Is Audit-quality Research Discipline Saturated or Still Researchable? A Bibliometric Analysis

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ABSTRACT

The objectives of this study are to illustrate the evolution of the audit-quality research discipline over the past forty years, determine whether this research discipline is expandable and, if so, what potential future research avenues need further examination, and understand the current knowledge structure of the audit-quality research discipline. To achieve these objectives, we employed bibliometric techniques (keyword-frequency and co-word analyses) to review a dataset of 1,831 articles extracted from the Scopus database between 1981 and 2021. A newly introduced keyword frequency tool (K-indicator) was used to measure the evolutionary stages of the audit-quality research discipline. We then employed co-word analysis visualizations to present the cognitive structure of the audit-quality field. The K-indicator revealed that audit quality had become a mature discipline with established concepts, keywords, and conclusions. Also, it indicated that despite extensive audit-quality research, there is room for further research. The co-word analysis showed that audit quality had reached a tight and coherent status from 1981 to the end of 2021. Co-word visualizations indicated that the audit-quality structure revolves around four main themes: auditor characteristics, client-related factors, audit-firm characteristics, and audit regulations. Therefore, the audit-quality research discipline concentrated on some specific elements and ignored others. To the best of the authors' knowledge, no similar study was conducted to determine whether the audit-quality notion is still researchable. Therefore, the results of this study would add much value to audit researchers, practitioners, and regulators.

Keywords: Audit quality, Evolution of audit quality, Bibliometric analysis, Keyword analysis, Keyword-frequency analysis, Co-word analysis.

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هل تخصص أبحاث جودة التدقيق مشبع أم لا يزال قابلاً للبحث؟ تحليل ببليومتري

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ملخص

تتمثل أهداف هذه الدراسة في توضيح تطور أبحاث جودة المراجعة على مدار الأربعين عامًا الماضية، وتحديد ما إذا كان هذا التخصص البحثي قابلاً للتوسع، وإذا كان الأمر كذلك، فما هي سبل البحث المستقبلية المحتملة التي تحتاج إلى مزيد من الدراسة؟ كذلك تهدف هذه الدراسة إلى فهم بنية المعرفة الحالية للأبحاث الخاصة بجودة المراجعة. ولتحقيق هذه الأهداف، قام الباحثون باستخدام التقنيات الببليومترية (تحليلات تكرار الكلمات المفتاحية والكلمات المشتركة) لمراجعة مجموعة بيانات مكونة من 1831 مقالة تم استخراجها من قاعدة بيانات سكوبس (Scopus) بين عامي 1981 و2021. تم استخدام أسلوب جديد لتحليل تكرار الكلمات المفتاحية (مؤشر K) لقياس المراحل التطورية لأبحاث جودة المراجعة، وكذلك خرائط تحليل الكلمات المشتركة لتقديم الهيكل المعرفي الخاص بمجال أبحاث جودة المراجعة. وكشف مؤشر K أن جودة المراجعة أصبحت مجالًا ناضجًا له مفاهيم وكلمات رئيسية واستنتاجات راسخة، كما أشارت النتائج إلى أنه على الرغم من الأبحاث الكثيرة في مجال جودة المراجعة، فمازالت هناك مساحة إضافية لمزيد من الابحاث. وأظهر تحليل الكلمات المشتركة أن تخصص جودة المراجعة قد وصل إلى حالة محكمة ومتماسكة مع نهاية عام 2021. كذلك أشارت الخرائط إلى أن هيكل جودة المراجعة يدور حول أربعة مواضيع رئيسية: خصائص المراجع، والعوامل المتعلقة بالعميل، وخصائص شركة المراجعة، ولوائح المراجعة. لذلك، ركز تخصص جودة المراجعة على بعض العناصر المحددة وتجاهل البعض الآخر. وفي حدود معرفة المؤلفين، لم يتم إجراء دراسة مماثلة لتحديد ما إذا كانت فكرة جودة المراجعة لا تزال قابلة للبحث. ومن ثم فلابد من الإشارة إلى أن نتائج هذه الدراسة ستضيف قيمة كبيرة لباحثي وممارسي ومنظمي مهنة المراجعة.

الكلمات الدالة: جودة المراجعة، تطور جودة المراجعة، التحليلات الببليومترية، تحليل تكرار الكلمات المفتاحية، تحليل الكلمات المشتركة.

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1. Introduction

The business community has witnessed several significant events during the past 25 years, such as the collapse of successive business entities (e.g. Enron, Nortel, WorldCom, and Northern Rock Bank), strenuous attempts to regulate the audit profession (e.g. Sarbanes-Oxley Act of 2002 and the establishment of the PCAOB), and other global events (e.g. the financial crisis of 2008 and the COVID-19 pandemic of 2019). Such events have demonstrated the significance of offering credible, high-quality financial reporting (Neri & Russo, 2014). Additionally, Detzen and Gold (2021) highlighted the important role that audit quality plays in the broader context of quality financial reporting. Maijoor and Vanstraelen (2012) argued that audit quality is the main reason for the existence of the audit profession. This is because the absence of high-quality audits erodes the public trust in audits. Therefore, audit quality has received considerable attention from both audit academics and practitioners during the past thirty years (Hay, 2015; Uyar et al., 2020).

Audit governing bodies have made several attempts to develop quantitative and qualitative measures to assess audit quality and issue "one-size-fits-all" audit-quality frameworks. Examples of such frameworks are those issued by the UK Financial Reporting Council (FRC) in 2008, the Canadian Public Accountability Board in 2014, the Chartered Accountants of Australia and New Zealand in 2014, the Nederlandse Beroepsorganisatie van Accountants in 2014, the Federal Audit Oversight Authority of Switzerland in 2014, and the International Accounting and Assurance Standards Board (IAASB) in 2014. Also, in 2015, another group of audit-quality frameworks was released by the Public Company Accounting Oversight Board (PCAOB) of the USA, the Accounting and Corporate Regulatory Authority of Singapore, and the International Organization of Securities Commissions (IOSCO). There are material variations among these audit-quality frameworks. The Federation of European Accountants (FEE) (2016) attributed these variations to the differences in regulatory approach and business models that issuers operate in.

The ACCA (2011:9) believes that auditing is evolving, stating that "*audit needs to evolve not just to take into account the historical financial statements, but also to give an opinion on more forward-looking, qualitative and non-financial data.*" Also, the IAASB (2011) demonstrated that audit activity is an ever-evolving process that adapts to changes in the business environment, financial reporting standards, regulations, and technology. As a result, the pursuit of audit quality cannot be considered a one-time program with conclusive results. Instead, it is a continuous process that ensures that audit quality keeps pace with the environment in which audits are performed. Therefore, efforts to improve audit quality are endless.

In parallel with the practitioners' efforts, extensive academic research has examined audit quality over the past thirty years. However, Detzen and Gold (2021), Ciger (2020), and Linnenluecke et al. (2017) expect more attention to be directed to this research area during the coming years. Such expectations stem from the unavailability of a single universal definition for audit quality, the unavailability of an agreed-upon framework of factors affecting audit quality, the lack of a unified set of measures of audit quality, and the variation among different stakeholders who perceive audit quality differently (Knechel et al., 2013; DeFond & Zhang, 2014; Christensen et al., 2016). Additionally, Montenegro & Brás (2018) attributed the extensive audit-quality research to the complexity, broadness, and multi-dimensionality of audit quality and its unobservable nature.

The extensive attention directed towards the audit-quality research discipline has resulted in an exponential increase in audit-quality publications. Thus, it has become challenging for researchers to trace trends in the audit-quality research discipline. The wide examination of audit quality during the past

forty years has raised an important question; is the audit-quality research discipline saturated or still researchable? To answer this question, obtaining a deeper and broader understanding of the complexities and nuances of the audit-quality research discipline has become necessary. This could determine whether this research discipline is expandable and, if so, which dimensions need further inspection. To achieve such an objective, there is a need to examine this research discipline more holistically. Here comes the role of bibliometric analysis techniques. Bibliometric analysis techniques enable researchers to deeply understand the underlying research discipline by obtaining a bird's eye view of the main actors (authors, citations, documents, journals, universities, and countries) and relations that exist between concepts, problems, and methods of that research discipline (mapping analysis) (Ciger, 2020).

The prior bibliometric-based studies (e.g. Ciger, 2020; Taqi et al., 2021) have paid considerable attention to the performance analysis types of bibliometrics (most productive authors, cited documents, productive countries, productive universities, productive journals, among others) with no attention given to mapping analysis. Additionally, they did not investigate the evolutionary stages of the audit-quality research discipline. Furthermore, they ended with the conclusion that audit quality is still a researchable topic that is expected to increase annually (Montenegro & Brás, 2018; Ciger, 2020; Taqi et al., 2021). Thus, such expectations motivate our study to fill this research gap by providing an updated picture of audit-quality research discipline and determining areas that received considerable attention and those overlooked by academic scholars.

Traditional literature reviews (narrative reviews, research syntheses, meta-analyses, systematic reviews, and structured reviews) greatly depend on researchers' subjective opinions and can cover a few studies (Denyer & Tranfield, 2006; Massaro et al., 2016). On the other hand, bibliometric analysis can be used to quantitatively analyze prior literature (Ding et al., 2001), improve the objectivity of review studies (Zupic & Čater, 2015), detect relationships among different

studies, visualize the cognitive structure (Uyar et al., 2020), and pinpoint implicit patterns in a given research discipline (Pizzi et al., 2021). Therefore, the use of bibliometric techniques enables researchers to broaden their scope in terms of the number of studies to be analyzed and the period to be covered (Ciger, 2020; Taqi et al., 2021).

Like other research disciplines, the audit-quality research discipline comprises a group of concrete research topics that reflect the problems, concepts, and methods related to that discipline (Braam et al., 1991). Bibliometric techniques would add value to audit quality debates by revealing important concepts and notions and generating insightful knowledge structure maps. Simnett et al. (2016) claimed that the objectives of audit research are to understand, assess, and promote audit quality. Hence, the aims of this review are as follows: First, we illustrate the evolution of the audit-quality research discipline over the past forty years. The second objective of this study is to determine whether the audit-quality research discipline is expandable and, if so, what potential future research avenues need further examination. The third objective revolves around understanding the current knowledge structure of the audit-quality research discipline. This knowledge will help us set up the current knowledge scope and determine potential gaps that require further investigation. To achieve these objectives, we applied keyword analysis to a dataset of 1,831 articles extracted from the Scopus database between 1981 and 2021. A newly introduced keyword frequency tool (K-indicator) was used to measure the evolutionary stages of audit-quality research discipline. We then employed co-word analysis visualizations to present the cognitive structure of the audit quality field. Hence, our main target is not to show or compare the results of prior literature, but to understand the evolutionary stages that audit quality has gone through and the conceptual structure of that research discipline.

This study contributes to the audit quality debate in several ways. First, it covers a wide range of studies (1,831) related to audit quality conducted between 1981 and 2021. Second, we analyze this large dataset using bibliometric techniques (keyword-frequency and co-word analyses) instead of performance analysis (authorship, journals, universities, countries, citations, and documents) conducted by bibliometric-based prior studies (e.g. Ciger, 2020; Taqi et al., 2021). Third, we measured the evolutionary stages of the audit-quality research discipline using a newly introduced keyword-frequency analysis tool (K-indicator). This indicator enables researchers to determine the evolutionary stages of the audit-quality research discipline and whether it is still researchable or saturated. Fourth, a co-word- analysis was adopted to map the conceptual structure of the audit-quality research discipline. This highlights the *status quo* of the audit quality and enhances our understanding of the overall audit quality concept without concentrating on specific factors. Fifth, the study provides an updated picture of the audit-quality research discipline, with potential research gaps that require further research.

This study will benefit different financial reporting stakeholders and others concerned with understanding audit quality. Basically, the results of this study will inform academic scholars of the stages that the audit-quality research has gone through and whether this discipline is still researchable or saturated. Also, if the audit-quality research discipline is still researchable, this study will indicate the areas that have received extensive attention in prior literature and potential future research opportunities. Additionally, evidence-based findings can help audit practitioners, standard-setters, and regulators review and improve audit standards, guidelines, and best practices to meet the needs of different stakeholders.

The remainder of this study is organized as follows. Section two presents related literature. Then, we present the methodology used in this study. Next, we present and discuss the results in Section four. Section five presents potential research areas that require further investigation. Finally,

Section six presents the conclusions and a summary.

2. Literature Review

2.1. *Audit Quality:* Although audit quality has been continuously evolving over the past 40 years, neither a single universal definition for audit quality nor an agreed-upon framework for audit-quality factors/indicators has been reached (Carcello et al., 1992). Knechel et al. (2013: 385) support this conclusion by stating that "*audit quality is much debated, but little understood.*" Additionally, Francis (2011), DeFond and Zhang (2014), and Montenegro and Brás (2018) extensively criticized the incompleteness and narrowness of prior audit quality definitions. DeAngelo (1981) and Carcello et al. (2002) defined the audit quality as a function of the independence and objectivity of auditors, audit effort, auditor competence, and adherence to professional standards. Besides, Palmrose (1988) and Casterella et al. (2009) focused on audit failures and litigation or claims against audit firms when defining audit quality. However, DeAngelo's (1981) definition remains valid and widely accepted among the audit community. DeAngelo (1981: 186) has defined audit quality as "*the market assessed joint probability that a given auditor will both discover and report a breach in the client's accounting system.*" The wide acceptance of DeAngelo's definition stems from its inclusion of the auditor's competence (discover), independence and objectivity (report), and financial statement users' perceptions of audit quality (market assessed).

Given that audit quality is a multi-dimensional topic that cannot be directly observed, academic scholars and practitioners instead used proxies to measure audit quality (Sutton, 1993; Wooten, 2003; Sulaiman et al., 2018). For instance, they used audit-

sampling strategies (Stuart et al., 2013), auditor independence (Austin & Herath, 2014), audit fees (Hay, 2015), key audit matters and audit report (Zureigat, 2010; Velte & Issa, 2019), audit-partner characteristics (Degan et al., 2021), office-level attributes (Krishnan, 2005), audit-team attributes (Al-Nawaiseh, 2010), oversight on auditing profession (Elshandidy et al., 2021), auditor competence (Ismail et al., 2019), auditor professional skepticism (Wedemeyer, 2010), audit tenure (Samosir, 2019), auditor industry-specific and client-specific expertise (Gal-Or & Gal-Or, 2021), in addition to the use of audit technologies (Tarek et al., 2017; Lowe et al., 2018).

Several studies have followed the traditional methods to review prior literature related to audit quality and its driving factors (Francis, 2004, 2011; Knechel et al., 2013; DeFond & Zhang, 2014; Montenegro & Brás, 2018; Detzen & Gold, 2021; El Badlaoui et al., 2021). The traditional way of reviewing the literature led to examining a limited number of prior studies. The findings of these review studies indicated that neither a universal consolidated framework was reached, nor did the stakeholders unify their perceptions of audit quality. Additionally, these studies have a consensus regarding the difficulty of defining, measuring, and determining the main factors affecting audit quality. It is worth noting that two review studies have used the bibliometric analysis to collect and analyze audit-quality prior literature (Ciger, 2020; Taqi et al., 2021). They paid considerable attention to the performance-analysis types of bibliometrics (most productive authors, cited documents, productive countries, productive universities, productive journals, among others) with no attention given to mapping analysis.

Montenegro and Brás (2018), Ciger (2020), and Taqi et al. (2021) argued that audit quality is still a researchable topic that is expected to increase annually. However, to the best of the authors' knowledge, no prior study has employed such techniques to investigate the evolutionary stages of the audit-quality research discipline. Furthermore, none of these studies mapped the development that occurred in the cognitive structure of audit-quality research between 1982 and 2021. Given the expectations of potential increase in audit-quality research publications in addition to lack of studies examining evolutionary stages and knowledge structure of the audit-quality research discipline, our study aims to fill this research gap using keyword-frequency and co-word analyses.

2.2. *Bibliometrics & Keyword Analysis*

The bibliometric-analysis approach can be viewed as a quantitative tool for analyzing published contributions and bibliographic units (Lamboglia et al., 2020). Bibliometric analysis provides researchers with a tool for collecting, evaluating, summarizing, and monitoring published articles in any research area (Ciger, 2020; Lamboglia et al., 2020). Cobo et al. (2011:146) defined bibliometrics as "a set of methods used to study or measure texts and information, especially in big datasets." The bibliometric approach enhances the quality of the literature review by adding two new functions: performance analysis and science mapping. According to Lamboglia et al. (2020), performance analysis focuses on the performance and activities of scientific actors (researchers, affiliations, countries, and journals), whereas science mapping focuses on revealing the knowledge structure of a given research field. This study focuses on science mapping to provide a detailed picture of the current knowledge structure of topics under research.

Science mapping depends mainly on keywords attached to publications. Keywords in publications are the terms or phrases depicting the topics and concepts discussed in these documents. Keyword analysis is a widely used classic bibliometric technique that illustrates a given research discipline's core topics and ideas (Cheng et al., 2020). According to Lu et al. (2021), the keyword-analysis technique depends on the keywords selected by the authors of the articles to express topics that are most relevant to the research.

The objective of keyword analysis is twofold (Choi et al., 2011). The first objective is to map the intellectual structure of a given research field, thus helping scholars understand the field's knowledge structure. The second objective is to identify emerging topics in this field. Keyword analysis can take several forms (Choi et al., 2011). One form is keyword-frequency analysis, the count of the appearance of keywords, which reveals the most researched areas in any discipline (Cobo et al., 2011).

Keyword-frequency analysis is extensively used to indicate a topic's significance, where high-frequency keywords are considered hot topics (Lu et al., 2021). Trevisani and Tuzzi (2018) indicated that the increasing frequency of a particular keyword over time mirrors the historical evolution of the corresponding notion. However, Wang and Chai (2018) argued that traditional keyword-frequency analysis offers partial insights into any research discipline. The majority of researchers disregard the significance of any given collection of keywords in reflecting the developmental state of a particular research discipline. As per Kuhn's (1962) widely acknowledged paradigm of scientific revolution, the science development goes through three stages: ''prescience'', ''normal science'', and ''crisis''. Therefore, Wang and Chai (2018) introduced a modified form of keyword-frequency analysis (K-indicator) to assess the developmental stage of any research field by focusing on the count of keywords (KC; number of unique keywords) and the frequency of keywords (KF; total occurrence of all keywords). This study adopts this technique of keyword frequency analysis to present the evolutionary stages through which the audit-quality research discipline has gone.

Another form of keyword analysis is the co-word analysis. Co-word analysis is a content-analysis technique that can map connections between items in textual data (Cobo et al., 2011). This technique depends on the co-occurrence of keywords, examines relationships among words located in the title, abstract, and keyword sections in documents, and describes the keyword centrality (Lu et al.,

2021). This indicates the cognitive structure of a given research discipline (the main concepts, problems, and ideas treated by the research field) (Hu & Zhang, 2015). The researchers used co-word analysis to map the literature based on the associations among various keywords. Two main assumptions should be made when conducting keyword analysis (Lamboglia et al., 2020; Uyar et al., 2020; Wang & Chai, 2018). First, the authors of the publications chose keywords that precisely depicted the content of those publications. Second, each publication in the dataset contained keywords. The authors adopted keyword frequency and co-word analyses to analyze and map the conceptual structure of the audit-quality research field.

3. Methodology

Bibliometric analysis provides researchers with a tool for collecting, evaluating, summarizing, and monitoring published articles in any research area (Ciger, 2020; Lamboglia et al., 2020). Bibliometrics offers performance analysis and science mapping (Cobo et al., 2011). Since prior studies focused on performance analysis (e.g. Ciger, 2020; Taqi et al., 2021), this study focuses on science mapping to provide a detailed picture of the current knowledge structure of audit quality and related factors.

3.1. Data Collection

In reviewing the literature, the selection process is crucial to ensure the validity and consistency of the subject to be analyzed (Pizzi et al., 2021), as shown in Table 1. Therefore, we agreed to use the Scopus database to search and collect our dataset, because it includes a wide range of peer-reviewed journals, offers extensive publications of high impact, and is reliable among business scholars (Cobo et al., 2011; Ciger, 2020; Lamboglia et al., 2020; Taqi et al., 2021; Pizzi et al., 2021). One of the authors used several different search queries to conduct a comprehensive search on

the Scopus database. After multiple searches, all authors agreed upon using the final search query of (TITLE-ABS-KEY ("audit* quality" OR "audit* effectiveness" OR "audit* efficiency" OR "financial statement audit* quality")) to collect as many articles as possible related to the audit-quality research discipline.

The authors selected only peer-reviewed articles (journal articles and review papers) to increase the reliability of the analysis following the recommendations of Atayah &

Alshater (2021). Table 1 shows the sequence of the selection process and the criteria used to include or exclude the articles during the search process. Following the recommendations of Uyar et al. (2020) and Wang and Chai (2018), the authors removed publications with no associated keywords to ensure the appropriateness of keyword analysis, as it is assumed that each article had its own keywords.

Table 1
Steps followed to reach final dataset

Description	Exclusion criteria	Remaining records
TITLE-ABS-KEY ("audit* quality" OR "audit* effectiveness" OR "audit* efficiency" OR "financial statement audit* quality")		2,924
Access	All types were included, whether open access or others.	2,924
Years	Including years from 1981 to 31 December 2021.	2,924
Subject area	Only (Business, Management and Accounting, Economics, Econometrics and Finance, Social Sciences, and Decision Sciences) were kept, and other subject fields were excluded.	2,442
Document type	Only articles and reviews were kept, and other types were excluded.	2,257
Publication stage	Both final documents and articles in the press were kept.	2,257
Source type	All sources were excluded except journals.	2,243
Language	All languages were excluded except English.	2,194
Total remaining publications before manual filtration		**2,194**
Manual filtration	Removing articles without keywords (280 articles excluded).	1,914
	Removing any article not related to external audit quality (83 articles excluded).	1,831
Total relevant publications		**1,831**

3.2. Data Processing and Analysis

Two authors manually screened each article's title, abstract, and keywords to exclude all irrelevant documents, resulting in a final dataset of 1,831 publications with 4,180 keywords that occurred 9,915 times. To ensure the validity and objectivity of our methodology, the other two authors reviewed the output, following the recommendations of Tranfield et al. (2003). Then, we excluded publications not directly related to external-audit quality (covering topics,

such as food safety auditing, internal audit quality, tax audit effectiveness, healthcare audit, internal corporate governance mechanisms, Shariah compliance, Shariah corporate governance, internal Shariah audit, and audit of environmental issues, such as emissions and pollution).

Then, we cleaned and standardized the keywords included in the dataset. keywords related to the same topic or having the same meaning were subrogated

with a unique keyword. Table 2 shows some examples of keywords that were reviewed and replaced with a revised unique keyword. We executed this step on the original data file to ensure the removal of duplicate keywords and unification of different keywords with the same meaning; i.e., to maintain the integrity of the analysis. Two authors conducted the standardization process, and the remaining two authors reviewed the results, with a discussion held with any divergence to reach an agreement among authors, as recommended by Lamboglia et al. (2020). The manual unifying of the keywords resulted in a final dataset of 2,980 keywords that occurred 8,920 times. The authors employed VosViewer[1] to conduct keyword and co-word analyses.

Table 2
Some examples of revised keywords

Original keywords	Revised keyword	Original keywords	Revised keyword
Auditor independence	Auditor independence	Skepticism	Professional skepticism
Independence		Scepticism	
Auditor's independence		Audit skepticism	
Independence in appearance		Auditor's skepticism	
Independence in fact		Going concern opinion	Going concern opinion
Competence	Auditor competence	Going-concern opinion	
Competency		Going concern reporting	
Auditor's competence		Going-concern audit report	
Non-audit services	Non-audit services	Going concern audit opinion	
Non-audit services		Sarbanes-Oxley Act	Sarbanes-Oxley Act
Non-audit services		SOX Act	
Financial restatements	Financial restatements	Sarbanes Oxley act	
Restatements		Audit report	Audit report
Financial statement restatements		Audit reports	
Accounting restatements		Audit reporting	
Auditor industry specialization	Auditor industry specialization	Auditor reporting	
Auditor specialization		Auditor report	
Auditor's industry specialization		Auditor reports	
Specialization		Auditor's report	
Ethics	Professional audit ethics	Internal controls	Internal controls
Auditing ethics		Internal control	
Auditor ethics		Internal control systems	

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[1] VOSviewer is a software that is used to conduct bibliometric analysis and construct visualization networks. These networks are constructed to show relationships among different actors, such as journals, researchers, or individual publications. Networks are constructed based on citation, bibliographic coupling, co-word, co-citation, or co-authorship relations.

Original keywords	Revised keyword	Original keywords	Revised keyword
Professional ethics		Proactive internal control system	
Board of directors characteristics	Board characteristics	Internal control quality	
Board of directors' characteristics		Internal control over financial reporting	
Board features		Internal control framework	
Board characteristics		Auditor change	Auditor change
Board attributes		Auditor changes	
Time budget pressure	Time budget pressure	Auditor judgment	Auditor judgment
Audit time budgets		Auditor judgments	
Time budgets		External auditor judgment	
Audit time budget pressure		Professional judgment	
Time budget constraint		Skeptical judgment	
Modified audit opinion	Modified audit opinion	Corporate governance	Corporate governance
Modified audit opinions		External corporate governance	
Modified opinion		Corporate governance attributes	
Information technology	Information technology	Code of corporate governance	
Information technology (IT)		Corporate governance practices	
Auditor technology adoption		Corporate governance regulation	
Technology		Good corporate governance	
Technology adoption		Governance	
Analytical procedures	Analytical procedures	Governance mechanisms	
Analytical procedure		Internal corporate governance	
Substantiate Analytical procedures		Corporate governance application	
Preliminary Analytical procedures		Corporate governance mechanisms	
Joint audit	Joint audit	Audit litigation	Audit litigation
Joint auditor		Auditor litigation	
Joint auditing		Litigation	

4. Results

The final dataset comprises 1,831 articles published between 1981 and 2021 in 314 journals. The number of journals indicates the spread of the audit-quality topic over many sources, reflecting the divergence and complexity of this research topic. Figure (1) shows the

upward curve of the audit quality literature during the past 40 years. The annual growth rate of this field is 9.96%, reflecting the attention paid to audit quality and the expected great attention in the future. The different events during the past 20 years justify the attention directed toward this topic.

2021 had the highest production (297 articles). Auditing: *The Journal of Practice and Theory* is the most productive journal with 177 documents, and Gul, F. A. is the most active author with 20 articles.

Figure (1)
Number of annual publications

4.1. Describing Scientific Development of Audit-quality Discipline

Wang and Chai (2018) introduced an indicator (K) that depends on the keyword count (KC) and keyword frequency (KF) to measure the evolutionary development of a given discipline. KC refers to the number of unique keywords, whereas KF refers to the total occurrences of all keywords. This analysis is based on the underlying assumption that each unique keyword refers to a unique concept. During the evolutionary cycle of any given research discipline, the number of publications would constantly increase, resulting in an increase in KF. However, the change in KC could be inequivalent to that of KF because of the preferential selection of keywords. As the research discipline evolves, certain keywords would have been gradually preferred and become more common among researchers. Therefore, Wang and Chai (2018) considered that the preferential selection of certain keywords reflects the gradual agreement among researchers and the developmental stage of that discipline. Containing totally unique keywords in publications of a

given discipline reflects the emergence stage, while sharing identical keywords by most publications reflects the maturity stage of that discipline.

Wang and Chai (2018) argued that the variation in KC relative to KF reflects the development of any discipline. However, KC and KF should be divided by the number of publications (A) in that discipline to normalize them and provide KFA and KCA. Thus, the K-indicator can be calculated as the ratio of KCA to KFA.

$$K \quad = \quad \frac{KC}{KF} \quad = \quad \frac{KC\,/\,A}{KF\,/\,A} \quad = \quad \frac{KCA}{KFA}$$

The K-indicator ranges between 1 and 0 to reflect the developmental stages of a given research field (as shown in Figure (2)), where 1 indicates that publications contain different keywords and 0 indicates that many publications contain similar keywords. The K-indicator is based on the popular scientific revolution introduced by Kuhn in 1962. According to Kuhn (1962), cited by Wang and Chai

(2018), the development of any given science goes through three phases: "prescience," "normal science," and "crisis." Because the "normal science" stage takes a much longer time range, Wang and Chai (2018) separated it into three sub-stages: "pre-normal science," "normal science," and "post-normal science" stages, resulting in a split of the development stages into four main intervals, as shown in Figure (2). When the K-value is between 1 and 0.75, the research discipline under study is in the "pre-revolution or revolution" stage, while it is in the "forming or pre-normal" stage when the K-value is between 0.75 and 0.5, in the "pre-normal or normal" stage when the K-value is between 0.5 and 0.25, and in the "post-normal or next pre-revolution" stage when the K-value is between 0.25 and 0.
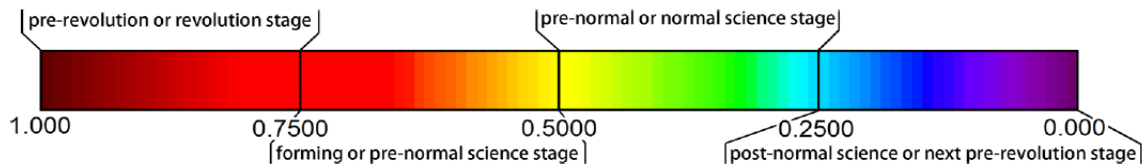

Figure (2)
The development phases represented by indicator K (Wang & Chai, 2018)

According to Wang and Chai (2018), a new research field (stemming from a previously affiliated one) mostly emerges from a "pre-revolution or revolution" phase, where the K-value might lie in the range of 0.25–0. With its growth, the field will enter the "forming or pre-normal science" phase (0.75–0.5). The research field reaches the "pre-normal or normal science" phase (0.5–0.25) by stabilizing KFA and KCA. With the stabilization of mature concepts, the research field will finally enter the "post-normal" phase and reproduce the next "pre-revolution" period (0.25–0), preparing to step into the next developmental phase, which may come with the appearance of new keywords (1–0.75).

Cobo et al. (2011) argued that the dataset should be split into various intervals to precisely analyze the evolution of a given research discipline over the years. Each interval included a group of consecutive years. In this study, we separated the literature timeline into five periods (1982-2001; 2002-2006; 2007-2011; 2012-2016; and 2017-2021). Unlike the other intervals, the first period (1981-2001) includes 20 years, because few studies were published during this period; publications of this period rarely provided keywords for their contents and witnessed no significant events. The audit-quality field has exponentially evolved from its forming stage (1982-2001 with 44 articles) to its boomingly developed stage (2017-2021 with 1,043 articles), with the keyword-frequency (KF) value increasing from 161 to 5,169 and the keyword count (KC) value jumping from 111 to 2066, as shown in Table 3.

Table 3
K-values and publication numbers between 1982 and 2021

Period	Before 2002	2002 - 2006	2007 - 2011	2012 - 2016	2017 - 2021
No. of Publications	44	78	219	468	1043
K	0.69	0.59	0.52	0.43	0.40

During the first period, the K-value (0.69) reflects that audit quality was in the "forming or pre-normal

science" phase. The K-value exhibited a declining curve in subsequent periods, as shown in Figure (3), reflecting the greater stability and maturity in this research field over time. In the second period, the K-value decreased rapidly by 0.10, indicating that the core concepts of the audit-quality discipline are being built up and enhanced, thus rapidly driving the audit quality-field to the "pre-normal or normal science" phase. However, the third interval witnessed a lower K-value by (0.07), reflecting the introduction of new concepts and ideas into the audit-quality research field, which makes the audit-quality field wider and more ramified. Thus, the first three periods show that the audit-quality field is in the "forming or pre-normal science" phase. In the final two periods, the K-values indicate that audit quality has already reached the "pre-normal or normal science" phase (0.5-0.25). Hence, we conclude that audit quality is an established and mature research field.

An association exists between changes in K-values and events that affect auditing and audit quality to a large extent. The beginning of the 2000s witnessed the Enron case and the consequent disappearance of Arthur Anderson, one of the Big-5 audit firms at that time. Regulatory authorities announced reforms, like the legislation of the Sarbanes-Oxley Act and the establishment of the PCAOB in 2002. In addition, other accounting and auditing scandals occurred

between 2002 and 2006 (for instance, Adelphia Communications, Worldcom, Xerox, Global Crossing, Tyco, among others). These events led to approximately double the number of articles in just five years compared to the previous period (20 years). The third period (2007–2011) witnessed the 2008 global financial crisis. Such a shock forces audit regulators to focus on the driving forces of audit quality (Ciger, 2020). For instance, the "Advisory Committee on the Auditing Profession" was established in the USA in 2008, and the "Green Book Audit Policy: Lessons Learned from Crises" was released in Europe in 2010. During the fourth period (2012–2016), several auditing-governing bodies started to issue audit-quality frameworks, such as the IAASB in 2014 and the PCAOB in 2015. The final period (2017–2021) witnessed the emergence and extensive use of new audit technologies (e.g. CAATs, big data analytics, machine learning, artificial intelligence, robotic process automation, and blockchain). In addition, the 2019 COVID-19 outbreak had disruptive effects on the auditing profession. Such events have contributed to an exponential increase in audit-quality research.
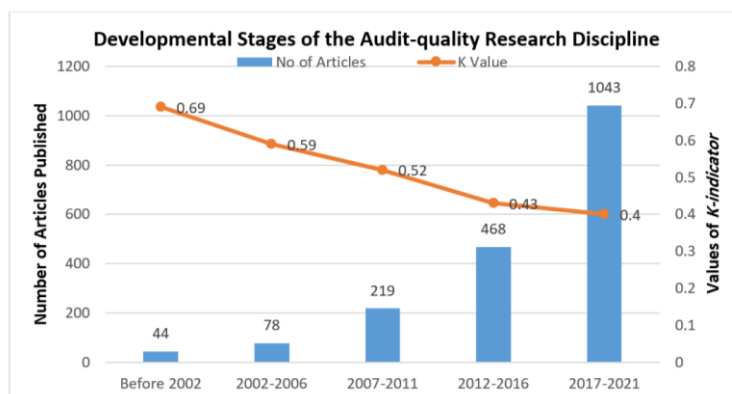

Figure (3)
Developmental stages of the audit-quality research discipline

Such results are consistent with the argument of ACCA (2011), IAASB (2011), and Teck-Heang & Ali (2008) that "auditing is evolving at all times." Our study shows that the audit-quality research field has gone through the "forming," "pre-normal," and "normal science" stages (1982–2021) without any reference to the "pre-revolution." We attribute this to the unavailability of data on the research conducted before 1981. Some events affected the audit profession and its quality prior to the 1980s. For instance, after the 1929 financial crisis, the 1930s witnessed the enactment of the 1933 and 1934 Securities Acts, and the establishment of the SEC (Detzen & Gold, 2021). If data about earlier periods was available, the K-value might have started from a higher ratio (i.e., the pre-revolution stage). Furthermore, with a decreasing K-value, we expect that audit quality will continue in the "normal science" stage for at least the next 15 years. It might then become saturated and step down to the crisis (post-normal or next pre-revolution) stage, where it might be split into several new sub-fields.

4.2. Visualization Maps of the Audit-quality Discipline

Keywords co-occur when two keywords (nodes) exist in the same article, reflecting the interrelatedness of the topics represented by these keywords (Xin & Cao, 2016). Visualizing the co-word network/map of any research field facilitates the presentation of knowledge communication and the cognitive structure of the field (Uyar et al., 2020; Wang & Chai, 2018). Researchers should focus on two aspects when analyzing visualizations: lines connecting nodes (edges), and the size of each node. Nodes represent keywords, and edges represent links among these keywords; the closer the nodes are to each other, the stronger their relatedness and co-occurrence (Cobo et al., 2011; van Eck & Waltman, 2018). The node size reflects its weight (importance); the larger the label and node size, the more connections it has with other nodes around it (Uyar et al., 2020; van Eck & Waltman, 2018).

In the first period (before 2002), as shown in Figure (4), the items in the network were dispersed and were not close to each other, reflecting the unrelatedness between audit quality and other keywords. The audit-quality node is not at the center of the map. In addition, the audit-quality node is not very large. These indicators mean that researchers did not consider audit quality a significant standalone research field, but a secondary topic in the auditing domain. Researchers have focused on auditor liability, litigation risk, auditing standards, auditor independence, and reduced audit-quality practices when investigating audit quality. Such relationships show the scattered nature of audit-quality research at that time. The network is consistent with the K-indicator value (0.69), which shows that audit quality was in the "forming or pre-normal science" phase before 2002 and was an immature research field. Moreover, we observe small-sized nodes that lie in the corners and are linked to the audit-quality node. These nodes represent emerging topics in the early stages of investigation in the audit-quality research field. Researchers infrequently use these keywords (nodes) at that time. For instance, they used auditor education, audit process-related keywords (analytical procedures, planned substantive tests, auditor judgment, partner preferences, client risk), time budget pressure, audit fee pressure, dysfunctional audit behavior, big-6 audit-firms, audit market concentration, and audit-firm industry specialization.

In the second period (2002-2006), the audit-quality node moved towards the centre of the network and became closer to other nodes, reflecting the greater attention given to it by the scholar community. We attribute this attention to consecutive accounting scandals and subsequent regulatory changes enacted. Researchers have examined the associations between audit quality and audit tenure/rotation, financial reporting quality, auditor independence, corporate governance, non-audit services, the big-6 audit firms, auditor-firm industry specialization, earnings management, discretionary accruals, and auditing

standards. Such relations reflect the tendency of academic scholars to analyze "what went wrong?" (Humphrey, 2008). Figure (5) shows a more organized and less scattered co-word network than in Figure (4), reflecting the direction taken by audit quality as a valuable research field that needs more focus. The magnitude of the audit-quality node indicates the importance of the audit quality in the network. These results are consistent with the K-value (0.59), indicating the consistent tendency of this nascent research field toward acquiring more stability and maturity. Audit quality was the most dominant keyword, followed by audit fees, corporate governance, and auditor independence. In addition, some potential emerging topics were infrequently studied with audit quality, such as board characteristics

(reflected in the following keywords: board expertise, board independence, managerial ownership, agency costs), audit process (audit procedures, audit hours, analytical procedures, evidence quality, evidence evaluation, auditor judgment, audit production, audit effort), audit market (audit fees competition, audit market regulation), risk management (client acceptance, client continuance, business risk), auditor legal responsibility (audit failure, Sarbanes-Oxley Act, auditor responsibility, auditor sanctions). Such emerging topics emphasize the academic community's tendency to understand audit quality from different dimensions.
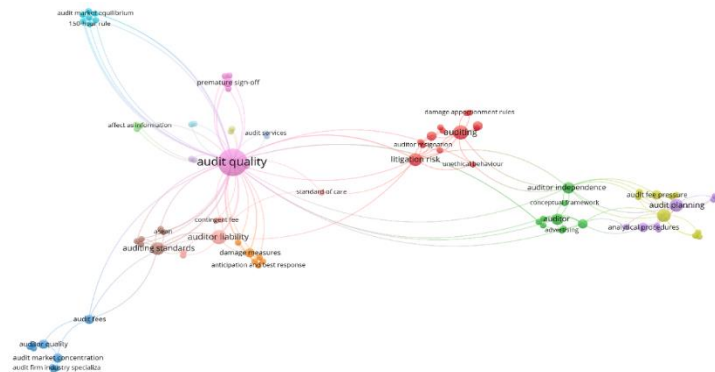

Figure (4)
Co-occurrence network 1982-2001 (before 2002)
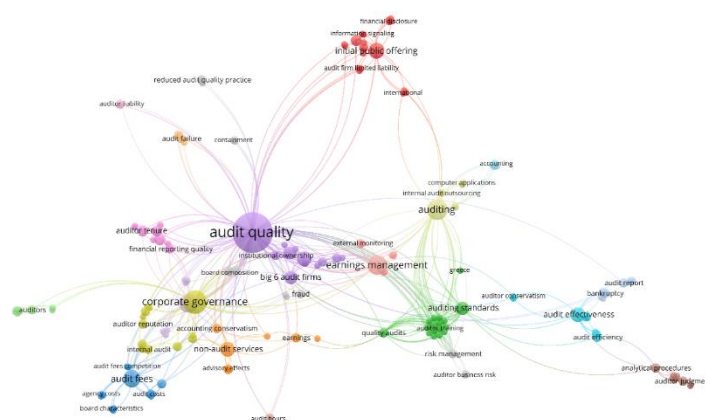

Figure (5)
Co-occurrence network 2002-2006

The network for the third period (2007-2011) indicates that the audit-quality field has become more compact and coherent. The audit-quality node tended to be at the center of the network and became closer and more connected to many other nodes. Since then, audit quality has been viewed as a large standalone research field that has been extensively studied across different dimensions. The network shows close relationships between audit quality and earnings management, the Sarbanes-Oxley Act, audit committees, auditor independence, corporate governance, going-concern opinions, auditor tenure, auditor-firm industry specialization, audit fees, financial reporting, audit efficiency, audit effectiveness, litigation risk, internal controls, and auditor quality. Figure (6) shows the size of audit quality as the largest node in the network, reflecting the significance of the audit-quality research area. The K-indicator of this period (0.52) indicates that the audit quality discipline is at the gates of the "pre-normal or normal science" stage; that is, the audit-quality research discipline is on its way to becoming a more stabilized and mature research field. The network shows potential research topics that researchers can investigate further in future studies to make audit quality more understandable to various stakeholders. These topics include client-related factors (client satisfaction, internal-audit function, internal-audit quality), auditor-related factors (auditor market share, auditor switching, auditor type, auditor reputation, auditor rotation), audit process-related factors (audit-review process, audit documentation, risk assessment, audit-team judgment, auditor conservatism, auditor judgment, professional skepticism), and market-related factors (market reactions, perceived audit quality, financial crisis, market valuation, and loan-loss provisions). These topics indicate that the audit-quality notion has broadened and is perceived differently by various stakeholders.
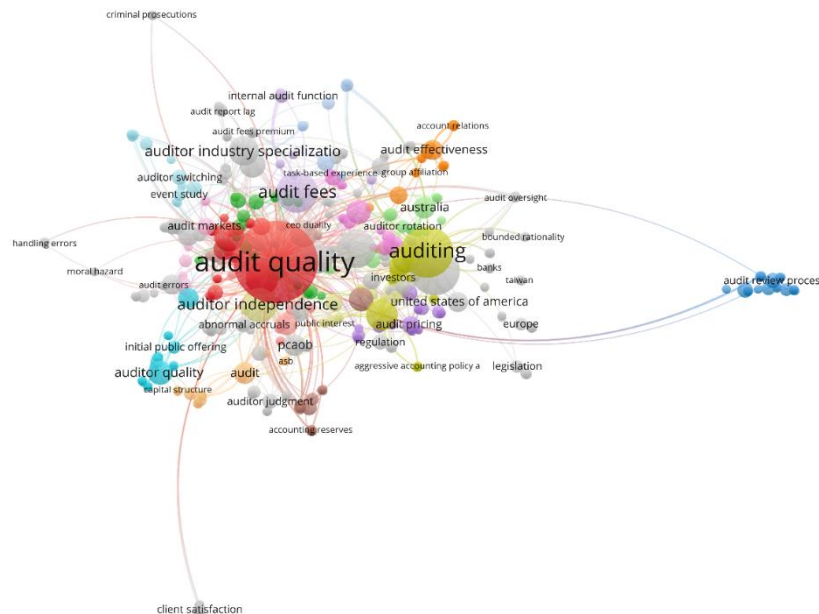

Figure (6)
Co-occurrence network 2007-2011

Audit-quality research received considerable attention during the fourth period (2012-2016) relative to previous periods. The network of the fourth period shows the compactness and maturity of audit-quality research.

Figure (7) shows the centrality of the audit-quality concept and its closeness to other nodes in the network. Sizable node and centrality reflect the significance of audit quality as a standalone research field connected to many other topics. Audit-quality research was fragmented during the previous two periods. This is evident from the lack of several large nodes that are close to and connected to audit quality. However, during this period, we observe numerous big nodes close to and connected to the audit-quality node, such as audit fees, earnings management, corporate governance, auditor independence, the Sarbanes-Oxley Act, and regulations. This reflects the tendency of academic scholars to focus on identifying the most significant factors that affect audit quality. The K-indicator for that period (0.43) shows that the audit-quality field has already entered a new stage: the "pre-normal or normal science" stage. Audit quality is closely related to and heavily studied with audit regulations (this is evident through the connection with the following keywords: auditing standards, audit regulations, Sarbanes-Oxley Act, and PCAOB inspections), audit output (going-

concern opinion, audit-report lag, audit report, financial restatements), auditor-related characteristics (auditor tenure, auditor judgment, auditor reputation, auditor independence, auditor-firm industry specialization, auditor experience, auditor quality), audit-firm characteristics (audit fees, audit-quality control, audit-firm size, small audit firms, big-4 audit firms, non-audit services, audit failure), and client-related factors (earnings quality, corporate governance, earnings management, discretionary accruals, internal controls, auditor-client relationships, audit committee). Furthermore, several topics were considered potential emerging research topics in the audit-quality research field, such as characteristics of the audit office, characteristics of the board (board independence, board ownership, foreign directors, multiple directorships, financial literacy of board members), audit-firm legal form (organizational form of audit firms, audit-firm limited liability), audit-quality proxies, and information technology.
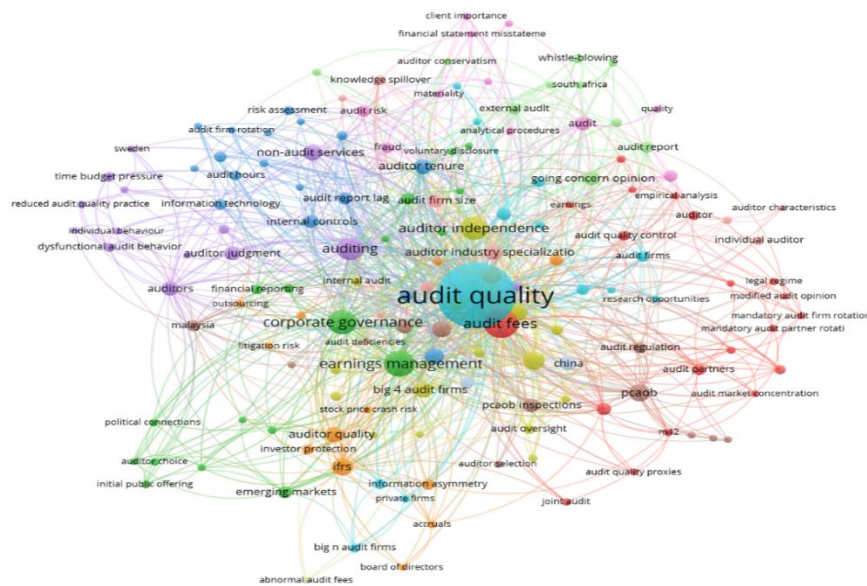

Figure (7)
Co-occurrence network 2012-2016

The network for the fifth period (2017–2021) shows the

ramification and broadness of audit quality, reflecting

the maturity and stability of this field. The network, as shown in Figure (8), shows the cohesiveness of this research discipline, as the audit-quality node has a central position close to all other nodes, reflecting the pivotal role that audit quality plays in the auditing domain. Additionally, a sizable node for audit quality indicates its significance. These results are consistent with the value of the K-indicator for that period (0.40), as the audit-quality research discipline is taking its way to become more stable and mature. Audit quality has been frequently studied with topics, such as audit fees, corporate governance, earnings management, auditor independence, big-4 audit firms, audit committees, PCAOB inspections, going-concern opinion, and auditor partner characteristics (audit partner experience, industry

specialization, rotation, workload). Additionally, some under-examined items appear as emerging topics, such as auditor-related factors (auditor education, training, competence, behavior, industry-specific experience, workload compression, gender diversity, and judgment), audit-related information technology (audit innovations, machine learning, artificial intelligence, big data, blockchain, audit data analytics, and continuous auditing), audit process-related factors (audit planning, risk assessment, audit evidence, audit process, audit sampling, and audit hours), audit output (key audit matters and critical audit matters), and other macro-level issues (audit market structure, audit market competition, and professionalism).
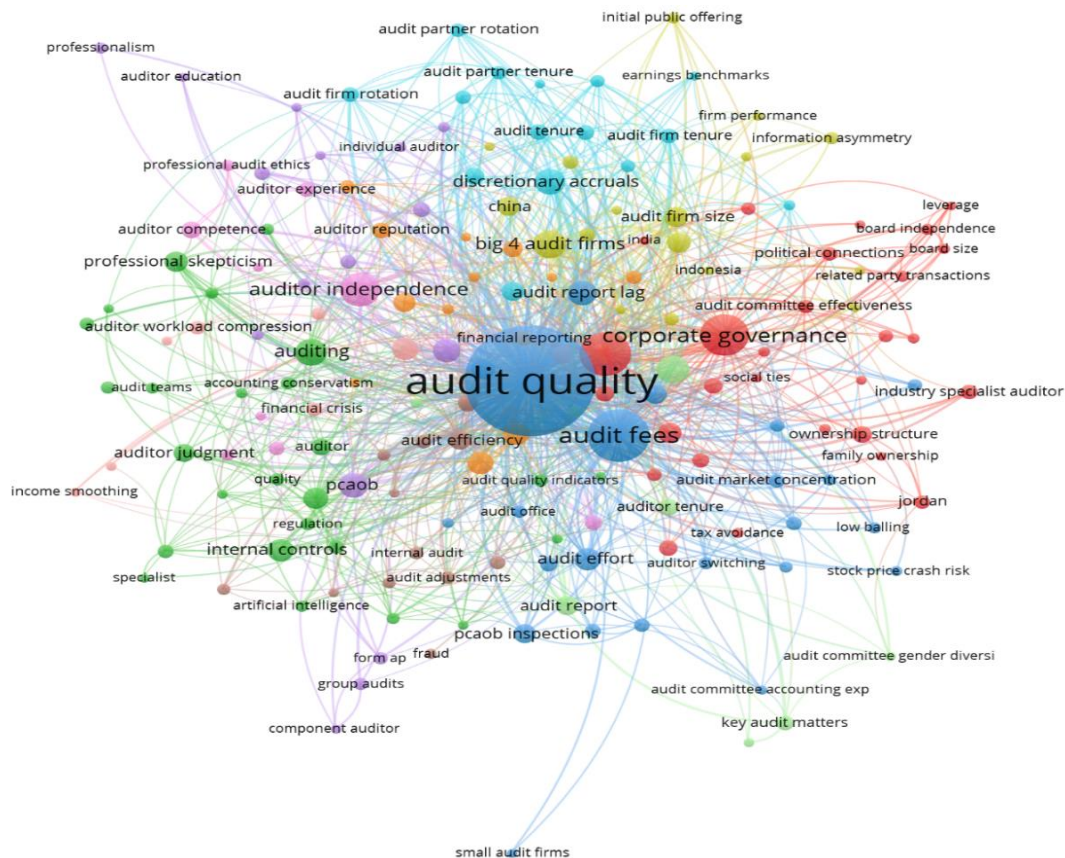

Figure (8)
Co-occurrence network 2017-2021

The network for the entire period (1982–2021) shows that audit quality is a tight and coherent research topic. We can observe how the audit-quality field evolved from being a subsidiary topic in the audit domain (before 2002) through the stability interval (2002-2011) to becoming a mature and coherent research field (2012–2021). Figure (9) shows the centrality and size of the audit-quality node in the network, reflecting the broadness, complexity, and variety of topics that affect and are affected by audit quality. The audit-quality structure during the first two periods was approximately the same (forming phase), but different from those of the other three consecutive periods. The network shows the attention that academic scholars have paid to input factors, such as auditor independence, auditor-firm industry specialization, non-audit services, auditing standards,

auditor judgment, audit effort, auditor experience, auditor competence, and auditor rotation. In addition, considerable focus is directed toward contextual factors, such as corporate governance, audit committees, internal controls, internal audit functions, audit regulations (SOX and PCAOB), ownership structure, audit markets (competition, structure, and concentration), and financial crises. Additionally, considerable attention has been directed to output factors, such as financial restatements, going-concern opinions, audit reports, audit report lags, audit opinion, and disclosures. However, little attention has been paid to process-related audit-quality factors (audit planning, analytical procedures, time budget pressure, audit effort, and audit effectiveness).
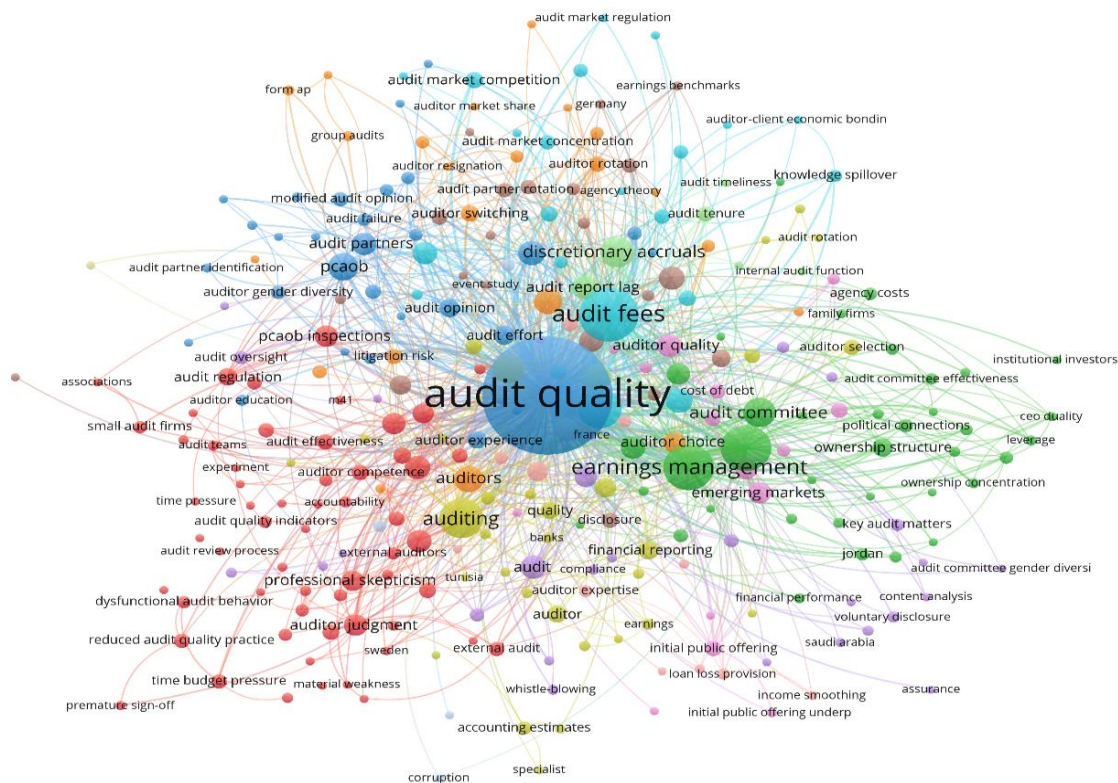

Figure (9)
Co-occurrence network of all periods 1982-2021

The audit-quality structure revolves around four main   themes. The first is auditor characteristics (auditor

independence, auditor quality, auditor firm industry specialization, and auditor tenure). The second is client-related factors (corporate governance, audit committees, earnings management, discretionary accruals, and auditor choice). The third is audit-firm characteristics (audit fees, non-audit services, big-6 audit firms, big-4 audit firms). The final theme is the audit regulations (auditing standards, Sarbanes-Oxley Act, IFRS, PCAOB, and PCAOB inspections). The imbalance in academic concentration on input (auditor characteristics and audit-firm characteristics) and contextual factors (client-related factors and audit regulations) might be attributed to an imbalance in the classical definitions of audit quality. DeFond and Zhang (2014), Montenegro and Brás (2018), Francis (2011), and Knechel et al. (2013) have extensively criticized the incompleteness and narrowness of prior definitions. DeAngelo (1981) and Carcello et al. (2002) emphasized the independence and objectivity of auditors, audit effort, auditor competence, and adherence to professional standards when defining audit quality, which are considered input factors. In addition, Palmrose (1988) and Casterella et al. (2009) focused on audit failures and litigations or claims against audit firms when defining audit quality, which represents contextual factors as part of the "litigation environment" factor of the IAASB audit-quality framework of 2014. The growing audit-quality research discipline reflects the response of that field to changes in the business environment, accounting and auditing standards, and financial regulation (IAASB, 2011). This is evident in examining the impact of issues, such as accounting scandals during the 2000s, the 2008 financial crisis, continuous technological developments, and the COVID-19 pandemic of 2019, on audit quality.

5. Future Research Opportunities

The audit-quality research discipline is currently in the "normal science" stage with a K-value of 0.40; thus, this research discipline is not yet saturated, and there is still some space for future research. The audit-quality research discipline has matured with stabilized concepts and is steadily taking steps towards the next developmental "post-normal phase", where it might be split into several new sub-disciplines with new keywords. Although the audit-quality literature is voluminous, keyword analysis pinpoints gaps that require further attention from academic scholars. We determined under-researched themes based on suggestions from visualization maps and keyword-frequency analysis. These infrequent keywords indicate less studied research themes that represent future research opportunities. Studying such factors would add value to the audit-quality literature.

5.1. Individual Auditors' Characteristics

Although the literature has paid too much attention to the attributes of individual auditors, there is still room for research to analyze the impact of newly proposed attributes on auditor performance and audit quality. The following topics have been infrequently studied in the literature: auditor narcissism, auditor personality, auditor negligence, cognitive processing, psychological characteristics, religiosity, auditor-degree specialization, critical thinking, higher academic qualifications, individual differences, self-esteem, and task-specific expertise. Additionally, providing a work environment full of stress, distraction, inequality, financial instability, and work overemphasis at the expense of personal life negatively affects the psychological side of the auditor. However, prior literature paid minimal attention to such issues by using the following keywords infrequently (burnout, audit-firm climate, geographically distributed work, quality of life, auditor work-life balance, deadline pressure, loyalty, stress, team stress, and work-life conflict).

5.2. Office-level Attributes

The prior literature paid minimal attention to the

effects of office-level attributes on audit quality. This shortage is apparent in the infrequent use of the following keywords: audit-office industry specialization, audit-office efficiency, audit-office reputation, audit-office tenure, audit-office size, and office-level characteristics. Krishnan (2005) showed that the Houston Office was an exception to Arthur Anderson's offices. An audit failure committed by a single office led to the collapse of one of the Big-5 audit firms worldwide, indicating the importance and impact of office-level attributes on the overall audit quality. Thus, more research on office-level attributes is needed to examine their impact on audit quality (Beck et al., 2019; Cameran et al., 2020).

5.3. Audit Team Characteristics

Audit-team attributes have received little scholarly attention due to the infrequent use of the following keywords (audit-team disruptions, judgments, knowledge transfer, brainstorming, and inter-team stress). We believe that relationships among audit team members can significantly affect audit quality. An effective and efficient audit process is a by-product of an audit team, the members of which have sufficient competencies, experience, and integrated skills (Moroney et al., 2019). Audit firms must take advantage of individual auditors' strengths and skills when allocating teams. Communication among team members is vital during different phases of the audit process to benefit from two-way discussions regarding the complex issues that arise during audit working. Thus, relationships among audit-team members could positively affect audit quality by facilitating the transfer of knowledge among audit-team members, providing on-the-job training from more experienced staff to novice staff, as well as better planning and execution of audit procedures (Kung et al., 2021).

5.4. Commercialization vs. Professionalism

The debatable impact of NAS on audit quality has received considerable attention from academic scholars without a conclusive result. Detzen and Gold (2021) argued that the audit profession started in the 1970s to emphasize commercial value in audits at the expense of professional value. Since then, audit firms have sought to maximize their revenue from audit and non-audit services. Further research is needed to thoroughly examine how audit firms can achieve a trade-off between commercialization and professionalism. This issue will be more debatable in the coming period because of the recent news that EY Global is considering dividing its business into two professional firms: one for audit and another for consulting services[2]. Such a split would improve independence of audit firms, thereby improving audit quality. However, this may negatively affect audit-firm returns. According to Monadnock Research, LLC, Big-4 auditors achieved a total global revenue of $168 billion last year, of which only $53 billion generated through audit services[3]. Thus, further research is needed to determine the potential consequences of such decisions on the global audit profession and audit quality.

5.5. Audit Innovations

The audit profession has adopted new disruptive audit technologies (big-data analytics, blockchain, machine learning, robotic-process automation, and artificial intelligence) (Atayah & Alshater, 2021). Innovations have transformed routine manual auditing tasks into automatic tasks. However, little is known about the impact of these new technologies on auditor judgment, skepticism, cognitive processing, competency, education, and other attributes (Abdelwahed et al., 2023). In addition, little is known about the direct impact of using such new technologies

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[2] More details are available in the article published by the Accounting Today Journal. https://www.accountingtoday.com/news/ey-considers-splitting-off-audit-firm

[3] More details are available in the article of Wall Street Journal. https://www.wsj.com/articles/accounting-firm-ey-considers-splitting-audit-and-advisory-businesses-11653592588

on the audit process and audit quality, especially with the unfavorable findings reported by Kend & Nguyen (2020) and Salijeni et al. (2019). They indicated that new disruptive technologies could erode audit quality, because of incompetent auditors and lack of guidelines. The prior literature has used the following keywords infrequently (big data, machine learning, robotic process automation, smart contracts, drones, data mining, data visualizations, and digital transformation). Thus, further research should examine how new audit innovations affect individual auditor attributes, audit processes, and audit quality.

5.6. Audit Training

Audit services depend on the auditors' technical knowledge and training. Westermann et al. (2015) indicated that most profession-related knowledge is acquired through on-the-job training, rather than through schools. In addition, Power (1991:340) stated that "learning accounting is similar to learning to ride a bike, that is not an intellectual process," reflecting that auditing is learned by doing. Such findings highlight the importance of the on-the-job training provided by experienced auditors to novice auditors; however, this theme has received no attention. Further research should consider this issue to determine how "learning by doing" is performed in the audit profession and whether it is effective. The 2014-IAASB framework stresses providing sufficient training to partners and staff on audit, accounting, and specialized industry issues. However, the keyword "auditor training" has only been investigated in a few studies. Thus, it is necessary to study the association between training-program characteristics [frequency, specialization (accounting, auditing, IT, other related issues), and types (on-the-job and off-the-job training)] and their impacts on audit quality.

5.7. Extended Audit Report

Prior literature has paid little attention to expanded audit reports, as the appearance of the following keywords is scarce: enhanced audit report, expanded audit report, KAMs,

and CAMs. Expanded/enhanced audit reporting provides different stakeholders with detailed information about the significant issues that auditors encounter during the audit and their solutions, the riskiest areas, significant estimates and judgments, restatements, and materiality assessments. Expanding audit reports with CAMs/KAMs is expected to increase the perceived and actual audit quality. However, recent studies provide conflicting results. Bédard et al. (2019) found no impact of expanded audit reports on French investors and auditors, whereas Li et al. (2019) reported an enhancement in perceived audit quality in New Zealand.

Moreover, financial-statement users benefit from non-financial information when making their decisions. However, few studies have investigated the association between non-financial data and audit quality. The literature infrequently uses the following keywords: integrated reporting, environmental auditing, social and governance disclosures, sustainability auditing, non-financial information, and non-financial reporting. This topic is hot without conclusive results, reflecting the need for future research.

5.8. Litigation Environment

Due to the mixed results regarding the impact of the litigation environment on audit quality, the question posed by Francis (2004) is still valid; "is legal risk necessary to achieve an optimal or even a satisfactory level of audit quality?". This question is logical, because some countries do not have a rigorous litigation environment, and their audit firms provide high-quality audits, whereas others with powerful litigation environments are full of audit failures, reflecting low-quality audits. However, Wooten (2003) and Francis (2004) argued that the infrequency or absence of audit failures does not mean that audit quality has been achieved. This point is critical to the

audit market, because some firms are international and offer services in many countries through their networks. Conducting a comparative study to compare the quality of audits offered by global audit firms in different countries could help us understand the impact of the litigation environment and audit regulations on audit quality.

5.9. COVID-19

Few studies investigated the impact of the COVID-19 pandemic on audit quality. The actual impact on the audit profession as a whole and on audit quality are still vague due to the recency of the COVID-19 topic and the few empirical studies conducted. For example, Albitar et al. (2021) conducted theoretical research to highlight the potential impact of the COVID-19 pandemic on audit quality. They indicated that the pandemic has negatively affected audit quality. The literature has introduced some rarely used keywords, reflecting the under-investigation of this topic (COVID-19 crisis, remote auditing, and social distancing). Additionally, there is a need for international evidence regarding the role of technology in mitigating the negative impacts of such a global crisis on audit quality.

6. Summary and Conclusions

This study was motivated by the claim of Simnett et al. (2016) that the objectives of audit research are to understand, assess, and promote audit quality. The main aim of this study was not to present and compare the results of the literature. The aims of this review are as follows: First, to illustrate the evolution of the audit-quality research discipline over the past forty years. Second, to determine whether the audit-quality research discipline is expandable and, if so, what potential future-research avenues need further examination. Third, to understand the current knowledge structure of the audit-quality research discipline. To achieve these objectives, we employed bibliometric techniques (keyword-frequency and co-word analyses) to review a dataset of 1,831 articles extracted from the Scopus database between 1981 and 2021. A newly introduced keyword-frequency tool

(K-indicator) was used to measure the evolutionary stages of audit-quality research discipline. We then employed co-word analysis visualizations to present the cognitive structure of the audit-quality field.

The results of this study contributed to the growing audit-quality literature. We investigated the evolutionary stages through which the audit-quality field has gone to determine whether it is still researchable. Using the K-indicator, keyword-frequency analysis revealed that audit quality has become a mature discipline with established concepts, keywords, and conclusions. Despite extensive audit-quality research, there is room for further research. This is consistent with Montenegro and Brás (2018), Ciger (2020), and Taqi et al. (2021), who argued that audit quality is still a researchable topic with an expected annual increase in the number of studies to be published on this research discipline. The audit-quality research discipline is expected to develop and become saturated within the coming 15 years, where it might be split into many new sub-fields with new keywords.

In addition, the co-word analysis showed that audit quality has reached a tight and coherent status from 1981 to the end of 2021. Co-word analysis mapped the knowledge and cognitive structure of the audit-quality field and enhanced our understanding of audit quality and its driving factors. The audit-quality structure revolved around four main themes: auditor characteristics, client-related factors, audit-firm characteristics, and audit regulations, with little attention paid to topics related to the audit process and output. Co-word visualizations indicated the concentration around some specific elements and ignorance of others. We attribute this overlook to the unavailability of internal data (from clients and audit firms).

Therefore, researchers need to concentrate on using auditors and other audit practitioners as units of analysis to obtain a more comprehensive picture of the

most relevant factors that impact audit quality. This finding is consistent with that reported by Knechel et al. (2013). Thus, audit firms and regulatory bodies should motivate audit firms to publish more details about the audit process (for instance, working papers and performance indicators). Owing to the difficulty of precisely measuring the audit-quality notion, we support Detzen and Gold's (2021) suggestion that the entire audit profession needs to be carefully investigated without specifically concentrating on audit quality, because audit quality is a by-product of a well-organized, formalized, and mature audit function.

Although this study makes numerous contributions to the literature, it also has several limitations. First, it assumes that researchers carefully selected keywords to represent the topics discussed. However, this assumption is sometimes invalid. Second, such a technique can offer a bird's eye view of a research discipline without examining the contents of the publications. Third, our dataset is constrained with the search query employed in this study; i.e., if the search query changes, the results will change. Thus, some studies that cover the examined topics might not be included in the dataset, since they don't include the search-query items in their titles, keywords, or abstracts. Fourth, keyword-frequency analysis is a retrospective analysis that does not offer any forward-looking indicators of the research trends of a given discipline. Fifth, using the Scopus database may have introduced some level of bias. However, this database is considered one of the most reputable databases for accounting and auditing.

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