with the overall trend of the number of articles published in the selected auditing journals from 2000 to 2016 (Figure 1). Although fluctuations were observable in some years, the overall trend followed an increasingly clear direction, showing researchers' growing interest in the domain. In particular, specific events or crises might have played a substantial role in a steep increase in some years, such as the passing of the Sarbanes-Oxley Act in 2002 and the severe global crisis that shook markets during 2008 and 2009.

[Insert Figure 1]

4.1 Frequency analysis of keywords

In order to observe the trend of the conceptual development in the auditing domain, we documented the most frequently cited keywords in the papers by period (Table 3). We recognized that, while the generic keyword *auditing* was the most frequently cited keyword in the first and second periods, it faded in the third period and fell behind *audit quality* and *audit fees*. Across the periods, *audit fees*, *audit quality*, *internal control*, and *non-audit services* became the most

frequently cited keywords in the articles. In addition, *auditor*, *corporate governance*, *internal auditing*, *audit committee*, *auditor independence*, *fraud*, *earnings management*, *financial reporting*, *audit reports*, *regulations*, and *audit risk* were dominant keywords in the articles. The high citation frequency of the keyword *Sarbanes Oxley Act* in the second period was apparently due to the impact of passage of this Act in 2002.

Concerning *auditor*, *auditor independence* was among the frequently studied themes; however, *auditor judgement*, *auditor liability*, *auditor choice*, *auditor tenure*, *auditor change*, *auditor switching*, and *auditor reputation* were among the less frequently studied themes. Among other themes, *financial reporting quality*, *Public Company Accounting Oversight Board*, and *continuous auditing* emerged as observable themes, particularly in the final period; however, *Enron* was the most frequently cited theme in the earliest period, probably in the aftermath of the corporate scandal, but not in the subsequent periods. Among countries, *United States of America* was most frequently cited as one of the keywords.

[Insert Table 3]

4.2 Social network analysis (SNA)

In this section, we highlight some significant indicators of the co-word network in the auditing discipline (Table 4). First, the *degree* of a network shows the total number of connections that an actor (i.e., keyword) has. In other words, the degree of a network indicates the number of lines emanating from a particular node (i.e., keyword) (Andrikopoulos & Kostaris 2017); hence, the higher the degree, the greater the number of lines connecting a particular keyword to other keywords, implying the tightness of the network (Wang & Chen, 2003). The increasing value of the average degree across the periods indicated the propensity for higher connectedness of the keywords in the auditing discipline (i.e., 7.17 in 2000–2005, 7.26 in 2006–2010, and 8.19 in 2011–2016). Second, the *density* of a network ranging between 0 and 1 denotes the proportion of existing links to all possible links in the network (Khan & Wood, 2015; Racherla & Hu 2010; Andrikopoulos & Kostaris 2017; Gallardo-Gallardo et al. 2017). The *density* values across the years (i.e., 0.006 in 2000–2005, 0.006 in 2006–2010, and 0.004 in 2011–2016) indicated a decreasing trend in the final period, and it was 0.003 for all periods, implying that 0.3% of all possible links between keywords actually existed. The apparently low-density value was not particularly surprising and it was attributable to the large size of the network in our case (Gallardo-Gallardo et al. 2017). Third, across the periods, the consistent increase in *connectedness* and

decrease in *fragmentation* in the network showed that the co-word network became increasingly tight and cohesive (Varga, 2011; Kılıç et al, 2019), because the connectedness index measures the extent to which individual actors are connected in the network, whereas the fragmentation index indicates how the network fragments into clusters (Shimada & Sueur, 2014).⁷

[Insert Table 4]

4.2.1 SNA of individual keywords

In this section, we provide the rankings of individual keywords in terms of *betweenness centrality* and *degree centrality*, since these two metrics are commonly-used network indicators to evaluate the centrality of keywords within the network (Kılıç et al., 2019). While *betweenness centrality* measures the capacity of a keyword to connect other keywords in the transmission of data within the network, like a broker (Sedighi, 2016), *degree centrality* demonstrates the number of keywords that a keyword is engaged with (Acedo et al., 2006; Khan & Wood, 2015).

According to Table 5, while the generic theme *auditing* had the highest betweenness centrality score in the first and second periods, it weakened in the third period, falling behind *audit quality*. Although *audit fees*, *internal auditing*, *auditor independence*, *audit committee*, *auditor*, and *earnings management* fluctuated slightly in the ranking, they held prominent places in the list, indicating their influence in connecting other keywords; however, the betweenness score for *corporate governance* and *fraud* slightly decreased across the periods. More interestingly, while *audit planning* and *Enron* were ranked high on the list in the first period, they disappeared in the subsequent periods. By contrast, while *Sarbanes Oxley Act*, *non-audit services*, *regulations*, *external auditing*, and *United States of America* were not present in the first period, they had high betweenness scores in the subsequent periods. Moreover, *Big 4 audit firms*, *assurance*, *financial reporting*, *financial reporting quality*, *Sarbanes Oxley Act Section 404*, *continuous auditing*, *Public Company Accounting Oversight Board*, and *professional skepticism* were among the emerging themes with high centrality in the final period only.

Table 6 presents the ranking of keywords relating to degree centrality, which is an indication of the engagement of a keyword with other keywords within the network. While the generic keyword *auditing* had the highest ranking in the first two periods, in terms of its connectedness with other keywords in the network, it weakened slightly in the third period. By contrast, it was observed that *audit quality*, *auditor*, and *internal control* were among the rising themes in the ranking across periods; furthermore, *corporate governance*, *internal auditing*, *audit fees*, *auditor*

independence, audit committee, Sarbanes Oxley Act, earnings management, and fraud were outstanding themes in all periods, although their centrality scores slightly fluctuated from period to period. *Financial reporting quality, non-audit services, regulations, United States of America, Public Company Accounting Oversight Board, discretionary accruals, assurance, Sarbanes Oxley Act Section 404, IFRS, and continuous auditing* were emerging themes in the second and/or third periods. Thus, both betweenness and degree centrality indicators partially deliver similar results about the trend of topics over the three sub-periods.

[Insert Table 5]

[Insert Table 6]

4.3 Visualization maps

If two themes exist together in the keywords of an article, they are said to co-occur (van Eck et al., 2013). The co-occurrence of multiple themes indicates the interrelatedness of the topics they represent (Zhu & Guan, 2013; Chen et al., 2016). This situation is also named the *co-word structure* of the discipline (Muñoz-Leiva et al., 2012a; Muñoz-Leiva et al., 2012b). One of the methods of highlighting the co-word structure of a discipline is the use of network visualization/maps; therefore, we also visualized the co-word structure of the auditing discipline, which complemented the network metrics presented in the preceding sections. In the visualizations, two elements drew our attention; the line between nodes and the size of the nodes. While lines indicate the co-occurrence of keywords, the size of the nodes demonstrates the centrality of the nodes within the network. The larger the size of the node, the more connections it has to other nodes around it. All visualizations were drawn with VOSviewer, which is a software program for visualizing bibliometric networks.⁸

According to Figure 2, in the first period, the network was relatively scattered, but *auditing* had a dominant position, followed by *audit fees, audit quality, fraud, audit planning, and auditor judgment*. This implied that these keywords served as important hubs in the co-word network, bridging the other keywords. In particular, different themes connected to *auditing* caused its node size to grow increasingly large.

In the second period, *auditing* was still the most dominant theme, followed by *audit fees*. This indicated that other keywords were somehow tied to these two themes. In particular, the centrality of *audit fees* in the network was probably due to clients' sensitivity to the *fee* and the

factors that might affect the *fee* determination of audit firms; moreover, *continuous auditing* appeared as an emerging theme in this period at the bottom of the map. In the upper part, *auditor judgement* was the discernable keyword in the network.

In the third period, the superiority of *audit quality* over other themes become indisputably evident; thus, other themes were shaped by it, and clustered around it; however, *risk management*, *materiality*, *corporate social responsibility*, *sustainability*, *information technology audit*, and *tax avoidance* were recognizable in other themes in this period.

Overall, the visualization maps across periods highlighted the increasingly tight and cohesive network of the co-word mapping. This may have been due to the fact that the number of articles concerning auditing increased, and the thematic structure intensified around certain topics, such as *auditing*, *audit quality*, and *audit fees*; however, we should clarify that first two periods were similar in some respects, but the third period was distinctly different from previous periods.

[Insert Figure 2]

4.4 Regional co-word analysis

4.4.1 Regional SNA of individual keywords

In order to test whether regions or continents prioritized certain auditing topics, we documented the betweenness and degree centrality of keywords on a continent basis (Table 7 and Table 8). In terms of both indicators, while *audit quality* was ranked first in Asia, it was ranked second after the generic keyword *auditing* in Europe and North America, and it was ranked fourth in Oceania. This was an indication that all regions prioritized *audit quality*, despite minor ranking differences, and it played a central role in connecting other keywords in the network. In Europe, Oceania, and North America, the connectivity of the generic keyword *auditing* in the network was stronger than in Asia. *Audit fees* appeared to play a significant role in all regions, since it was ranked second, third, or fourth, depending on the region or the selection of the betweenness or degree centrality indicator. Despite slight differences in the ranking, *internal auditing*, *corporate governance*, *auditor*, *audit committee*, and *auditor independence* seemed to retain their places among highly central topics. Although *internal control* was among the intensively studied themes of Asian, European, and North American researchers, it was not yet within the scope of Oceanian researchers. Oceanian and North American researchers did not take *non-audit services* into consideration as much as Asian and European researchers did. Asia, in particular, appeared to focus more on *earnings management*, *information asymmetry*, *business risk*, and *modified audit*

opinion than the other three regions. In that region, *Malaysia*, *China*, and *Hong Kong* appeared to be highly studied countries, since the former two nations scored highly on both the betweenness and degree centrality indicators, and Hong Kong scored highly only on the degree centrality indicator. Although North American researchers were interested in the *Sarbanes Oxley Act*, the researchers in the other three regions were not, probably due to the Act originating in the United States of America. North America differed from other regions in focusing on *continuous auditing*, *auditor judgment*, *risk assessment*, *analytical procedures*, *Public Company Accounting Oversight Board*, *financial reporting quality*, and the *United States of America* as a country. Europe also differed from the other regions in focusing notably on *Big 4 audit firms*, *risk management*, *going concern*, and *audit expectations gap*. The *United Kingdom* was the outstanding country in European studies, while Australia and New Zealand were the two preeminent countries in Oceania. This region aligned itself with certain topics, rather than with other regions, regarding *public sector*, *ethics*, *greenhouse gas emissions assurance*, *litigation risk*, *audit failures*, *non-audit fees*, *expectation gap*, and *IFRS*.

4.4.2 Regional visualization maps

As shown in Figure 3, the regional visualization maps highlighted that the auditing literature in North America was cohesive, with the co-word structure concentrated around the generic keywords of *auditing* and *audit fees*. The keywords surrounding these two outstanding themes were also notable topics of interest for researchers in this region; specifically, *eXtensible Business Reporting*, *e-commerce*, and *information technology audit* seemed to demonstrate the repercussions of a new form of business (i.e., e-business). In Asia, *audit quality* was the most dominant theme, to which other themes were somehow tied. This may have been attributable to the severe Asian crisis of 1998, which probably caused researchers to focus excessively on audit quality as a means to prevent future corporate scandals. In the chart, the node size for *auditor* signified that it was almost as important as *audit quality* as the primary actor in the auditing process. Other themes that appeared in the region were *audit opinions*, *audit risk*, *China*, and *audit*. Compared to other regions, the co-word structure of Europe differed, with the dominant component, *auditing*, being connected to other themes in the network. Secondly, *agency theory* and *audit markets* clustered closely around the *auditing* theme. In Oceania also, the *auditing* theme was the dominant component, but *audit fees* and *audit quality* had quite sizable nodes, signifying that these two keywords played an important role in the transmission of data among keywords. In

the four *tails* of the map, the following four themes appeared to be significant and emerging: *Enron*, *assurance services*, *fraud*, and *audit*.

Overall, it was obvious that the generic keyword of *auditing* was the dominant component in North America, Europe, and Oceania, but not in Asia. By contrast, *audit quality* and/or *audit fees* appeared to be outstanding themes across North America, Oceania, and Asia.

[Insert Table 7]

[Insert Table 8]

[Insert Figure 3]

5. CONCLUSION

This paper contributes to the auditing literature in a number of ways, by providing a synthesis of 3,636 unique keywords cited in 2,119 articles and by addressing five research questions: The main research topics that structure the auditing discipline; the dominant, fading, and emerging themes in the field of auditing; the research trends in the years between 2000 and 2016; the differences in research patterns and trends in the auditing discipline across regions; and future directions for auditing research. We hope that the results will help researchers to orient their future research topics accordingly. In particular, we urge junior researchers to shape their research orientation in the auditing field by considering regional preferences, as well as the global overview. The paper also assesses the changes in the conceptual structure of auditing across the studied periods and across regions, which might be useful in updating research agendas in a timely manner, guiding region-specific studies, and inspiring researchers to better position themselves in this respect.

The main findings of this study can be summarized as follows. The consistent decline in fragmentation and increase in connectedness within the co-word network showed that the auditing discipline is becoming increasingly tight and cohesive (Varga, 2011; Kılıç et al, 2019). Although the results indicated the dominance and centrality of the generic *auditing* keyword in the earlier periods of the study, it had faded in the final period. The *audit quality* theme became the most dominant one in the third period, and all other themes were shaped by it and positioned around it. This finding implied the convergence of the entire auditing literature about *audit quality* in this period; thus, our findings confirmed that the focus of auditing research between 2011 and 2016 was on *audit quality*, as an assurance of high-quality financial reporting⁹ (DeFond & Zhang, 2014). Alternatively, the whole thematic structure of auditing could be said to be consequence-driven, linking all other themes to *audit quality* eventually. This might encourage researchers to focus on

audit quality when designing their future research. Regarding the frequency, betweenness and degree centrality analyses, as the network maps show, the keyword *audit fees* was extremely popular among researchers across periods and regions. Its centrality in the network charts indicated that it was highly influential in its connections to other keywords in the network. It was also noteworthy that, according to the frequency analysis, the researchers tended to include the generic keywords *auditing* and *auditor* less frequently in the third period than in the first and the second periods, while *internal control* and *non-audit services* were increasingly studied. Due to the intervention of the Securities and Exchange Commission, the audit market came to be directly regulated by the government through the Sarbanes Oxley Act, which largely aimed to improve audit quality (DeFond & Zhang, 2014). This regulation seems to have caused an explosion of researchers' interest in the Act and it incited them to focus on *audit quality*, *financial reporting quality*, *audit fees*, and *internal control*, among other themes, in connection with the Sarbanes Oxley Act. According to Sharma (2017), it stimulated worldwide reform of audit regulations and influenced the research, profession, practice, and education of auditing. *Continuous auditing* was a topic that intensively interested researchers after 2005 in our dataset. Advances in information technology, the rise of the real-time economy, and massive fraud scandals played a major role in the emergence of continuous auditing practices (Eulerich & Kalinichenko, 2018). Researchers have generally tended to study continuous auditing using XML-based accounting systems (Murthy & Groomer, 2004), in an internal auditing context (Gonzalez et al., 2012), to determine whether it enhances financial reporting quality (Lee et al., 2014), to assess how to minimize the cost of continuous audit practices arising from the maintenance of a large dataset (Pathak et al., 2005; Pathak et al., 2007), and to evaluate the incremental value of continuous auditing practice (Farkas & Murthy, 2014). Although *big data* had relatively low frequency and network scores in the analyses, resulting in us not commenting on it in previous parts of the paper, it recently emerged as a theme; the first paper concerning big data was published in 2014 and only a few papers were published on the subject, mainly by North American researchers. Those published papers focused on how big data will transform accounting and auditing practices (Bhimani & Willcocks, 2014; Warren et al., 2015); the drivers of, and obstacles, to big data evolution in audits (Alles, 2015); the consequences of big data in accounting and auditing (Krahel & Titera, 2015); the impact of big data on audit evidence; and audit judgements and financial statement audits (Brown-Liburd et al., 2015; Cao et al., 2015; Yoon et al., 2015). It therefore seems to be a strong candidate for one of

the future research avenues. The dominant themes appearing across the studied period showed that the auditing discipline is undergoing a transformation; while the education period, the statistics period, and the corporate governance period prevailed up to 2000 (Lesage & Wechtler, 2012), audit quality, audit fees, and internal control have become outstanding since 2000, with other themes surrounding them as aforementioned.

The regional analysis showed that the continents converged to some extent, but also diverged from each other in other respects. *Audit quality, audit fees, internal auditing, corporate governance, auditor, audit committee, and auditor independence* were the central research focus, despite minor deviations in ranking between the four regions (North America, Asia, Europe, and Oceania); however, in the lower rankings, they prioritized different themes. While North America prioritized *Sarbanes Oxley Act* and *continuous auditing*, Asian studies concentrated on *information asymmetry, business risk, and modified audit opinion*, among other topics, while Europe focused more on *Big 4 audit firms, risk management, and going concern*. Oceanian studies tended to cover *public sector, ethics, greenhouse gas emissions assurance, litigation risk, audit failures, and non-audit fees*, among other topics. Finally, the regional analysis highlighted the countries that were under close scrutiny by researchers in the articles.

Our findings might inspire scholars to expand their scope regarding dominant and emerging themes that might shape their topics of interests. The results might also provoke new research topics, by showing in which dimensions they can deepen their existing research interests; for example, can themes positioned at the periphery be connected to *audit quality, auditor independence, internal control, or internal auditing*? Considering dominant or emerging themes in the auditing discipline, journal editors or guest editors could formulate special issues relating to *continuous auditing* and *big data*. The findings might also inspire researchers to conduct more specific co-word studies concerning the outstanding themes in this study. The growth of the digital economy and audit analytics, enabled by big data, may have played a role in the emergence of *continuous auditing* and *big data* (Vasarhelyi et al., 2015; Hagan, 2018). By highlighting regional similarities and differences, the study may guide regional researchers to explore which themes are overly studied and which ones are under-researched. The findings may help practitioners to learn the interests of researchers, so that they might better cooperate with the researchers to advance the auditing discipline and facilitate access to data. This might align academics and practitioners more effectively in addressing trends and/or under-researched topics. Regulators might also benefit from

the results in setting their priorities; for example, considering the prominent keywords, they might contemplate the enrichment of *audit quality*, the factors that affect *audit fees*, the strengthening of *internal control*, and so on. Moreover, inclusion of the *regulations* keyword among frequently cited keywords, especially in the second and third periods, was an indication that researchers should consider SEC-initiated regulations (i.e., the Sarbanes Oxley Act), IFRSs, non-audit services, audit report lags, and audit firm rotation regulations. This might alleviate the concerns of regulators concerning the inutility or incompetence of academic auditing research. Finally, the overall and regional results may help auditing instructors to design and revise curricula in the auditing discipline, so that they can better align graduates with trend topics and future research directions.

Although we established an extensive list, the number of accounting and auditing journals on which this study was based constitutes a limitation. Future studies might consider articles published in a wider set of journals (i.e., accounting, business, finance, economics, and management) or other databases, such as Scopus, to compare and contrast with the findings of this study; moreover, the methodology for this study could be adapted to include more refined keywords, based on those outstanding in this study, such as *audit quality*, *audit fees*, *auditor independence*, *internal control*, or *internal auditing*, which might provide more synthesized implications. In particular, *continuous auditing* and *big data* appeared recently as promising and under-searched themes that deserve to be the focal point of future studies.

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TABLE 1 List of journals in the sample

No	Name of the journal
1	Abacus-A journal of Accounting Finance and Business Studies
2	Accounting and Business Research
3	Accounting and Finance
4	Accounting Horizons
5	Accounting Organizations and Society
6	Accounting, Auditing and Accountability Journal
7	Asia-Pacific Journal of Accounting & Economics
8	British Accounting Review
9	Contemporary Accounting Research
10	Critical Perspectives On Accounting
11	European Accounting Review
12	International Journal of Accounting Information Systems
13	Journal of Accounting and Economics
14	Journal of Accounting and Public Policy
15	Journal of Accounting Research
16	Journal of Business Finance and Accounting
17	Management Accounting Research
18	Review of Accounting Studies
19	Spanish Journal of Finance and Accounting
20	The Accounting Review
21	International Journal of Auditing
22	Auditing: A Journal of Practice and Theory
23	Journal of International Accounting Auditing and Taxation
24	Managerial Auditing Journal

TABLE 2 A sample list of keyword synchronization

Audit committees	Audit committee
Audit litigation	Auditor litigation
Auditor changes	Auditor change
Auditor dismissals	Auditor dismissal
Auditor fees	Audit fees
Big 4	Big 4 audit firms
Big 4 accounting firms	Big 4 audit firms
IFRS	International Financial Reporting Standards
Interfirm controls	Inter-firm controls
Internal audit function	Internal auditing function
Internal controls	Internal control
Non-audit	Non-audit
Non-audit services fees	Non-audit services fees
Organisational change	Organizational change
Restatement	Restatements
Sarbanes-Oxley Act (SOX)	Sarbanes–Oxley Act
Sarbanes-Oxley Section 404	Sarbanes–Oxley Act Section 404
SOX	Sarbanes–Oxley Act
USA	United States of America
Voluntary audits	Voluntary audit

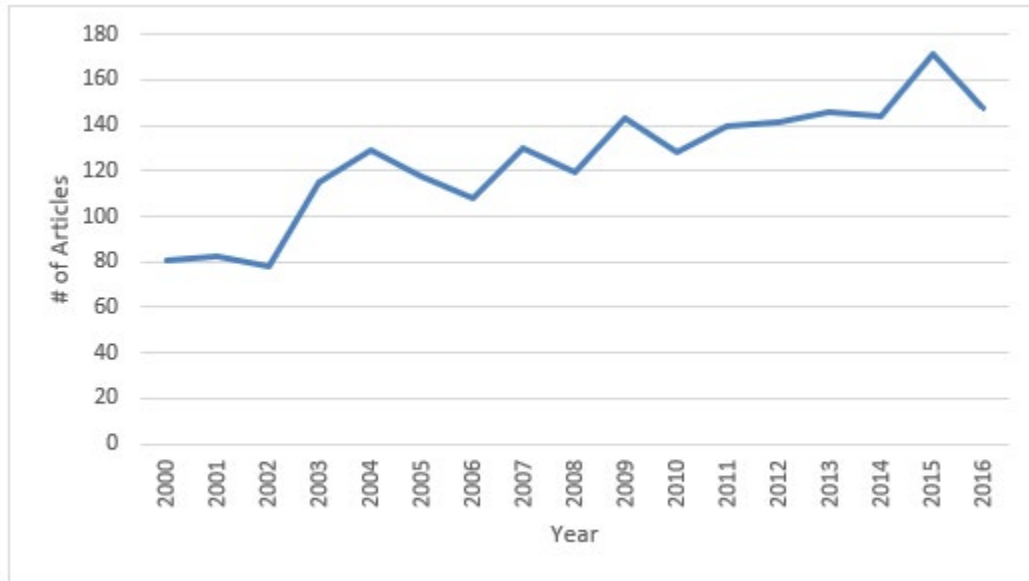


FIGURE 1 The overall trend of number of articles published on auditing

TABLE 3 Most frequently appearing keywords across the analysis sub-periods

2000–2005		2006–2010		2011–2016		All periods	
Auditing	103	Auditing	127	Audit quality	126	Auditing	313
Corporate governance	50	Corporate governance	64	Audit fees	116	Audit fees	217
Internal auditing	49	Audit fees	57	Auditing	83	Audit quality	211
Audit fees	44	Auditor	55	Corporate governance	77	Corporate governance	191
Auditor	43	Audit committee	54	Audit committee	70	Audit committee	162
Audit committee	38	Audit quality	52	Internal auditing	61	Internal auditing	160
Auditor independence	36	Internal auditing	50	Internal control	55	Auditor	143
Audit quality	33	Sarbanes Oxley Act	41	Auditor	45	Internal control	115
Fraud	25	Internal control	39	Auditor independence	38	Auditor independence	103
Audit	23	Auditor independence	29	Sarbanes Oxley Act	37	Sarbanes Oxley Act	86
Internal control	21	Earnings management	27	Earnings management	25	Earnings management	72
Accounting	21	Auditing standards	24	Financial reporting quality	24	Fraud	65
Earnings management	20	Fraud	21	Public Company Accounting Oversight Board PCAOB	23	Audit reports	50
Audit planning	18	Audit reports	20	Financial reporting	21	Financial reporting	48
Audit reports	14	Regulations	16	Non-audit services	20	Audit	47
Accountability	13	External auditing	16	Regulations	20	Auditing standards	46
Accounting standards	13	Non-audit fees	15	Audit	19	Accounting	43
Enron	13	Risk management	15	Fraud	19	Non-audit services	43
Financial reporting	13	Disclosure	14	Sarbanes Oxley Act Section 404	18	Regulations	43
Auditor judgment	13	Financial reporting	14	Audit risk	18	Audit risk	38
Independence	13	Non-audit services	14	Big 4 audit firms	17	External auditing	38
Risk management	12	Malaysia	14	Audit reports	16	Audit opinions	35
Auditing standards	12	United States of America	13	Restatement	16	Auditor judgment	34
Audit risk	11	Audit opinions	12	Audit opinions	16	Risk management	34
Analytical procedures	11	Accounting	12	Continuous auditing	15	Audit planning	33
Ethics	10	Earnings quality	12	Discretionary accruals	15	Going concern	33
Going concern	9	Going concern	11	IFRS	14	United States of America	33
Non-audit services	9	Australia	11	Non-audit fees	13	Disclosure	32
External auditing	9	Ethics	11	United States of America	13	Financial reporting quality	32
Board of directors	8	Arthur Andersen	11	External auditing	13	Non-audit fees	31
Sarbanes Oxley Act	8	Auditor's fees	11	Going concern	13	Ethics	30
Risk assessment	8	Auditor choice	10	Assurance	13	Independence	30
Industry specialization	8	Board of directors	10	China	13	Earnings quality	30

Expectation gap	8	Auditor tenure	10	Auditor judgment	12	Continuous auditing	27
Risks	7	Earnings	9	Material weakness	12	Auditor tenure	26
Audit opinions	7	Auditor judgment	9	Audit pricing	12	Discretionary accruals	26
United States of America	7	Audit risk	9	Disclosure	12	Auditor choice	26
Auditor change	7	Auditor liability	9	Auditor choice	12	Board of directors	26
Regulations	7	Industry specialization	9	Earnings quality	12	Assurance	25
Sustainable development	7	Quality	8	Audit report lag	12	Industry specialization	25
Assurance	7	Bankruptcy	8	Independence	11	Analytical procedures	25
Client acceptance	6	Standards	8	Audit markets	11	Public Company Accounting Oversight Board PCAOB	25
Initial public offerings IPOs	6	Section 404	7	Auditor tenure	11	Accountability	25
Quality audit	6	Auditor switching	7	Going concern opinions	11	Malaysia	24
Earnings quality	6	Continuous auditing	7	Materiality	11	Big 4 audit firms	23
Effectiveness	6	Litigation risk	7	Professional skepticism	11	Risk assessment	23
Business risk	6	Audit planning	7	Auditing standards	10	China	23
Discretionary accruals	6	United Kingdom	7	Accountability	10	Auditor liability	23
Internet	6	Audit judgment	6	Agency theory	10	Audit pricing	23
Auditor liability	6	Audit pricing	6	Auditor industry specialization	10	Australia	23
Disclosure	6	Risk assessment	6	Conservatism	10		
Materiality	6	Auditor reputation	6	Accounting	10		
Information systems	6	Material weakness	6	Critical	10		
		China	6	Auditor reputation	10		

TABLE 4 Network indicators

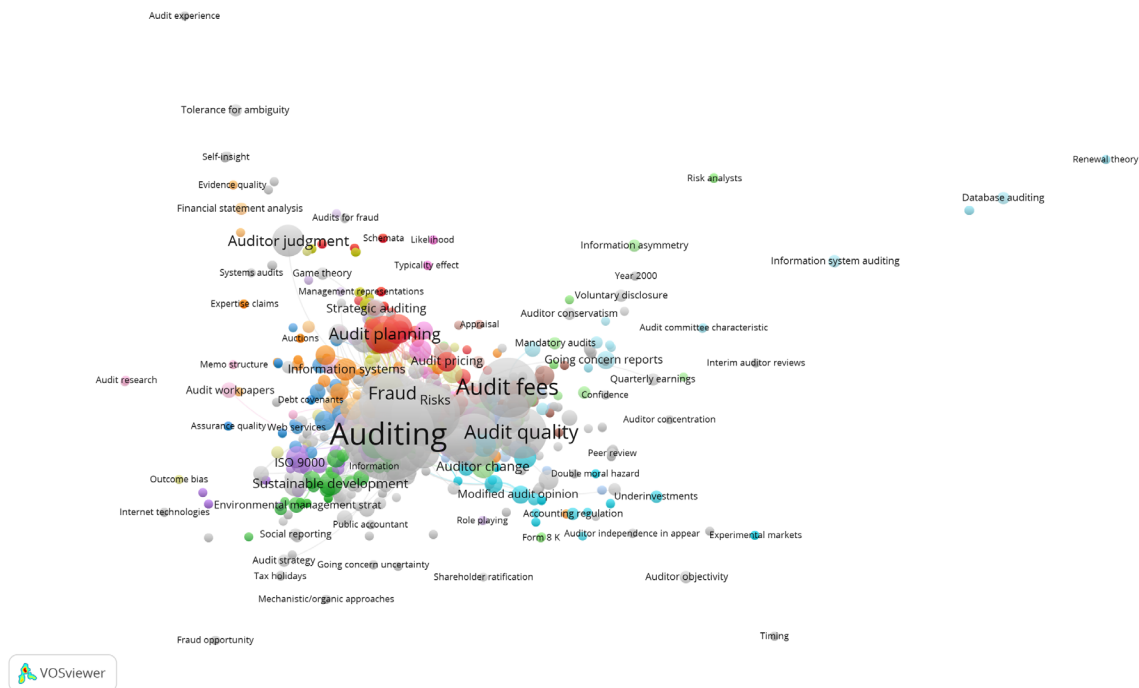
Indicator	2000–2005	2006–2010	2011–2016	All periods
Average Degree	7.17	7.26	8.19	9.16
Density	0.006	0.006	0.004	0.003
Components	29	26	27	37
Connectedness	0.850	0.855	0.901	0.925
Fragmentation	0.150	0.145	0.099	0.075

TABLE 5 Top 25 keywords with high betweenness centrality

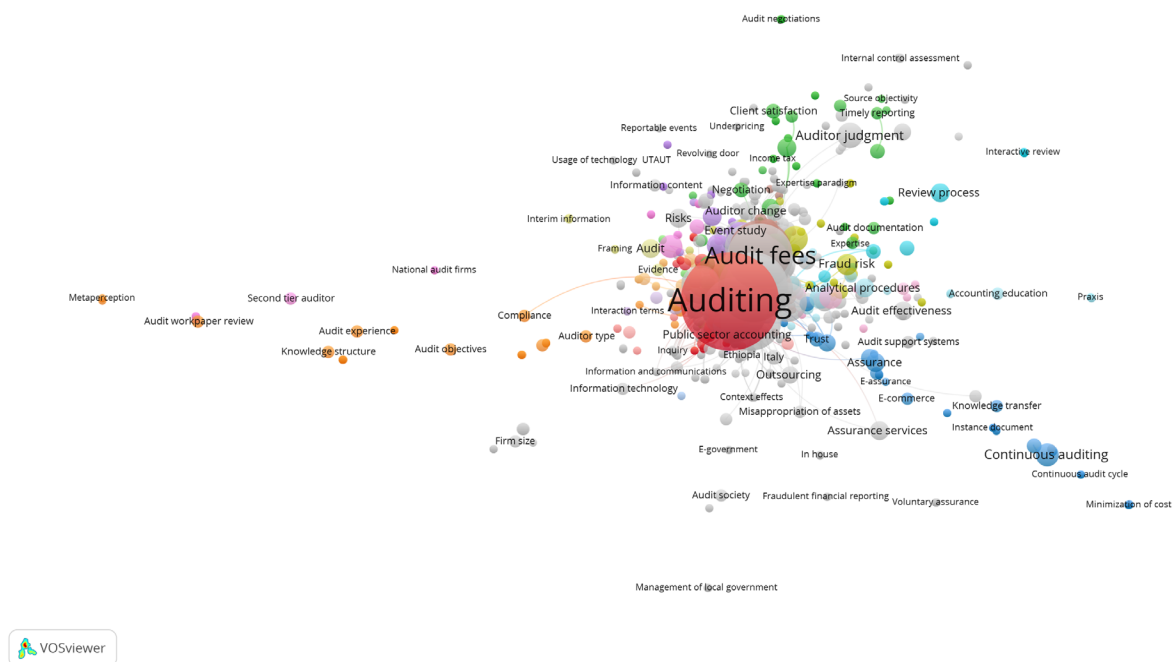
2000–2005		2006–2010		2011–2016		All periods	
Words	Betweenness	Words	Betweenness	Words	Betweenness	Words	Betweenness
Auditing	252372.92	Auditing	212361.69	Audit quality	495839.14	Auditing	1566485.59
Corporate governance	107382.19	Audit fees	102675.20	Auditing	419509.30	Audit quality	1098018.66
Auditor independence	79906.26	Corporate governance	98601.97	Audit fees	336332.73	Audit fees	838954.41
Audit quality	76826.00	Audit quality	97850.14	Internal auditing	234581.27	Internal auditing	666342.76
Internal auditing	72870.55	Sarbanes Oxley Act	73618.11	Corporate governance	193220.13	Corporate governance	623720.17
Audit fees	67902.70	Internal control	57857.37	Auditor	187883.44	Auditor	531134.18
Auditor	46235.62	Internal auditing	53164.46	Internal control	151859.42	Internal control	440016.67
Fraud	39896.03	Auditing standards	51887.83	Audit committee	140932.73	Audit committee	400768.45
Audit committee	35100.45	Fraud	46503.90	Auditor independence	88629.88	Auditor independence	384815.84
Audit planning	31888.35	Audit committee	44764.14	Sarbanes Oxley Act	76047.40	Sarbanes Oxley Act	356725.32
Audit	31530.96	Earnings management	42002.91	Fraud	64323.95	Fraud	279032.10
Enron	30579.45	Auditor	40766.69	Audit	58775.95	Audit	220141.58
Earnings management	27756.95	Auditor independence	27207.53	Earnings management	56903.79	Earnings management	203542.17
Internal control	27110.34	Non-audit services	24870.09	Big 4 audit firms	55098.40	Audit reports	202091.07
Accountability	24103.20	Audit reports	22850.31	Assurance	46316.93	Auditor judgment	201346.41
Audit reports	23016.90	External auditing	19390.39	Financial reporting	45646.77	Auditing standards	165059.96
Auditor judgment	22850.53	Auditor judgment	18601.76	Regulations	45378.21	Audit planning	149788.87
Auditing standards	22027.25	Accounting	18515.05	Financial reporting quality	43928.10	Accounting	136956.08
Independence	21089.49	Audit effectiveness	17835.94	External auditing	43180.95	Audit risk	127471.81
Accounting	20991.76	Agency theory	17570.56	Sarbanes Oxley Act Section 404	38791.60	Continuous auditing	121410.21
Risk assessment	19549.27	Disclosure	16653.42	Analytical procedures	38211.37	Assurance	114876.20
Risk management	19378.73	United States of America	16263.06	Non-audit services	38022.04	Regulations	113976.24
Analytical procedures	17982.36	Regulations	15486.60	Continuous auditing	37513.56	United States of America	112978.87
Business risk	16652.34	Audit opinions	14720.30	Public Company Accounting Oversight Board PCAOB	36636.08	Disclosure	106247.94
Audit risk	15811.72	Audit risk	14497.12	Professional skepticism	35897.16	Audit opinions	103265.61

TABLE 6 Top 25 keywords with high degree centrality

2000–2005		2006–2010		2011–2016		All periods	
Words	Degree	Words	Degree	Words	Degree	Words	Degree
Auditing	262	Auditing	301	Audit quality	374	Auditing	750
Corporate governance	148	Audit fees	160	Auditing	329	Audit quality	542
Internal auditing	145	Corporate governance	145	Audit fees	328	Audit fees	532
Audit fees	128	Audit quality	134	Corporate governance	231	Corporate governance	443
Auditor independence	125	Audit committee	122	Auditor	207	Internal auditing	411
Audit quality	112	Auditor	121	Internal auditing	205	Auditor	382
Auditor	105	Internal auditing	117	Audit committee	202	Audit committee	342
Audit committee	91	Sarbanes Oxley Act	114	Internal control	170	Internal control	302
Audit	90	Internal control	109	Auditor independence	142	Auditor independence	301
Internal control	69	Auditor independence	84	Sarbanes Oxley Act	113	Sarbanes Oxley Act	234
Audit planning	69	Earnings management	80	Financial reporting	93	Fraud	198
Accounting	65	Fraud	79	Earnings management	92	Audit	192
Fraud	62	Auditing standards	66	Audit	87	Earnings management	189
Enron	62	Audit reports	56	Financial reporting quality	84	Accounting	149
Accountability	59	External auditing	53	Fraud	78	Audit reports	147
Earnings management	58	Disclosure	49	Non-audit services	76	Financial reporting	139
Independence	53	Accounting	48	Regulations	71	Regulations	125
Audit reports	50	Regulations	46	Big 4 audit firms	70	Auditing standards	124
Auditor judgment	43	Audit opinions	46	United States of America	70	Audit risk	124
Accounting standards	42	Non-audit services	43	Public Company Accounting Oversight Board PCAOB	64	Audit opinions	121
Audit risk	41	Audit risk	42	Discretionary accruals	61	United States of America	120
Financial reporting	39	Risk management	41	Assurance	61	Non-audit services	119
Auditing standards	37	Going concern	40	Sarbanes Oxley Act Section 404	60	External auditing	118
Ethics	37	Arthur Andersen	38	IFRS	60	Independence	115
Sarbanes Oxley Act	37	United States of America	36	Continuous auditing	59	Auditor judgment	115



Period: 2000–2005



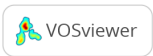
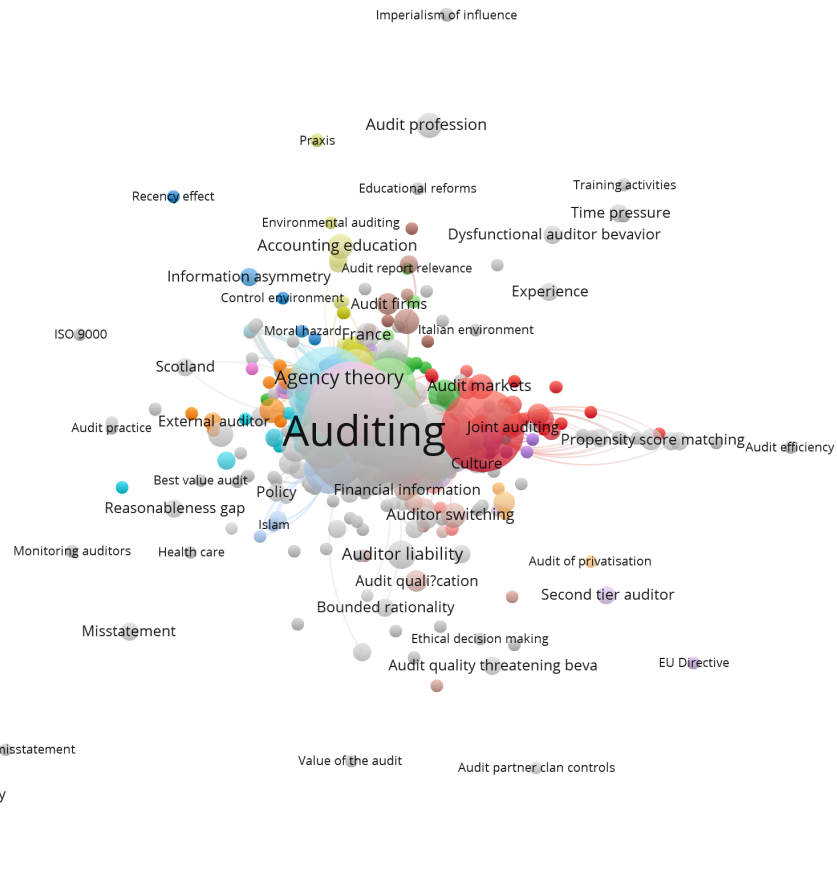
Period: 2006–2010

TABLE 7 Betweenness centrality (regions)

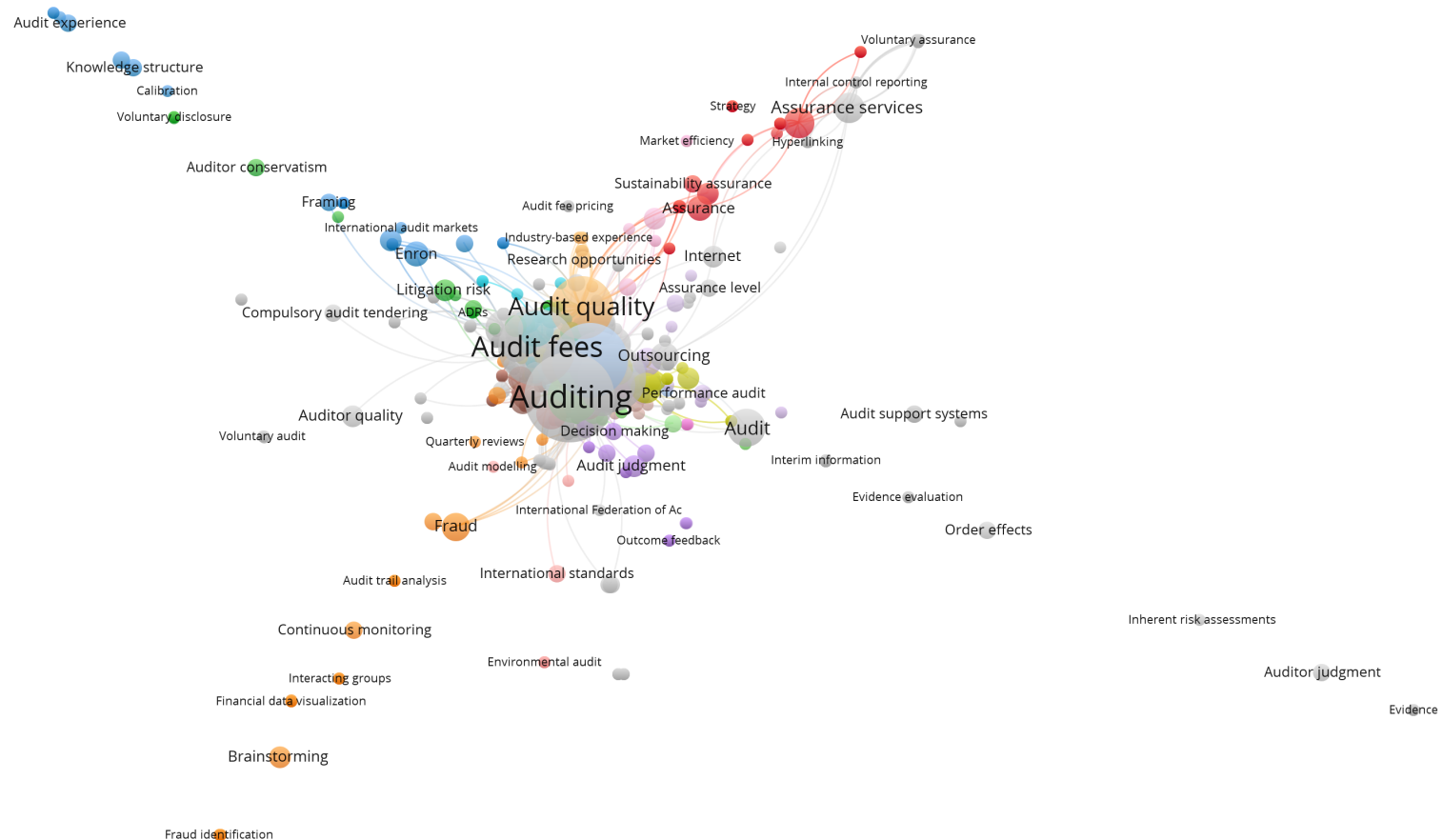
Asia		Europe		Oceania		North America	
Audit quality	38788.43	Auditing	202936.82	Auditing	49787.45	Auditing	441764.79
Audit fees	27182.73	Audit quality	103583.97	Corporate governance	40550.78	Audit quality	359165.87
Corporate governance	27149.64	Internal auditing	79224.34	Audit fees	33413.66	Audit fees	250926.02
Malaysia	18619.43	Audit fees	76224.24	Audit quality	26569.54	Sarbanes Oxley Act	200843.09
Auditing	14924.07	Auditor	66448.95	Internal auditing	26485.69	Corporate governance	198958.79
Audit committee	14322.06	Auditor independence	61215.28	Australia	21844.13	Internal control	179891.19
Earnings management	13405.96	Corporate governance	55833.47	Auditor independence	17835.31	Internal auditing	164556.44
Internal control	13008.29	Audit committee	48792.76	Audit committee	11954.08	Auditor	147089.15
Auditor	11128.51	Regulations	40464.19	Auditor	11382.51	Fraud	122166.47
Internal auditing	10992.94	Auditing standards	35931.30	Audit	10576.28	Audit committee	118403.35
Audit opinions	7083.89	Audit reports	35248.82	Accounting	9298.68	Auditor independence	98738.84
China	6372.32	Internal control	32913.94	Public sector	7926.67	Auditor judgment	95016.17
Non-audit services	5897.39	Accounting	23279.46	Ethics	7166.80	United States of America	73234.93
Fraud	5022.15	United Kingdom	17972.72	Accountability	7093.63	Audit planning	66115.10
Auditing standards	4795.49	Audit planning	17069.13	Greenhouse gas emissions assurance	6984.74	Analytical procedures	65911.05
Information asymmetry	4387.53	Non-audit services	16679.20	Litigation risk	6200.01	Earnings management	58480.34
Auditor independence	4278.28	Audit	16055.19	Arthur Andersen	6183.81	Continuous auditing	55636.19
Business risk	4005.58	Big 4 audit firms	15478.66	Independence	6108.96	Risk assessment	53614.54
Disclosure	3822.60	Going concern	14715.30	Earnings management	6080.13	Disclosure	49664.29
Assurance	3652.45	Financial reporting	14338.49	Fraud	5934.29	Audit reports	48477.76
External auditing	3562.09	Risk management	13992.43	Audit reports	5913.13	Materiality	45048.72
Audit	3406.87	Enron	13657.56	Enron	5676.37	Experimental economics	42303.81
Accounting	3374.08	Sweden	12846.96	New Zealand	5481.06	Auditing standards	40594.58
Legal environment	2669.13	Spain	12812.61	Audit failures	5192.22	Non-audit services	40487.26
Modified audit opinion	2290.98	Assurance	12780.04	Expectation gap	4848.73	Assurance	38688.99

TABLE 8 Degree centrality (regions)

Asia		Europe		Oceania		North America	
Audit quality	110	Auditing	279	Auditing	137	Auditing	362
Audit fees	88	Audit quality	154	Audit fees	117	Audit quality	291
Corporate governance	76	Internal auditing	146	Corporate governance	94	Audit fees	275
Auditor	60	Audit fees	139	Audit quality	85	Corporate governance	221
Auditing	60	Corporate governance	121	Internal auditing	75	Internal control	201
Audit committee	57	Auditor	119	Australia	61	Sarbanes Oxley Act	200
Malaysia	56	Auditor independence	116	Auditor independence	61	Audit committee	191
Earnings management	47	Audit committee	87	Audit committee	58	Internal auditing	186
Internal control	44	Internal control	83	Auditor	58	Auditor	174
Internal auditing	42	Audit	71	Audit	38	Fraud	142
Auditor independence	33	Regulations	69	Ethics	32	Auditor independence	139
Audit opinions	33	Audit reports	66	New Zealand	31	Earnings management	111
China	29	Auditing standards	61	Earnings management	31	United States of America	109
External auditing	28	Accounting	58	Accounting	29	Auditor judgment	93
Non-audit services	25	Non-audit services	53	Independence	28	Continuous auditing	80
Audit	25	Financial reporting	52	Industry specialization	27	Audit planning	78
Hong Kong	23	Risk management	47	External auditing	26	Financial reporting quality	71
Discretionary accruals	23	United Kingdom	43	Financial reporting	25	Analytical procedures	71
Fraud	22	Audit opinions	42	Audit reports	25	Accounting	68
Auditor tenure	21	Big 4 audit firms	40	Audit opinions	25	Disclosure	67
Board of directors	20	Going concern	39	Public sector	24	Audit	67
Audit risk	20	Fraud	38	Non-audit fees	23	Audit risk	65
Information asymmetry	19	Audit expectations gap	36	Expectation gap	23	Risk assessment	63
Financial reporting	17	Agency theory	34	IFRS	23	Public Company Accounting Oversight Board PCAOB	62
Earnings quality	15	External auditing	34	Audit risk	22	Financial reporting	60
Modified audit opinion	15	Accountability	34			Independence	60
Business risk	15						
Auditing standards	15						



Europe



Oceania

FIGURE 3 Regional co-word network maps based on largest component in the network

ENDNOTES

¹ Author keywords are assigned by the authors of the research paper (Romo-Fernández et al., 2013).

² Please see more bibliometric studies that have examined publishing patterns (i.e., authorship, journals, institutions, countries, and regions) in the field of accounting (Hasselback et al., 2003; Jones & Roberts, 2005; Chan et al., 2006; Chan et al., 2012; Gaunt, 2014; Endenich & Trapp, 2016; Merigó & Yang, 2017).

³ Co-authorship occurs when two or more authors participate in the production of a study leading to a journal publication (Tucker et al., 2016).

⁴ Co-citation exists between two publications or researchers when they are cited in the same document (i.e., listed in the same bibliography) (Meyer et al., 2007).

⁵ From early 1930s to mid-1960s, the frequency of the themes concerning education (i.e., school, course, student, and etc.), from mid-1960s to early 1990s the themes concerning statistics (i.e., statistics, probability, audit sample, sampling, and etc.), from early 1990s to 2000s the themes concerning corporate governance (i.e., governance, audit committee, etc.) were found to be higher (Lesage & Wechtler, 2012).

⁶ Another prominent auditing journal (i.e., Accounting, Auditing and Accountability Journal) was already included in the list.

⁷ A fragmentation index equivalent to 1 shows that all actors in the network are disconnected, while an index equivalent to 0 demonstrates the existence of a single cluster connecting all actors in the network (Shimada & Sueur, 2014).

⁸ Please see www.vosviewer.com to get more detailed information and to download the software.

⁹ Indeed, this is supported by also our finding which shows *financial reporting quality* is one of the most frequently cited keywords and has the high betweenness and degree centrality score.