

The Development Trajectory and Emerging Field of Forensic Accounting: Insights from a Visualization Map Analysis

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Abstract: Forensic accounting is the use of financial-legal knowledge and investigative skills to conduct fraud checks, consulting services, dispute resolution and other review activities. In order to explore the development characteristics and emerging trends of forensic accounting in the past 20 years, the literature of forensic accounting from 2000 to 2020 was reviewed. The review is based on two sets of bibliographic records retrieved from the Web of Science. The core dataset, consisting of 2,120 original research papers, was constructed from a topic search. The expanded dataset, consisting of 17,991 articles, was constructed by citation expansion. The overall structure of its intellectual landscape is characterized in terms of thematic concentrations of co-cited references and emerging trends of surging keywords and citations to references through a scientometric review. The research in this article draws the conclusion, Forensic accounting: (i) lacks accurate definitions of disciplines. (ii) needs to combine data analysis capabilities with IT technology to detect abnormal transactions, analyze hidden relationships, and identify potential fraud in the era of big data. (iii) has very intensive research on fraud detection, and non-fraud issues require our in-depth research.

1. INTRODUCTION

Since the “Enron” incident in the early 21st century, the number of company scandals, frauds and failures has exploded. These events accelerated the Great Depression, contributed to the 2008 financial crisis, and greatly affected the effective operation of free market capitalism. Legal proceedings related to scandals, fraud and failures have soared in terms of the number and complexity of cases. At the same time, scandals, frauds and failures have caused the public to lose confidence in CPAs' ability to solve such problems. These conditions have promoted the growth of the demand for forensic accountants. As an interdisciplinary subject of accounting, law and investigation technology, forensic accounting is still developing. The development of forensic accounting is reflected in the following four aspects.

Firstly, the definition of forensic accounting is becoming more scientific. It is incomplete to define forensic accounting simply as the accounting technique for litigation services or the CPA's use of professional knowledge or investigative techniques to communicate results to specific groups. Siegel and Shim [1] treat legal issues as the only result of forensic accounting. The American Institute of Certified Public Accountants supported this wider and deeper portrayal, describing forensic accounting as services which generally involve the application of specialized knowledge and investigative skills possessed by CPAs to collect, analysis, and evaluate evidential matter, and to interpret and communicate findings in the courtroom, boardroom, or other legal or administrative venues. Botes and Saadeh [2]

took a thorough review of the literature to find evidence to support the development of a nomenclature for forensic accounting. The article finally defines forensic accounting as the use of financial expertise, investigative skills and legal knowledge to conduct fraud checks, consulting services, disputes and other reviews, the results of which may be communicated to the court.

Secondly, the development of forensic accounting in various countries is uneven. After the Enron financial scandal broke out, forensic accounting in the United States, Canada, and the United Kingdom has emerged. After two decades of rapid development, the US, Canada and the UK have many professional forensic accounting institutions, and those engaged in forensic accounting-related work provide professional certification. In other regions, forensic accounting is still in its infancy or awakening. The Saudi Organization for Certified Public Accountants is responsible for promoting the accounting and auditing profession and all other related matters. However, SOCPA does not pay enough attention to forensic accounting. To make matters worse, only few experts and scholars in Ukraine pay attention to The concept of “forensic accounting”, even if there are accounting firms in Ukraine that are engaged in forensic accounting-related work [3].

Then there are more and more scholars discussing the professional skills and education of forensic accounting. Forensic accounting involves the in-depth application of accounting, auditing and legal knowledge, as well as communication skills and reasoning skills, which are the common views of experts and scholars [4, 5]. With the development of technology, IT skills have gradually become necessary skills. Especially for the recent development of digital transformation, it is important to integrate big data analysis and forensic accounting into business courses and education. The integration of logical reasoning with IT capabilities and big data analysis capabilities is a major difference between forensic accounting and traditional CPA skills.

On the last aspect, the application areas of forensic accounting are constantly expanding. Broadly speaking, forensic accountants render three kinds of services: consulting, non-scientific testimony and investigation services. Specifically, it includes litigation consultation, criminal investigation, insurance claims, business-related fraud investigation, dispute resolution, etc. [6]. With the rise of cloud computing and intelligent technology, combining forensic accounting technology with fraud detection is a new development trend. Effective forensic accounting will be deeply applied in anti-fraud procedures and fraud investigations [7, 8]. Simultaneously, in anti-fraud investigations, forensic accounting technology can enhance audit evidence collection capabilities to assess fraud risks and promote correct fraud detection.

Bibliometrics was proposed by Pritchard [9] and defined it as “the application of mathematical and statistical methods to discover the nature and trend of the development of a certain discipline by calculating and analyzing different levels of textual information.” It is widely used in bibliometric research in various research fields, including the medical topics about necroptosis and coronaviruses; in the field of environmental science-- nonpoint source pollution and Geopolymer; Research topics like Purpose - social commerce and value management in management; Research on the topic of remote laboratories and higher education studies in the education community; researched the problem of information security risk, the cloud computing for computer science. It can be seen that bibliometrics is not only used in natural sciences, but also widely used in the research of social sciences to discover the nature and trends of a certain discipline.

DiGabriele and Huber [10] did a research that explores the topics and methods used in forensic accounting research published in forensic accounting journals. The survey is limited to forensic accounting journals. There are only a few hundred data, and the results are limited. Unlike conventional literature surveys usually prepared by domain experts, our review is guided by computer-aided technology in CiteSpace, which is a visual analysis system used to visualize emerging trends and major changes in the scientific literature. The purpose of this article is to reveal the intellectual landscape of the study of forensic accounting, determine the thematic patterns, and explore landmark articles and emerging trends.

2. DATA AND METHODOLOGY

A. Datasets collection

This article adopts a looser retrieval strategy. As Chen [11] said: Pragmatically it is easier and more efficient to simply skip an irrelevant branch than keep refining the original topic search query until all noticeable irrelevant topics are eliminated. Two datasets of bibliographic records related to forensic accounting were retrieved from Web of Science. First, a stricter definition of the search formula is used to reduce false fetching errors, and the subject search is carried out. The dataset obtained is called the core dataset. Then the dataset obtained by citation expansion of the core dataset is an expanded dataset, which represents a broader core environment. Key findings are highlighted based on the core dataset and then move onto a more detailed study of the expanded dataset using various visual analytic functions implemented in CiteSpace Data collection [12].

The core dataset is retrieved by a topic search in the Web of Science. Forensic accounting is still in the stage of vigorous development, and its uncertain definition makes it difficult to construct search strategies for Web of Science. There is no clear definition on Wikipedia, but the opinions of different scholars are quoted. According to the definition of forensic accounting and the use of the EBSCO subject terms query function, the hypernyms of forensic accounting include accounting and forensic sciences, related words include fraud expert, evidence investigations and synonyms include fraud accounting and investigative accounting. A record is included in core dataset if any of terms is found in the title, abstract or keyword fields of the record. The expanded dataset is a superset of the core dataset, with additional records obtained through association through citation links. In Web of Science 21, 373 articles cited the entire core dataset. In order to improve accuracy, this article selects commercial finance, law, economics, management, business and education from all categories of Web of Science to achieve the purpose of refinement. These records have been merged into the dataset studied in this article. As is shown in Table 1, the expanded dataset, consisting of 17,991 records (or about eight times as many as the core dataset), sets the core dataset in a broader context with contributions from a total of 22,498 distinct authors of 5,749 institutions. The expanded dataset contains over 641,808 references and 49,030 keywords. Our scientometric review focuses on document co-citation networks and networks of co-occurring keywords based on expanded datasets.

Table 1 the Core And Expanded Datasets Used in the Analysis

Dataset	Duration	Results	Authors	Institutions	Keywords	References
Core	2000-2020	2120	3,472	1,522	9,236	91,571
Expanded	2000-2020	17,791	22,498	5,749	49,030	641,808

B. Research Methodology

Bibliometrics usually uses the co-word network as a tool to study scientific frontiers [13]. Co-word analysis analyzes the co-occurrence of vocabulary and noun phrases in the literature collection, determines the research topic, and describes the relationship between the topics. Co-word analysis can perform co-word cluster analysis, co-word frequency analysis, and sudden word monitoring. It is generally believed that the more word pairs appear in the same document, the closer the relationship between these two topics. Mathematical operations are performed on the distance between words in the co-word relationship network, and the subject words with close distances are gathered together to form clusters with relatively independent concepts. The frequency of keywords appearing in the literature of a certain research field can determine the research hotspots and development trends of the field. The bibliometric method usually combines co-occurrence clustering and co-word frequency analysis. Kleinberg [14] proposed an algorithm to detect burst. If the citation frequency of a paper suddenly increases rapidly, then the safest explanation is that the paper hits a key part of the complex system of the academic field. Such nodes in the knowledge network usually reveal a promising or interesting work. Focusing on words with a sudden increase in the relative growth rate of the focus word, the change of the word frequency growth rate based on a single word is more likely to involve the change

of local hot spots in the field.

Ronald Burt, University of Chicago, When studying whether people’s positions in social networks are related to the quality of their ideas and ideas [15], found that people around structural holes tend to have a greater advantage. The structural hole theory in social networks can be extended to citation networks, embodied in the search for nodes with a high degree of mediation. Kuhn's paradigm theory is embodied as clusters that appear in one time period after another. The dominant color of the cluster reveals the age of their prosperity. The combination of Burt structural hole and Kuhn paradigm theoretical transformation is that nodes connect different clusters. Centrality measures include degree centrality and Betweenness Centrality [16]. Degree centrality is defined as the number of connections a node has. Degree centrality represents the simplest concept of centrality, because it is only the number of neighbors of a node in the network. Betweenness centrality that if the node is more important as an intermediary in the network, the node will be more centralized. From this, we can gain a deeper understanding of how one cluster is connected to another almost completely independent cluster, and which specific literature has played a key role in the paradigm shift.

3. RESULTS ANALYSIS

Scientometrics conducts a macro analysis of literature, including the share of a country or a specific institution in the output of global scientific literature in a certain period of time [17]. In this study, the number of published articles is considered an indicator of the number of research productivity.

A. Research landscapes

1) Country/Territory distribution

In terms of the volume of publications, as shown in Table 2, the top ten most productive countries are the United States, the United Kingdom, Australia, Canada, China, the Netherlands, Germany, Italy, Spain, and New Scotland. Among them, the number of papers issued by the United States is almost the sum of the number of papers issued by the last nine countries, indicating the leading position of American forensic accounting in the field of research. The fraud scandal between Enron and Arthur Andersen Certified Public Accountants reduced the trust in the auditors, and the forensic accountant's quantification of fraud in this case caused Andersen to pay sky-high compensation. Subsequently, the Sarbanes-Oxley Act increased the benefits of forensic accounting, and forensic accounting became a niche market in the United States. The academic research of forensic accounting in the United States ranks among the best. Three journals, the Journal of Forensic Studies in Accounting and Business (JFSAB), Forensic & Investigative Accounting (JFIA) and The Journal of Forensic Accounting: Auditing, Fraud & Risk (JFA), published research results on forensic accounting. Forensic accounting education in the United States is a pioneer.

Table 2 Top Productive Countries/Territories of Publications in Forensic Accounting

Country/Territory	TA	TA%
USA	1015	47.41%
England	187	8.73%
Australia	145	6.77%
Canada	100	4.67%
P.R CHINA	70	3.27%
Netherlands	58	2.71%
Germany	44	2.06%
Italy	38	1.77%
Spain	33	1.54%
Scotland	27	1.26%

TA Total articles, TA % share in articles



Fig.1 The Number of Articles Published by American Authors in the Core Dataset Researching Forensic Accounting from 2000 to 2020

There are currently more than 100 American universities offering forensic accounting majors. From 2000 to 2007, the number of papers published in the US for forensic accounting was less than 30 per year; from 2008 to 2014, the amount of publications increased sharply; in the past 6 years, the number fluctuated but remained at a relatively high level shown in 0.

2) Institutions distribution

As shown in Table 3 there is no research institution with an absolute leading position in the number of publications. However, among the top 20 most productive research institutions, only three seats belong to non-US nationals, namely University of Toronto in Canada, Monash University in Australia, and University Oxford in England. This is in line with the fact that United States, the United Kingdom, Australia, and Canada are the most productive countries in the world. This encourages you to choose the research institutions in Table 2 to exchange and learn forensic accounting research ideas when you want to conduct cooperative research with institutions.

Table 3 Top Productive Institute of Publications in Forensic Accounting

Institute	Frequency	Institute	Frequency
Univ Illinois	29	Arizona State Univ	13
NYU	29	Univ Texas Austin	13
Univ Calif Berkeley	24	Cornell Univ	13
Harvard Univ	24	Monash Univ	12
Univ Chicago	19	George Mason Univ	12
Stanford Law Sch	17	Yale Univ	11
Columbia Law Sch	16	Depaul Univ	11
Univ Michigan	15	Univ Kansas	10
Univ Calif Los Angeles	15	Univ Oxford	10
Univ Toronto	13	Univ Alabama	10

3) Disciplinary integration

In order to analyze the literature discipline at the macro level, Chen and Leydesdorff [18] designed a double map overlay to reveal the pattern of scientific literature combination on the global scientific literature map. The global base map depicts the interconnectedness of more than 10,000 scientific journals. These journals are further divided into areas representing publications and citation activities in subject areas. 0 shows a two-graph overlay visualization of articles published between 2000 and 2020 due to a forensic accounting topic search. The colored curve represents the reference path, which starts from the reference map on the left and points to the reference map on the right.

The nature of each zone is determined by a set of logs belonging to the zone. Each area is marked by the most commonly used words in the title of the corresponding journal. The forensic accounting literature mainly appears in the blue area on the s base map and marked with the label “Economics/Economy/Politics” on the reference map.

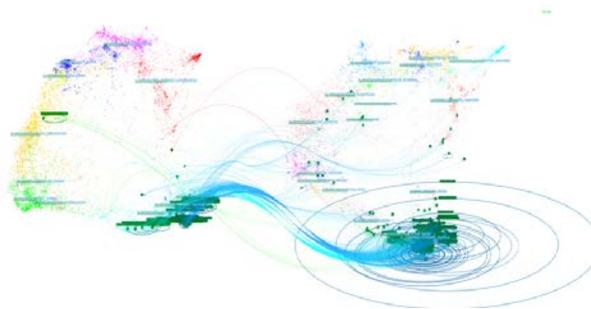


Fig.2 A Dual-Map Overlay of Core Dataset, Which Contains 2120 Articles Published between 2000 and 2020 is Shown.

The citation curve from the main area points to the area in the citation graph on the right. For example, the blue citation links in 0 are divided into several categories. The main destination areas cited include economics / economics / politics, psychology / education / society.

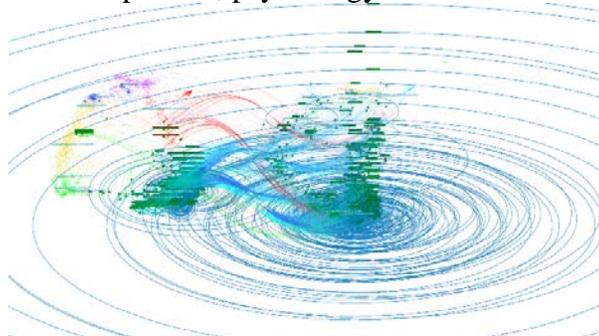


Fig.3 A Dual-Map Overlay of Expanded Dataset, Which Contains 17,791 Articles Published between 2000 and 2020, is Shown.

B. Research frontier

1) *Co-word network analysis*

When analyzing keywords co-occurrence, this article first analyzes the time when each keyword appears, forming a keyword Time Zone as shown in 0. According to the results of the TimeZone diagram, it is divided into three time periods: 2000-2005 (Q1), 2006-2010 (Q2), and 2011-2020 (Q3) for co-word analysis. Otherwise, the number of co-words during Q1 is large and closely related, which leads to the weakening or concealing of the co-occurrence effect of keywords in Q2 and Q3. The co-occurrence effects of keywords in Q2 and Q3 are shown in 0 and 0. 0 shows a large number of gray links, which represent the co-occurrence of forensic accounting keywords from 2000 to 2005.

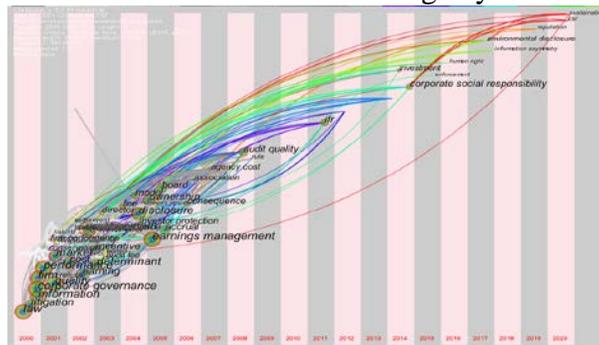


Fig.4 Keyword Timezone Diagram is Derived from the Expanded Dataset

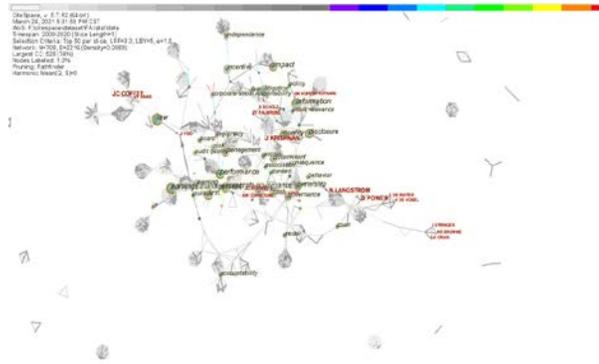


Fig.5 A Document Co-Word Network of the Expanded Dataset from 2000 to 2020

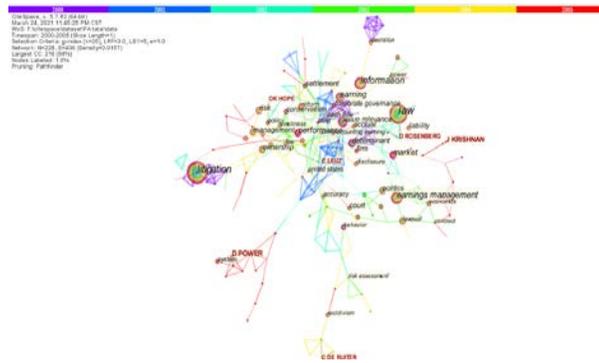


Fig.6 A Document Co-Word Network of the Expanded Dataset from 2000 to 2005

In the keyword co-occurrence network diagram during Q1 shown in 0, the most prominent keyword node is law and litigation, which also accords with the attribute that forensic accounting originally appeared to provide litigation support for litigation cases. After 2002, the Sarbanes-Oxley Act, the Statement of Auditing Standards No. 99 and the Accounting Oversight Committee of Listed Companies did not eliminate the pressure on the CFO to manipulate the accounting statements, but forced the top management to certify the financial statements No fraud and material misstatement. In the Q2 period, the research topics of law and litigation in forensic accounting research began to weaken, and research topics such as earnings management, performance, and information disclosure began to emerge.

In the keyword co-occurrence network diagram during the Q3 period, the keyword corporate governance connects keywords such as company performance, directors, ownership structure, compensation, etc. Onoh [19] found a significant positive correlation between the application of forensic accounting and corporate governance measured by board performance. The application of forensic accounting can improve corporate governance by improving the performance of the organization's board of directors. Keyword -fee radiates audit quality, non-audit services and internal control. Whenever a fraudulent financial report is disclosed, stakeholders first are not concerned about who the directors are, but the first question they have to ask who is the company's auditor. Therefore, it is necessary to improve audit quality from the perspective of forensic accounting to reduce the occurrence of fraud in financial statements in the era of information revolution. Earnings management and motivation, investment protection, quality, and the realization of receipts and payments appear together. Companies used earnings management to avoid taxation, they will cause serious tax losses. Therefore, forensic accountants are entrusted by tax authorities to determine Whether those companies that implement active tax avoidance are reasonable tax avoidance. Companies with high corporate social responsibility disclosure are unlikely to conduct earnings management. In addition, the relationship between corporate social responsibility disclosure and earnings management can be seen as an alternative mechanism. Forensic accountants consider financial fraudsters through earnings

by private professional companies may help local governments deal with the increasingly serious challenges of fraud, especially the digital fraud carried out by organized criminal groups.

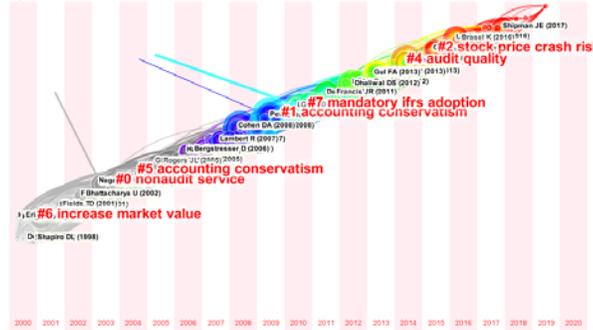


Fig.9 A Co-Citation Timezone Diagram of the Expanded Dataset.

Table 4 Summary of Thematic Concentrations Emerged from the Expanded Dataset

Cluster #	Size	Silhouette	Mean (Year)	Label (log-likelihood ratio)
0	100	0.812	2002	nonaudit service
1	84	0.856	2009	accounting conservatism
2	78	0.929	2013	stock price crash risk
4	63	0.865	2013	audit quality
5	55	0.878	2004	accounting conservatism
6	55	0.924	1999	increase market value
7	48	0.901	2001	mandatory ifrs adoption

C. Research hotspots

This article investigates the frequency of keywords to obtain the most popular research topics and their trends. Through the cluster analysis of keywords from 2016 to 2020, we can obtain the latest topics in the forensic accounting literature. This research conducted a keyword analysis to gain an in-depth understanding of forensic accounting research trends and trends and frontiers in frontier fields.

High-frequency keyword analysis This article selects the top 50 keywords with the highest frequency in Table 5. It can be seen that the focus and hotspots of global organizational research in the past two decades are mainly in three aspects: corporate governance, financial accounting and information disclosure, law and litigation. In the context of the era of big data, the impact on forensic accounting and the application of IT technology and forensic accounting are less researched, indicating that the frontier research on forensic accounting is not sufficient. In the keyword detection of this study period, a total of 1,005 keywords were found, of which only 50 (5%) keywords appeared once or twice. Key words that appear less frequently are not necessarily the subject of distance education from forensic accounting research. The reason for their appearance may be that these keywords are not standard so that they are not widely recognized by researchers or emerging research topics. The lack of continuous research results in a very low frequency of occurrence. However, by analyzing the time when these low-frequency keywords appeared, these keywords all appeared in 2000-2007 and are not part of an emerging theme.

The frequency of the research topic “Corporate Governance” is 1,708 (frequency 2.2%), which is significantly higher than the next few keywords. The node in the keyword graph is also significantly larger than other keywords; at the same time, by viewing the largest node “Corporate Governance” The volume of posts can be found in the research on the subject of Corporate Governance, which has continued and expanded continuously over the past 20 years shown in 0. It shows that forensic accounting is closely integrated with corporate governance through earnings management and performance, usually for the prevention, control and governance of corporate financial fraud. “Poor” corporate governance is the main cause of dismal performance, manipulation of financial reports, and dissatisfaction with stakeholders [8]. However, modern corporate fraud is extremely complicated, and

the skills of accountants and legal experts are insufficient to deal with the company's ills. The need to respond to this ever-changing criminal threat has aroused the appeal of forensic accountants [22]. Influenced by companies, governments, regulatory agencies, and courts, people with higher levels of expertise are now required to analyze today's complex financial transactions and events. Forensic accounting has become the primary force in dealing with financial fraud and accounting scandals.

Table 5 Top 25 Most Frequently Occurring Keywords

number	keywords	count
1	corporate governance	1,708
2	earnings management	1,593
3	law	1,592
4	quality	1,561
5	performance	1,542
6	information	1,476
7	firm	1,271
8	impact	1,236
9	management	1,174
10	disclosure	1,169
11	market	1,077
12	determinant	957
13	earning	903
14	litigation	871
15	governance	846
16	cost	823
17	ownership	814
18	risk	753
19	incentive	676
20	accrual	535

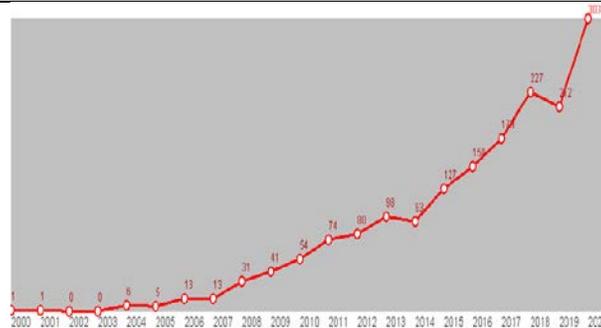


Fig.10 Key Words Corporate Governance Posting Trend

In order to study the research hotspots in the last five years, as is shown in 0 the keywords from 2016 to 2020 were clustered using CiteSpace to form eight clusters, which represent the most popular research field of forensic accounting. The top 5 most commonly used keywords are basically consistent with the results of the large sample from 2000 to 2020. In keyword clustering, silhouette greater than 0.7 indicates that the clustering is efficient and convincing. As is shown in Table 6, the silhouettes of these eight clusters are all greater than 0.9, indicating that the clustering effect is particularly good. This article divides the eight clusters into three categories.

The first category is the field of corporate governance. Fraudulent companies are more likely to conduct earnings management in the first few years before fraud is discovered [23]. To distinguish between earnings management and fraud, auditors and forensic accountants need to consider management motivations. The motivation and integrity of management still need more research. The main problem with corporate sustainability reports is that they may misunderstand non-financial information to stakeholders. Due to the great need to provide evidence for this growing popularity and

a large amount of publicly disclosed information, this concern provides forensic accountants with an opportunity for review. Rehman and Hashim [24] believed that forensic accounting has a direct and significant impact on sustainable corporate governance. In addition, forensic accounting can be part of governance management that eliminates fraud and achieves sustainable corporate governance. Forensic accounting may be an assessment tool to strengthen corporate governance and can help contain the threat of corporate crime. The fraud prevention effect of forensic accounting is used to realize the maturity of corporate governance [25].

The second category is external supervision, including the Sarbanes-Oxley Act and audit quality. The Sarbanes-Oxley Act, the Statement on Auditing Standards-99 and the Public Company Accounting Oversight Board requires top management to prove that the financial statements are free of fraud and material misstatement. It is not enough to use independent auditors to ensure the degree of assurance. Adding a forensic accountant to the audit team is an advantage. Auditors make intuitive judgments because time, cost, or data limitations prevent the use of statistical methods [26], but the intuitive investigation of forensic accountants is one of the top five characteristics of their profession, which will not affect the work effect of forensic accountants [27].

The third category is forensic accounting in the context of big data. Forensic accountants now have access to a large amount of structured data and unstructured data, as well as an increasing number of non-traditional data sources, such as news media, Email and social media. As a result, forensic accountants used advanced technical tools in their investigation practice. forensic accountants use social media and network monitoring, voice search and analysis, visualization and reporting tools. In order to regulate the protection of trade secrets, there was a discussion on the use of trade secret audits [28]. During the protection period of trade secrets and later infringements, the forensic accountant can be used for business analysis. Blockchain is called a distributed ledger for financial and non-financial activities. Enterprises voluntarily or are forced by industry regulations to use blockchain technology to ensure the security of information. The integration of accounting information and blockchain is a new trend. Forensic accounting should be at the forefront of the industry and understand blockchain technology [29]. Integrating big data topics into forensic accounting courses and redesigning forensic accounting courses have become new trends [30].

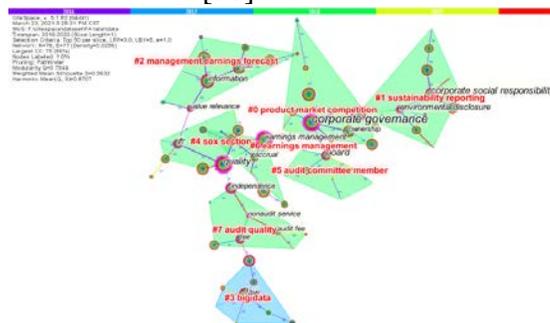


Fig.11 Keyword Cluster Map

Table 6 Via Summary Of Thematic Concentrations Emerged from the Expanded Dataset

ClusterID	Size	Silhouette	mean(Year)	Label (LLR)
0	13	1	2016	product market competition
1	12	0.905	2017	sustainability reporting
2	10	0.932	2016	management earnings forecast
3	8	1	2016	big data
4	8	1	2016	sox section
5	8	0.972	2017	audit committee member
6	8	1	2016	earnings management
7	8	0.911	2017	audit quality

D. Burst detection

1) Burst keywords analysis

Top 30 Keywords with the Strongest Citation Bursts

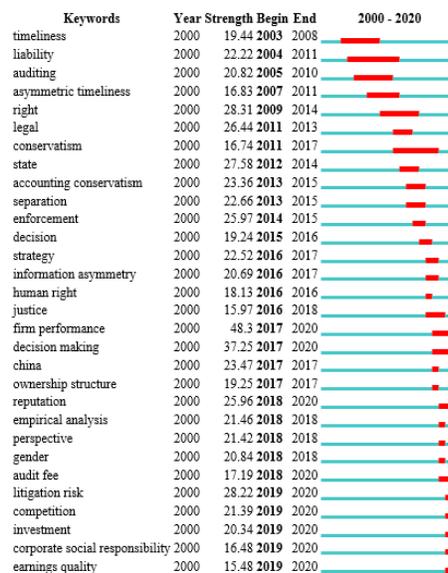


Fig.12 Top 30 References with Strong Citation Bursts

The strongest emergence strength is firm performance in 0. Company performance is one of the main motivations for management's financial fraud Forensic accounting has the ability to analyze fraud intuitively, and the participation of forensic accountants in criminal affairs is usually the consequence of fraud [31]. Yang and Lee [32] determined the causality of the forensic accounting implementation strategy diagram based on the balanced scorecard and checked the best strategy diagram method for forensic accounting decision-making by applying combined multiple-criteria decision making.

There are 17 burst words in the past five years, and about 35% of the emergence lasts for only one year. Emergent words that last until 2020 include firm performance, decision making, audit fee, litigation risk, competition, investment, social responsibility, corporate finance, etc. Faboyede [33] believed that forensic accountants can play a role in getting SMEs out of the poverty alleviation environment and various challenges. They suggested that small business entrepreneurs, through forensic accountants, can formulate policies, strategies and procedures that constitute a key part of the effort required to meet the challenges of their business growth. Does forensic accounting bear litigation risks like auditors? The greater the number of institutional investors holding company stocks, the higher the audit fees and the greater the litigation risk they bear. Managing risk at the client's portfolio level will affect the auditor's litigation risk [34]. The auditor's litigation risk is closely related to the fraud risk of the client unit. The main role of forensic accounting is to detect fraud in time, so it will reduce the litigation risk caused by customer fraud.

2) Burst citation analysis

The dynamics of a field can be characterized in part by articles that have received the steepest increase of citations, that is, citation bursts. 0 shows the top 30 references with the strongest citation bursts. A citation burst indicates the likelihood that the scientific community has paid or is paying special attention towards the underlying contribution. Instead of discussing all the 30 references, the following discussions will be limited to the ones with the strongest burst in the group of articles that started to burst at the same time. If several references started to burst in year 2010, only the one with the greatest magnitude of burst will be concentrated on. References selected in this way are indicated by red arrows in 0.

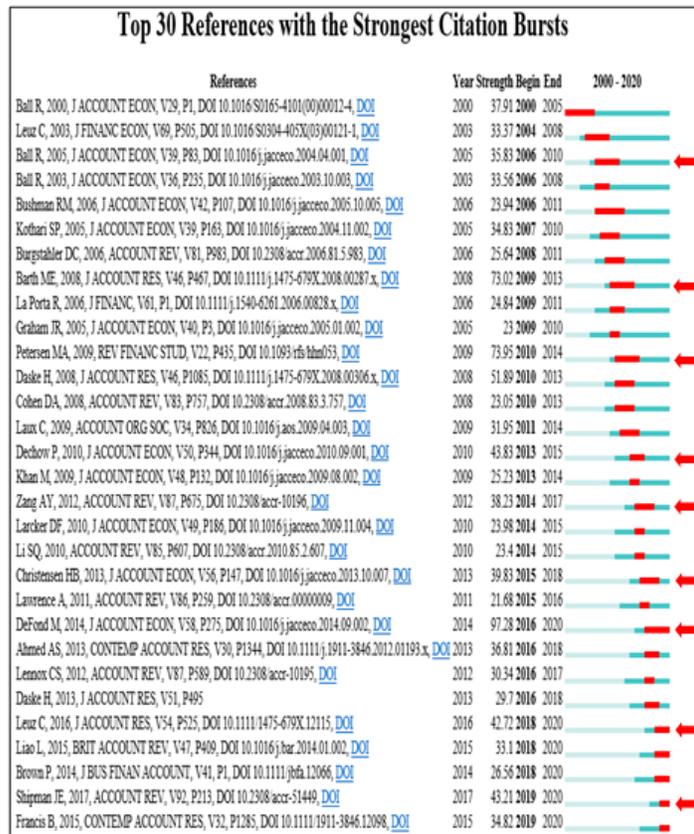


Fig.13 Top 30 Cited References with the Strongest Citation Bursts in the Expanded Dataset

0 shows the top 30 references with the strongest citation bursts in the expanded dataset. Furthermore, references that started to burst at the same time are considered as a group. For each group, the reference with the strongest burst within the group will be focused on. Table 7 shows the representative references for each of five groups of references by the beginning time of burst. Ball, Shivakumar [35] investigated Earnings quality in UK private firms. This paper is used as a citation for 880 articles on the Web of Science. This article is ranked the third by the strength of its citation burst. Barth et al.'s article published in 2008 has found firms applying IAS generally evidence an improvement in accounting quality between the pre- and post-adoption periods. The burst lasted for 3 years from 2010 till 2013. In 2009, Petersen MA.'s article published in 2008 has the second strongest citation burst in the entire expanded dataset. This paper studied the characteristics of standard errors produced by different research methods in empirical research on corporate finance and asset pricing. In 2010, Dechow P et al. point out that the "quality" of earnings is a function of the company's basic performance. The strongest burst starting from 2014 is associated with a paper by Zang [36]. The article studies whether managers use actual activity manipulation and accrual-based revenue management instead of revenue management. The author concludes that managers will adjust the level of accrual revenue management based on the level of actual activity manipulation achieved. The strongest burst from 2015 is due to a 2013 paper by Christensen HB et al. The study shown that after the mandatory adoption of International Financial Reporting Standards, the changes in accounting standards seem to have little impact on market liquidity. Citation bursts starting in 2016 are led by Defond and Zhang [37] s article, Which has the strongest citation burst both in the core and expanded dataset. Leuz and Wysocki [38] investigated that link disclosure and reporting activities to firm-specific and market-wide economic outcomes by empirical studies, which is strongest burst starting in 2016. The strongest burst from 2019 is due to a paper by Shipman, Swanquist [39]. The article reviewed the use of PSM for estimating average treatment effects (ATEs) in accounting research from 2008-2014.

These references with the strongest citation bursts are related to mandatory IFRS adoption, financial accounting information and earnings management. We need to consider applying forensic accounting to new areas. For example, forensic accountants use investigative techniques to increase the transparency of the company's disclosed financial information quality, so that investors can make investment decisions based on more sufficient information and promote the construction of an effective capital market.

Table 7 Representative References With the Strongest Citation Bursts in the Same-Year Groups

Study	citation burst		
	Strength	Begin	End
Ball R, 2005	35.83	2006	2010
Barth ME, 2008	73.02	2009	2013
Petersen MA, 2009	73.95	2010	2014
Dechow P, 2010	43.83	2013	2015
Zang AY, 2012	38.23	2014	2017
Christensen HB, 2013	39.83	2015	2018
DeFond M, 2014	97.28	2016	2020
Leuz C, 2016	42.72	2018	2020
Shipman JE, 2017	43.21	2019	2020

4. Conclusions

When analyzing data, searching for forensic accounting keywords from the web of science core collection resulted in too many irrelevant documents. Even if a more rigorous search formula is selected, the precision rate is still low. This shows that forensic accounting lacks accurate definitions of disciplines from researchers. Therefore, it becomes very important to strengthen the space for the forensic accounting discipline to consolidate the standards.

Scientific measurement reveals the development process and emerging trends of forensic accounting. From the perspective of national and institutional contributions, American academic institutions have led the vigorous development of forensic accounting. In the context of big data, forensic accountants use data visualization, predictive analysis, behavior analysis, content analysis, social network analysis, geospatial analysis and many advanced anti-fraud technologies to adapt to increasingly complex economic transaction activities. The integration of forensic accounting, big data and IT technology has become a new trend in the development of forensic accounting. Existing forensic accounting courses and programs do not fully cover the topics of big data and data analysis. It is necessary to integrate big data topics into forensic accounting courses and redesign forensic accounting courses.

For the development of forensic accounting in the early 21st century, its focus has gradually shifted from providing support for litigation to corporate governance. Forensic accounting has a direct and significant impact on sustainable corporate governance. Forensic accounting can be part of eliminating fraud and achieving sustainable corporate governance. Forensic accounting may be an assessment tool to strengthen corporate governance and can help contain the threat of corporate crime. The fraud prevention effect of forensic accounting is conducive to improving the maturity of corporate governance. Fraud is still the main object of investigation for forensic accounting. Forensic accounting is considered as a more effective means of fraud than auditing. Auditors will learn relevant skills from forensic accountants, which will help improve audit quality.

The scientometric study has limitations when discovering emerging trends in forensic accounting. The main reason is that forensic accounting is still in continuous development, and there are relatively few researches on forensic accounting in the field of fraud removal, which leads to a relatively small amount of literature citations and cannot meet the clustering standard. which leads to a relatively small

amount of literature citations and cannot meet the clustering standard. Therefore, the non-fraud problem of forensic accounting needs our in-depth study.

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