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Hyperautomation in Accounting: A Bibliometric Journey Through Artificial Intelligence and Robotic Process Automation Integration

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ABSTRACT

The integration of advanced digital technologies has significantly transformed accounting practices over the past few years. However, structured analysis of how hyperautomation, primarily through tools such as artificial intelligence (AI) and robotic process automation (RPA), is affecting the field remains limited. This study examines the evolution of hyperautomation research in accounting, identifying key trends, thematic areas, and the countries that have contributed to this field. A bibliometric approach was employed to analyse peer-reviewed journal articles published between 2019 and 2024 in the Web of Science database, using tools such as BiblioMagika, Excel, and VOSviewer. Co-occurrence analysis was applied to reveal dominant research themes and the intellectual structure of the field. The findings reveal a notable growth in publications since 2019, with the United States and China as the most prolific contributors. Core themes include intelligent automation in auditing, financial analysis, corporate governance, and sustainability. This study offers the first comprehensive bibliometric mapping of hyperautomation in accounting, contributing to a clearer understanding of its academic evolution. The results inform both future research and practical applications. Limitations include the database scope and the need for further inquiry into ethical and organizational challenges surrounding adoption.

1. Introduction

The advent of hyperautomation marks a transformative shift in the accounting profession, offering unprecedented opportunities for enhancing efficiency, accuracy, and scalability in financial operations. Introduced by Gartner in 2019 as a strategic technology trend, hyperautomation refers to the integration of Robotic Process Automation (RPA), Artificial Intelligence (AI), Machine Learning (ML), and cognitive technologies to automate both routine and complex tasks [1-5]. This technological advancement is particularly relevant in the accounting domain, where precision, regulatory compliance, and timely decision-making are paramount [6]. As organizations increasingly face pressures to adapt to digital transformation [7], hyperautomation provides a powerful tool to meet the growing demands of a globalized economy [8].

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Accounting processes, traditionally dependent on manual inputs, are increasingly benefiting from automation technologies that reduce human error, improve reporting accuracy, and support real-time decision-making [9]. The integration of AI with RPA empowers systems to handle unstructured data, recognize patterns, and execute informed decisions [10]. These developments have positioned hyperautomation as a focal point in discussions of accounting innovation, both in academic research and professional practice.

Despite its potential, research on hyperautomation in accounting remains limited and fragmented. While there is growing interest in individual technologies such as AI and RPA, few studies systematically examine their integrated application within accounting. Challenges such as deployment complexity, organizational resistance, and workforce disruption have been noted, but a comprehensive investigation is lacking [11]. Furthermore, the terminology surrounding hyperautomation and related technologies is often used inconsistently [12], which complicates efforts to synthesize research findings and develop standardized frameworks for evaluating its effectiveness. Another critical issue is the scarcity of research examining the ethical implications of hyperautomation [13], including concerns about transparency, accountability, and the potential for algorithmic bias in decision-making processes. Addressing these problems is crucial for advancing both academic inquiry and practical applications of hyperautomation in accounting.

To address these limitations, this study conducts a bibliometric analysis to map the evolution, key themes, and intellectual structure of hyperautomation-related research in accounting from 2019 to 2024, focusing on peer-reviewed journal articles indexed in the Web of Science database. The expected outcomes include the identification of major contributors, research clusters, and emerging trends, which may inform future academic inquiry and guide practitioners in adopting data-driven, intelligent automation solutions. This study offers an original contribution by presenting the first comprehensive bibliometric mapping of hyperautomation in accounting, providing novel insights into the field's development and highlighting strategic directions for both research and practice. By doing so, it not only captures the current landscape of scholarly work but also establishes a foundation for future studies, contributing to a deeper understanding of how hyperautomation is transforming the accounting profession and offering practical guidance for its responsible implementation. Specifically, the study seeks to:

i. Analyze the evolution of academic research on hyperautomation in accounting, focusing on the key technologies (e.g., AI, RPA, ML) and their applications.
ii. Identify the most influential publications contributing to the discourse on hyperautomation in accounting.
iii. Examine the geographic distribution within hyperautomation research, highlighting regional disparities.
iv. Explore the emerging themes and research clusters within the literature, including the impact of hyperautomation on operational efficiency, workforce transformation and ethical considerations.
v. Provide actionable insights and future directions for both researchers and practitioners, focusing on the opportunities and challenges associated with hyperautomation in accounting.

The following research questions guide the study:

i. What are the key trends and thematic clusters in academic literature on hyperautomation in accounting?

ii. How has the discourse on hyperautomation evolved, and what are the major turning points or breakthroughs in the research?
iii. Who are the leading contributors (countries) to the research on hyperautomation?
iv. What are the main applications of hyperautomation technologies in accounting, and what impact have they had on operational efficiency, decision-making and compliance?
v. What ethical challenges and concerns arise from the adoption of hyperautomation in accounting, and how are these addressed in the existing literature?
vi. What gaps exist in the current body of research on hyperautomation, and what areas should future studies focus on?

The remainder of the paper is organized as follows: the subsequent section delivers a comprehensive literature review, including an examination of prior bibliometric studies relevant to this research. The third section delineates the methodologies and data utilized in the analysis, while the fourth section presents the findings derived from the data. The fifth section engages in a detailed discussion of the results, highlights key conclusions and offers a synthesis of the primary findings, implications, avenues for future research and recognized limitations. The final section serves as a concise summary of the entire study.

2. Literature Review

To provide a foundation for this study, this section first examines the evolution from RPA to hyperautomation in the accounting field. Then it reviews previous bibliometric research to identify current limitations in the literature.

2.1 The Evolution from RPA to Hyperautomation in Accounting

RPA in accounting refers to the use of software bots to automate repetitive, rule-based tasks such as data entry, reconciliation and transaction processing, which traditionally required manual effort. This technology enables accounting professionals to focus on more value-added activities, like financial analysis and decision-making, thereby improving operational efficiency and reducing the likelihood of human error [14,15]. As organizations pursued digital transformation, RPA emerged as a key driver of process standardization and operational efficiency [16]. However, its limitations became apparent in handling unstructured data and executing judgment-intensive tasks, revealing the need for greater cognitive capabilities and setting the stage for integration with AI [17-19]. Figure 1 illustrates the evolution of RPA from rule-based automation to intelligent data processing, and ultimately to human-like cognitive reasoning.

AI, particularly in the form of ML, cognitive computing, and deep learning (DL), has the potential to revolutionize accounting by automating complex cognitive tasks. AI can process vast volumes of structured and unstructured data, identify patterns, detect anomalies, and deliver insights beyond the reach of conventional tools [6]. Applications such as chatbots, recommendation engines, and fraud detection systems exemplify AI's expanding role in accounting. In response to these advancements, Chakraborty *et al.,* [17] proposed the concept of True Cognitive RPA, which emphasizes systems capable of understanding and interpreting complex events with human-like cognitive depth. The goal is to transition from passive automation to active, context-aware decision-making [16].

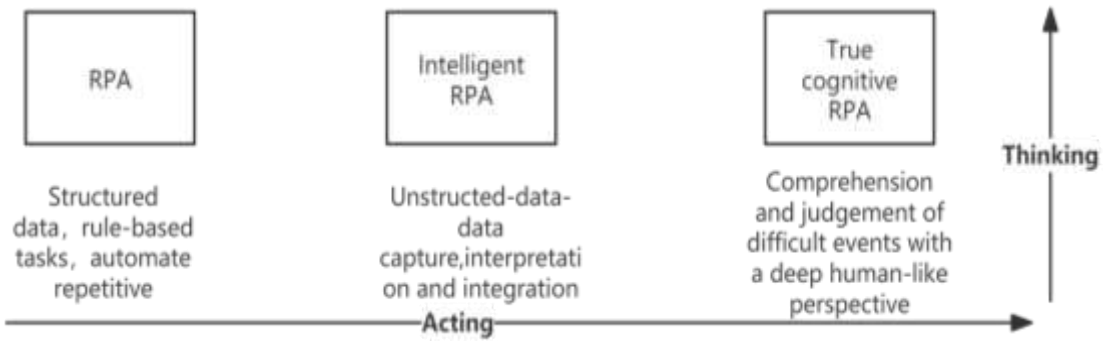

Fig. 1: Present and future RPA [17]

Building on these developments, the concept of hyperautomation has emerged as a comprehensive approach that integrates RPA, AI, ML and other advanced technologies to achieve end-to-end automation of both routine and complex business processes [10,15]. Unlike traditional automation, which is confined to discrete tasks, hyperautomation enables systems to autonomously manage, analyze and act on information across entire workflows. As outlined by Madakam *et al.,* and Yunus *et al*., [3,20], this paradigm involves the orchestration of multiple intelligent technologies to reduce human intervention, improve scalability and enhance responsiveness. As organizations adopt hyperautomation, they unlock substantial gains in efficiency, accuracy, and decision-making capabilities across various functions, including financial services [1,21,22]. Empirical evidence suggests that hyperautomation has significantly improved operational performance, underscoring its transformative potential for the future of accounting [22].

However, despite the promise of these technologies, their implementation is often met with resistance, as employees are concerned about job displacement and the complexity of transitioning to AI-based systems. Studies reveal that, over time, as users gain familiarity with these systems, their attitudes tend to shift positively, particularly when AI is shown to enhance job satisfaction by reducing mundane tasks and providing more opportunities for creative, value-added work [14]. However, successful integration requires strong IT governance, robust data security frameworks, and a focus on long-term sustainability to avoid the pitfalls of short-term adoption strategies [10]. By addressing these challenges, organizations can fully harness the transformative potential of these technologies in accounting, ultimately redefining the role of accountants in the digital age [23].

2.2 Prior Bibliometric Research on Hyperautomation in Accounting

Although the term "hyperautomation" is not yet widely used in accounting research, its underlying technologies — such as AI, RPA and ML — have received growing attention. These technologies are central to the automation of accounting processes, yet current bibliometric studies have not explored them collectively as part of a unified automation paradigm. This study addresses that gap by offering a focused bibliometric analysis of research at the intersection of these technologies and accounting (Table 1).

Several prior bibliometric reviews have analyzed how emerging technologies are shaping accounting; however, their scope typically remains fragmented or outdated. Indrayani *et al.*, [24] conducted a comprehensive bibliometric analysis to map the evolution of research on emerging technologies in accounting, identifying clusters related to technology acceptance, professional practice, education and research methodologies. However, their study lacks a specific focus on hyperautomation technologies, such as AI and RPA, which are now fundamentally reshaping accounting practices, including auditing and financial reporting. This gap is further echoed in the work of Kumar *et al.,* [25], who explored the applications of AI and blockchain in various business sectors,

identifying finance and accounting as key areas of relevance. However, their analysis, limited to the period between 2017 and 2020, emphasizes broader business contexts rather than the specific transformations in accounting processes that AI and RPA facilitate. The present research aims to address these limitations by examining how hyperautomation technologies directly impact operational efficiency, auditing, and compliance within the accounting profession.

Further contributing to this discourse, Kalbouneh *et al.,* [26] examined the intellectual structure of sustainability accounting, highlighting the importance of AI and big data in corporate environmental management and accountability. While their findings provide valuable insights, they do not sufficiently engage with hyperautomation technologies, such as RPA, which are pivotal in automating core accounting tasks. Similarly, Abad-Segura *et al.,* [27] conducted a thorough analysis of emerging technologies in corporate accounting from 1961 to 2019, identifying key research lines such as cost accounting and information technology [28]. However, their analysis does not encompass the significant advancements in hyperautomation technologies that have emerged since 2019. By incorporating the latest developments in AI, RPA and ML, this research aims to provide a more current understanding of the transformative effects of these technologies on accounting processes.

Lastly, *Chiu et al.,* [29] focused on technological developments in Accounting Information Systems (AIS) journals; they identified topics such as continuous auditing and management accounting. However, their analysis was limited to a limited range of journals, and their conclusions were drawn in 2016, before intelligent automation technologies became central to discussions of accounting innovation.

These studies provide foundational insights but do not fully capture the technological convergence characterizing current research. They either predate the acceleration of hyperautomation or treat its components in isolation. This study builds on their contributions by analyzing recent literature (2019–2024) and explicitly focusing on how AI, RPA and related tools are transforming auditing, reporting, and regulatory compliance in the accounting profession.

By drawing on the most current developments, this research provides a more integrated view of automation in accounting, highlighting key thematic patterns and intellectual structures that emerge from the literature. It contributes to the ongoing discourse by clarifying how hyperautomation enhances operational efficiency, reduces human intervention, and improves decision-making in complex accounting environments. The findings also have practical implications for professionals and policymakers seeking to understand and apply automation technologies in practice.

While this study does not focus on ethical issues, it acknowledges the growing concerns about algorithmic transparency, job loss, and data security in the context of automation. Future research should further explore these dimensions to ensure that technology integration is done in a balanced and socially responsible manner.

In summary, while previous bibliometric studies have made significant contributions to our understanding of digital transformation in accounting, they have not yet explored the concept of hyperautomation in a coherent and up-to-date manner. This study fills this gap by providing a targeted, up-to-date and conceptually unified analysis, providing academic insights and practical guidance for navigating the evolving accounting technology landscape.

Table 1
Summary of previous studies

Ref.	Domain & Search Query	Objective of the Study	Total Document, Data Source & Coverage	Attributes Examined	Main Findings
[24]	Domain: Emerging technology in accounting. Search Query: TITLE ("Accounting" AND "technology")	To trace the evolution of research on emerging technologies in accounting, map clusters, and identify research gaps	324 documents from Scopus, covering 1982–2024	- Research trends - Clusters - Most-cited publications - Country contributions - Keywords	Mapped four clusters related to technology acceptance, education, professional practice, and research methodologies in accounting. Identified gaps for future exploration.
[25]	Domain: AI and Blockchain Integration in Business. Search Query: ("AI" OR "Machine Learning" OR "Blockchain") AND ("Business").	To explore the applications and benefits of integrating AI and blockchain in various business sectors and identify research gaps.	106 documents from Scopus, covering 2017-2020	- Publication productivity - Most influential articles - Prominent topics - Co-occurrence analysis - Intellectual structure	Identified four thematic clusters: supply chains, healthcare, secure transactions, and finance and accounting. The study concluded with 10 application areas where AI and blockchain integration can provide significant benefits to businesses in the era of IR 4.0.
[26]	Domain: Sustainability Accounting in the Corporate Environment. Search Query: TITLE ("sustainability accounting" AND "corporate environment").	To explore the intellectual structure of sustainability accounting and identify key trends, gaps, and research opportunities.	679 documents from the Web of Science database, covering 2003–2022	- Research trends - Most influential authors and publications - Country-level contributions - Keyword co-occurrence - Bibliographic coupling	Identified four major research themes: reporting and disclosure, management control systems, environmental management, and stakeholder accountability. The study emphasized the need for further exploration of the role of technology (AI, big data) in sustainability accounting.
[27]	Domain: Emerging Technologies in Corporate Accounting. Search Query: TITLE ("emerging technologies" AND "corporate accounting").	To analyze global research trends and future directions in emerging technologies related to corporate accounting between 1961 and 2019.	1126 documents from Scopus, covering 1961–2019	- Publication trends - Thematic clusters - Keyword co-occurrence analysis - Author affiliations - Country contributions	Identified six research lines: technology, information technology, cost accounting, investments, optimization, and employment. The study provided a comprehensive overview of how emerging technologies are reshaping corporate accounting, identifying gaps for future research.
[29]	Domain: Accounting Information Systems (AIS) and Emerging Technologies. Search Query: TITLE ("AIS" AND "Emerging Technologies")	To conduct a bibliometric analysis of six AIS journals and explore their contributions to research on emerging technologies in accounting.	681 documents from six AIS journals (Journal of Information Systems, International Journal of Accounting Information Systems, Journal of Emerging Technologies in Accounting, etc.) covering 2004–2016	- Research methodologies - Accounting areas - Emerging technologies - Journal comparison	Identified key themes in AIS journals related to auditing, financial reporting, and managerial accounting, with significant contributions to emerging technologies research such as AI, XBRL, and continuous auditing.

3. Methods

Bibliometric research plays a crucial role in understanding the accounting field within the context of technological advancements and the shift to a digital business environment. Bibliometric analysis has provided valuable insights into the structure and dynamics of the research landscape [30]. It enables researchers to identify influential authors who have made significant contributions to the field, as well as popular journals that publish high-quality research. Moreover, it allows the detection of emerging research trends, helping researchers stay current with the latest developments.

3.1 Search Strategy

This study employs a bibliometric analysis to explore the academic literature on hyperautomation in accounting. The bibliometric data were sourced from the Web of Science (WoS) database, covering the period from 2019 to 2024. This study period ensures that the analysis captures the latest research advancements, trends, and contributions in the fields of hyperautomation, AI, RPA and their impact on accounting. WoS was selected for its comprehensive indexing of peer-reviewed articles across various disciplines, ensuring the inclusion of high-quality academic publications [31,32].

To identify relevant literature, the search was conducted across all fields of the database, with a focus on articles published in English. The search strategy employed a combination of specific and broad terms to capture a wide range of studies related to hyperautomation, intelligent process automation, cognitive automation and related concepts, including AI, ML, RPA and software robots, within the context of accounting. The exact search string used is as follows (Table 2):

Table 2
Detection of keywords in WoS core collection database

Selected keywords	No. of exported documents (after cleaning)
ALL= ((“Hyper-automation” OR "Intelligent Process Automation" OR "Intelligent Automation" OR " Integrated Automation Platform” OR” Cognitive Automation ") AND (“Artificial Intelligence” OR "AI" OR "Machine Learning" OR "Cognitive Computing" OR "Deep Learning") AND (“Robotic Process Automation” OR "RPA" OR "Automation Software" OR "Digital Workforce" OR "Software Robots") AND “Accounting”)	1 document
ALL= ((“Hyper-automation” OR "Intelligent Process Automation" OR "Intelligent Automation" OR " Integrated Automation Platform” OR” Cognitive Automation ") AND (“Artificial Intelligence” OR "AI" OR "Machine Learning" OR "Cognitive Computing" OR "Deep Learning") AND “Accounting”)	1 document
ALL= ((“Hyper-automation” OR "Intelligent Process Automation" OR "Intelligent Automation" OR " Integrated Automation Platform” OR” Cognitive Automation ") AND (“Robotic Process Automation” OR "RPA" OR "Automation Software" OR "Digital Workforce" OR "Software Robots") AND “Accounting”)	1 document
ALL= ((“Artificial Intelligence” OR "AI" OR "Machine Learning" OR "Cognitive Computing" OR "Deep Learning") AND (“Robotic Process Automation” OR "RPA" OR "Automation Software" OR "Digital Workforce" OR "Software Robots") AND “Accounting”)	22 documents
ALL= ((“Artificial Intelligence” OR "AI" OR "Machine Learning" OR "Cognitive Computing" OR "Deep Learning") AND “Accounting”)	890 documents
ALL= ((“Robotic Process Automation” OR "RPA" OR "Automation Software" OR "Digital Workforce" OR "Software Robots") AND “Accounting”)	44 documents
ALL= ((“Hyper-automation” OR "Intelligent Process Automation" OR "Intelligent Automation" OR " Integrated Automation Platform” OR” Cognitive Automation ") AND “Accounting”)	1 document

This search yielded an initial total of 960 records. The time frame for the search was set between 2019 and 2024 to capture the most recent developments and trends in hyperautomation technologies as they pertain to accounting practices.

3.2 Data Collection

All records retrieved from the WoS database were subjected to a rigorous screening process. The inclusion criteria were limited to articles, as they were considered most relevant for a bibliometric analysis of scholarly discourse. Other types of documents, such as book chapters, editorials, and non-peer-reviewed sources, were excluded from the study. Furthermore, the scope was limited to articles published in the categories of business, management, and business finance to maintain a focus on accounting and related subject areas.

After preliminary screening using EXCEL, 48 records were excluded due to irrelevance or duplication, resulting in a dataset of 912 articles for bibliometric analysis. The records were extracted on October 5, 2024. Figure 2 presents an overview of the data collection process and the inclusion criteria for the bibliometric analysis of hyperautomation.

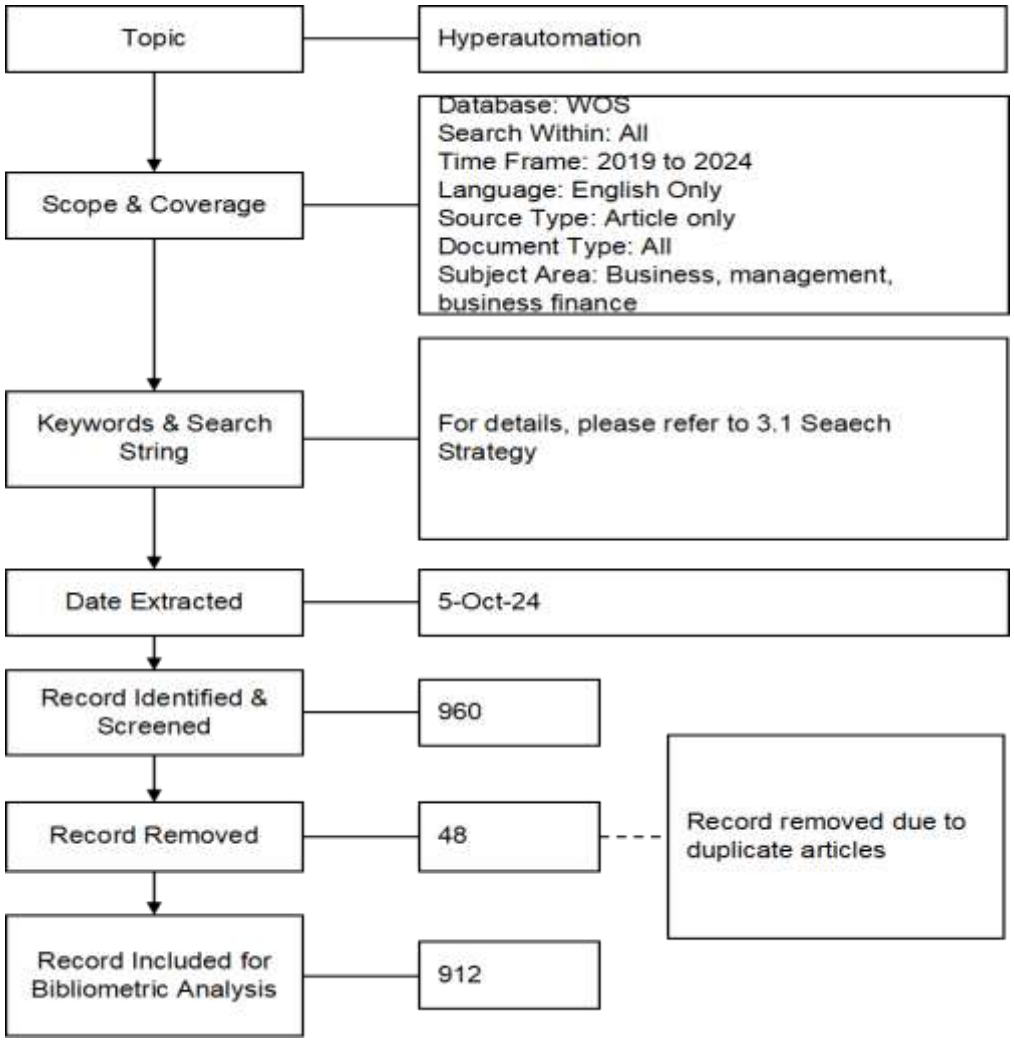

Fig. 2: Flow diagram of the search strategy [33,34]

3.3 Data Cleaning and Harmonization

To ensure the accuracy and consistency of the data before conducting the bibliometric analysis, we utilized BiblioMagika [35] and Excel to clean and harmonize authors' names, institutions, and countries. This tool resolves common issues such as variations in author name formats (e.g., "J. Doe" vs. "John Doe"), inconsistencies in institutional names, and discrepancies in country naming conventions (e.g., "USA" *vs.* "United States"). By standardizing these elements, we ensured that the data accurately reflects geographic distributions in the hyperautomation field.

In addition, OpenRefine [35] was employed to clean the dataset's author keywords and index keywords. This step was crucial for ensuring consistency in keyword co-occurrence analysis, as variations such as "AI" and "Artificial Intelligence" could fragment thematic trends. Through OpenRefine, synonymous or redundant terms were merged, resulting in a more cohesive and reliable dataset for identifying key research themes and trends in the literature.

3.4 Tools

The data from the WOS database was then exported as an Excel (.xlsx) and a Plain text file (.txt). This dataset contains the following information: type, year, language, topic area, source title, keywords, abstract, country, affiliation, citations and authorship. For the bibliometric analysis, we used Microsoft Excel to conduct a performance analysis, which included calculating key metrics such as the total number of publications (TP), citation counts and journal counts. This tool enabled an in-depth assessment of research productivity and impact within the field of hyperautomation in accounting, providing critical insights into the leading authors, institutions and countries contributing to this area.

Additionally, VOSviewer was used for visualizing the co-occurrence analysis of keywords, enabling the mapping of thematic clusters and trends within the literature [36]. This tool enabled the identification of frequently occurring keywords and their relationships [37], helping to reveal the intellectual structure of the research field and emerging areas of interest in hyperautomation.

4. Results

4.1 Publication Output and Growth Trend

The number of papers published by a specific entity, such as a journal, institution, or nation, over a given period is used to measure publication activity. Indicators of publication activity provide insights into the quantitative growth and structural evolution of a research field. They also help identify the most influential journals, organizations, and countries contributing to a particular discipline [38].

This section presents key bibliometric findings that assess the development of literature on hyperautomation and accounting during the research period of 2019 to 2024. The study examines the most prolific authors, institutions, and countries. The findings indicate a significant exponential growth in the literature on hyperautomation in accounting, highlighting the increasing relevance of this topic in recent years.

As shown in Figure 3, publication activity was relatively low in 2019, with only 54 publications. However, there was a notable increase in the number of publications in both 2020 and 2021, followed by significant peaks in 2022 (n = 151). This upward trend continued, with 212 publications in 2023 and reaching 302 publications in 2024. In terms of citations, the 912

publications accumulated a total of 60,369 citations, with an average of 66.19 citations per publication. Figure 1 illustrates that the number of citations has increased exponentially in parallel with the growth in published papers.

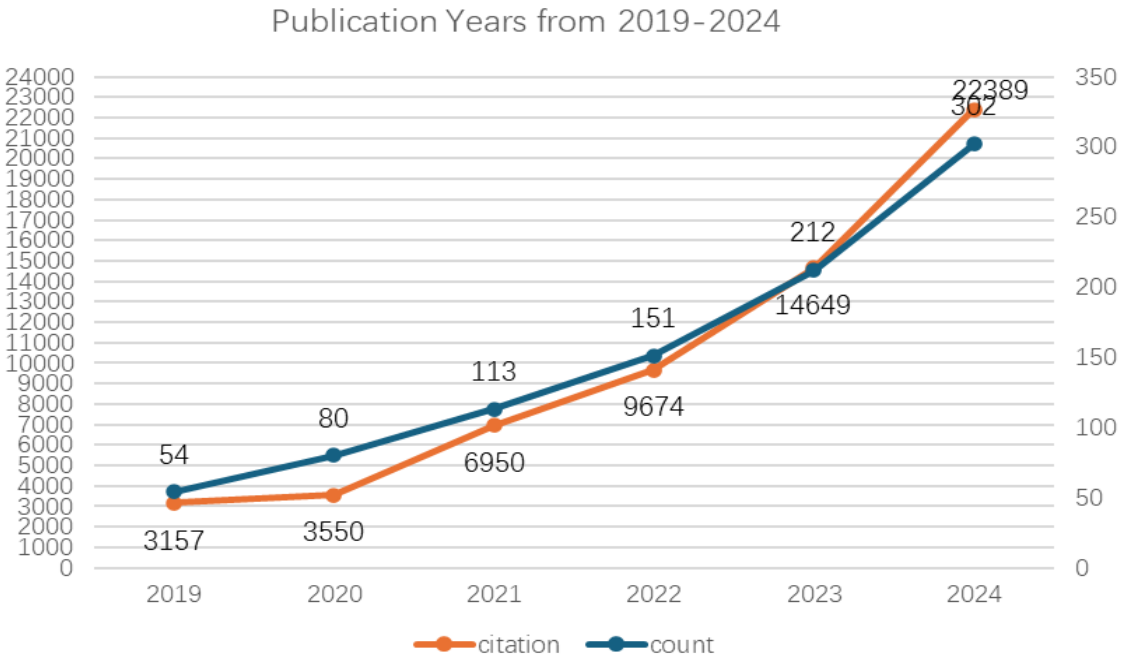

Fig. 3: Publication years from 2019 to 2024

4.2 Top Publications, Countries and Journals

This section highlights the most influential publications and countries contributing to the field of hyperautomation. In Figure 4, the top countries are identified based on the number of publications, providing a clearer understanding of their impact on the topic. The countries featured in Figure 4 account for 61.75% of all publications in this area. The United States leads with 528 publications, followed by China with 295.

Globally, several countries have made significant contributions to the development of emerging technologies, including AI and RPA, such as the United States, China, the United Kingdom, Australia and Spain. These nations have a strong presence in the tech industry, with many top technology companies and research institutions based within their borders. The United States and China are the largest spenders on research and development (R&D) globally [39]. American companies, such as Apple, Google and Microsoft, have a significant influence on the global tech landscape. Meanwhile, Chinese companies, including Huawei, Alibaba and Tencent, have become key players in sectors like telecommunications, e-commerce and internet services.

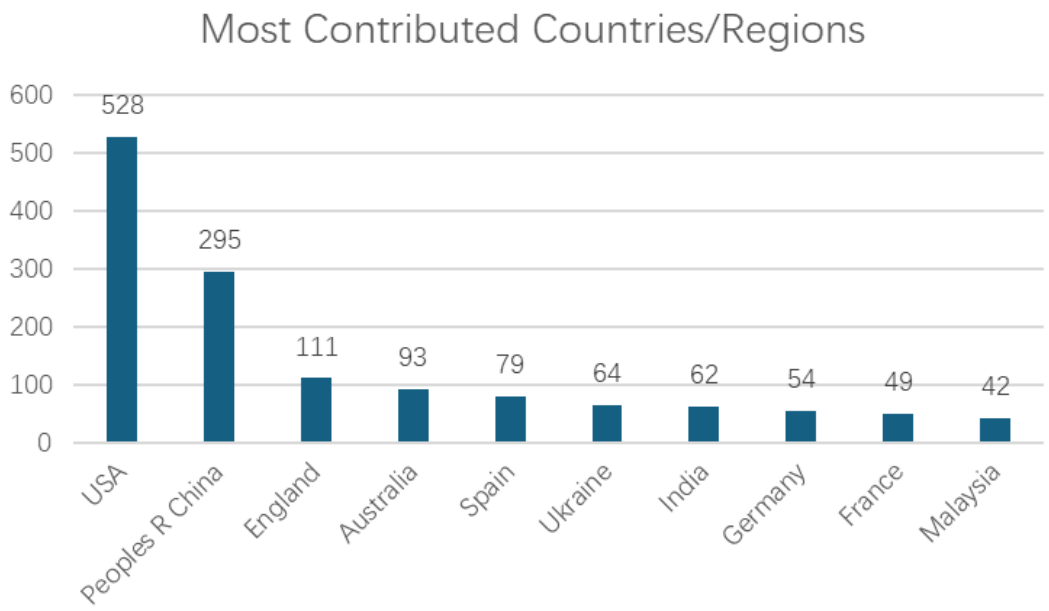

Fig. 4: The most contributed countries/regions

Globally, AI technology has undergone extensive development and application, with significant contributions from scientists worldwide toward advancing future professions. Major professional organizations, headquartered in countries such as the United States, China and the United Kingdom, have played a crucial role in shaping professional accounting standards and procedures, particularly in relation to emerging technologies.

Figure 5 presents a list of journals with the highest number of publications related to hyperautomation, AI, RPA and accounting. The journal Intelligent Systems in Accounting, Finance and Management leads with 36 publications, accounting for 16% of the total. The International Journal of Accounting Information Systems follows with 30 publications, while the Journal of Emerging Technologies in Accounting has 26 publications. Other notable journals include the Journal of Financial Reporting and Accounting, with 20 publications, and Accounting and Finance, with 19 publications. Together, these ten journals represent 24.67% of all papers published in this area. As noted, these journals primarily focus on the intersection of accounting and information technologies.

Fig. 5: The most contributed journals

4.3 Co-occurrence Analysis

Co-occurrence analysis of author keywords identifies and visualizes the relationships between frequently used terms within a set of academic publications. This analysis, conducted using VOSviewer, helps in understanding the conceptual structure of a research field by showing how often specific keywords appear together in the same papers. The strength of these relationships is depicted through a network of nodes (keywords) and edges (co-occurrence links) [40], revealing the interconnectedness between different research themes. In this context, keywords that appear together frequently signify that they represent related or overlapping research areas, which helps identify thematic clusters and trends within literature [30]. The co-occurrence map in this analysis was generated using the complete counting method. This method ensures that every co-occurrence of keywords is counted equally, meaning each instance where two keywords appear together in a publication contributes to the overall strength of their connection [41].

A minimum threshold of 9 occurrences was set, meaning that only keywords that appeared at least nine times in the dataset were included in the analysis. Out of the 2,841 keywords present in the dataset, 42 met this threshold, but 39 keywords were selected for further study. This filtering process ensures that the most frequently used and impactful keywords are included, allowing for a more precise and more focused understanding of the main themes in the research field.

In the resulting network, nodes represent keywords, where node size indicates their frequency; larger nodes correspond to more commonly used terms [40]. Edges denote co-occurrence relationships, where edge thickness reflects the strength of association [42]. Colors represent clusters, grouping keywords that frequently co-occur, thus representing distinct thematic areas within the research landscape [30]. The co-occurrence analysis generated four different clusters as shown in Figure 6, each representing a thematic area within the research field of hyperautomation, AI, RPA and accounting.

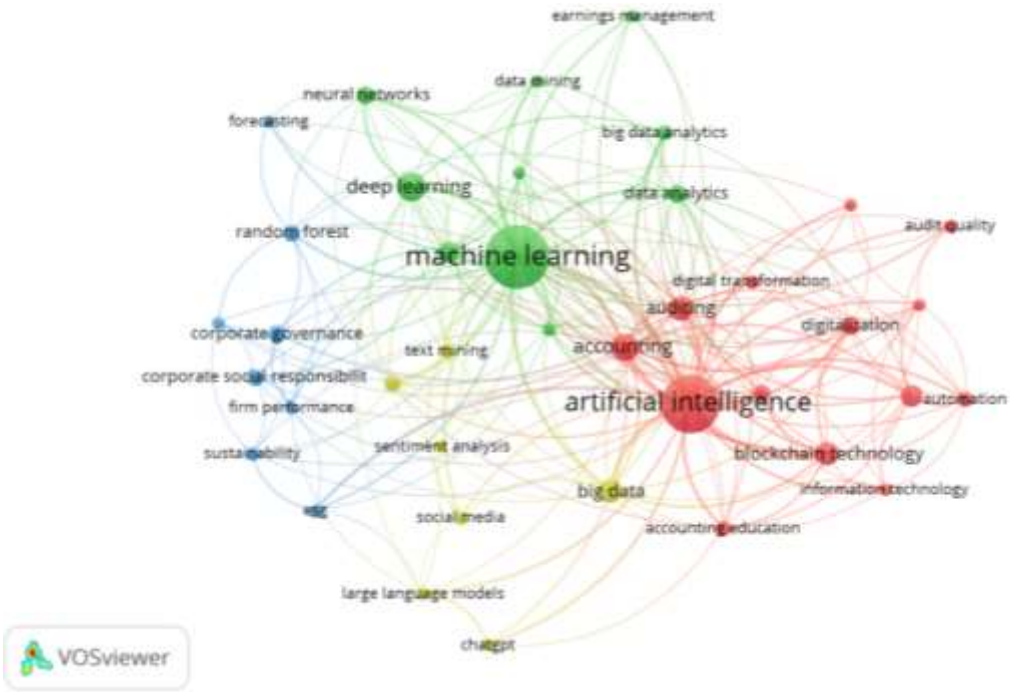

Fig. 6: Network visualization of the co-occurrence analysis of the keywords [43]

These clusters highlight different focal points within the literature and illustrate how various technological trends are influencing the evolution of accounting practices. Below is an expanded and detailed interpretation of each cluster:

Cluster 1 (Red Cluster) – Artificial Intelligence (AI), Accounting, Auditing and Robotic Process Automation (RPA):

This cluster represents the integration of AI and RPA into accounting and auditing processes (Table 3). Central keywords include AI, accounting, auditing, RPA, automation and blockchain technology. The inclusion of these terms reflects the growing influence of AI and RPA in automating traditional accounting tasks and improving audit processes.

Table 3
Keywords in cluster 1

Keywords	Links	Total link strength	Occurrences
Accounting	27	82	42
Accounting Education	11	22	14
Artificial Intelligence	30	202	186
Audit Quality	6	10	11
Auditing	21	60	35
Automation	10	21	13
Blockchain Technology	14	56	30
Decision-Making	6	11	9
Digital Transformation	7	12	12
Digitalization	12	33	18
Financial Reporting	12	16	9
Fintech	11	30	17
Information Technology	9	14	9
Robotic Process Automation	13	30	28

AI: AI is playing an increasingly critical role in accounting, particularly in areas that involve large-scale data analysis, decision support, and the automation of routine tasks. AI-driven tools can enhance accuracy in financial reporting, identify patterns in vast datasets, and detect anomalies in real-time, helping accountants and auditors focus on high-value activities rather than repetitive tasks [45].

RPA: RPA is closely linked to AI in this cluster. It automates repetitive, rules-based tasks such as data entry, transaction processing, and invoice management [46]. In auditing, RPA can streamline processes by automatically generating audit trails, checking compliance, and flagging discrepancies that require human oversight. The co-occurrence of AI and RPA in this cluster emphasizes the synergy between these technologies in reshaping the accounting profession.

Blockchain Technology: The presence of blockchain in this cluster highlights its potential for creating secure, immutable records of financial transactions. Blockchain's decentralized and transparent nature ensures that financial data is traceable, reliable, and resistant to tampering, which is critical for auditing and compliance [47]. Blockchain is also useful in areas such as fraud detection and ensuring the integrity of financial reporting.

This cluster highlights the transformative impact of hyperautomation technologies, such as AI and RPA, in reducing manual workloads, enhancing financial accuracy, and ensuring transparency in auditing and financial processes. The increasing adoption of blockchain technology further enhances these goals by securing and validating financial data.

Cluster 2 (Green Cluster) – Machine Learning (ML), Big Data and Data Analytics:

The green cluster is centered around the application of ML, big data, and data analytics in accounting and financial decision-making (Table 4). Keywords such as ML, DL, big data, data analytics, textual analysis, and neural networks dominate this cluster, reflecting the growing importance of data-driven approaches in modern accounting practices.

Table 4
Keywords in Cluster 2

Keywords	Links	Total link strength	Occurrences
Big Data Analytics	9	22	13
Data Analytics	16	35	18
Data Mining	10	16	10
Deep Learning	17	42	46
Earnings Management	6	10	9
Finance	13	25	12
Machine Learning	35	182	216
Neural Networks	10	23	19
Textual Analysis	13	33	25
Topic Modelling	8	15	10

ML and DL: These technologies are pivotal in processing large datasets and extracting insights that were previously unattainable using traditional accounting methods. ML models are applied to a wide range of accounting tasks, including fraud detection, financial forecasting, risk assessment, and performance evaluation [48]. DL, a subset of ML, is beneficial for tasks involving unstructured data [49], such as image recognition in audit documentation or speech analysis in financial reporting.

Big Data and Data Analytics: With the increasing availability of large datasets, big data analytics has become essential for analyzing complex financial information and improving decision-making [50]. In accounting, big data can be used to identify trends, forecast future financial performance, and optimize resource allocation [51]. The inclusion of data analytics highlights the importance of sophisticated analytical techniques in harnessing big data for more precise and insightful financial analyses.

Textual Analysis and Topic Modeling: These techniques, closely associated with ML, are used to analyze unstructured textual data from sources such as financial reports, social media, and news articles. Textual analysis enables accountants and financial professionals to gauge market sentiment, assess corporate reputation, and comprehend stakeholder perceptions, all of which are crucial for effective risk management and informed strategic decision-making [52].

This cluster highlights the growing reliance on data science and ML algorithms in accounting to process vast amounts of data, providing more profound insights into financial performance, risk factors, and market conditions. The use of textual analysis highlights the increasing importance of unstructured data in informing financial decisions, enabling professionals to extract valuable insights from previously untapped data sources.

Cluster 3 (Blue Cluster) – Corporate Governance, Sustainability and Firm Performance:

This cluster centers on the themes of corporate governance, sustainability and firm performance (Table 5). Keywords such as corporate governance, corporate social responsibility (CSR), sustainability, firm performance, financial performance and Environmental, Social and

Governance (ESG) are prominent in this cluster, indicating a focus on how hyperautomation and AI are being applied to improve organizational accountability, sustainability and performance management.

Table 5
Keywords in Cluster 3

Keywords	Links	Total link strength	Occurrences
Corporate Governance	9	18	18
Corporate Social Responsibility	9	13	16
ESG	7	17	11
Financial Performance	8	13	10
Firm Performance	8	12	10
Forecasting	5	9	10
Random Forest	11	20	17
Sustainability	9	11	11

Corporate Governance and CSR: Hyperautomation technologies, such as AI and RPA, are being increasingly applied to enhance transparency and accountability in corporate governance. These technologies can help organizations monitor compliance with regulations, ensure ethical business practices, and enhance decision-making processes at the board level [53,54]. AI can provide real-time insights into governance issues, while RPA automates tasks such as regulatory reporting and audit compliance, allowing firms to maintain high standards of corporate governance.

Sustainability and ESG Reporting: With growing pressure on firms to meet sustainability standards, automation technologies are being utilized to track and report on ESG metrics [55]. AI tools can assess a company's environmental impact, analyze social responsibility initiatives, and ensure compliance with governance frameworks. Automated reporting systems also help firms produce timely and accurate ESG disclosures, which are crucial for maintaining investor trust and meeting regulatory requirements [56].

Firm and Financial Performance: Hyperautomation technologies are not only being used to ensure compliance but also to enhance firm performance. By automating routine financial tasks and providing data-driven insights, AI and RPA contribute to enhanced financial decision-making, more effective resource allocation and improved operational efficiency [57]. This cluster reflects the growing recognition that automation technologies are crucial for both enhancing bottom-line performance and ensuring that organizations fulfill their ethical and governance obligations.

This cluster suggests that hyperautomation plays a pivotal role in supporting ethical business practices and sustainable growth, while also improving firm performance by providing real-time data for informed decision-making. The focus on corporate governance and CSR highlights the importance of aligning technology-driven efficiencies with broader social and environmental goals.

Cluster 4 (Yellow Cluster) – Natural Language Processing (NLP), Sentiment Analysis and Unstructured Data:

The final cluster centers on the use of natural language processing (NLP) and sentiment analysis in analyzing unstructured data (Table 6). Key terms include natural language processing, ChatGPT, sentiment analysis, text mining, social media and large language models (LLMs).

Table 6
Keywords in Cluster 4

Keywords	Links	Total link strength	Occurrences
Big Data	16	51	31
Chatgpt	4	12	10
Large Language Models	8	14	9
Natural Language Processing	11	24	16
Sentiment Analysis	6	7	9
Social media	6	11	12
Text Mining	9	16	11

NLP and Sentiment Analysis: NLP is used to analyze large amounts of unstructured textual data from various sources, including social media, financial reports, news articles, and earnings call transcripts [58]. These analyses enable financial professionals to understand public sentiment, detect market trends, and assess corporate reputation[59]. Sentiment analysis tools, which analyze the tone and context of written or spoken language, provide valuable insights into stakeholder opinions and market reactions, enabling organizations to make informed, data-driven decisions [60].

Large Language Models (e.g., ChatGPT): The inclusion of ChatGPT and other large language models in this cluster highlights the potential of AI-driven language models to automate tasks such as report generation, customer service, and financial analysis [59]. These models can process and generate human-like text, making them valuable tools for automating repetitive tasks in accounting and finance. In addition, it has the potential to significantly impact auditing and fraud detection processes within the accounting field [61].

Text Mining and Social Media: Text mining is increasingly being used to extract insights from large datasets, particularly unstructured data found on social media platforms [62]. Companies can utilize social media data to track trends, measure customer satisfaction, and pinpoint potential risks or opportunities in real-time.

This cluster underscores the increasing significance of unstructured data in financial decision-making and the application of NLP and AI-driven language models to derive insights from vast volumes of text. These technologies are playing a crucial role in enabling real-time analysis of sentiment and behavior, which is particularly valuable for market prediction and risk management.

The four clusters identified in this co-occurrence analysis provide a clear picture of how hyperautomation technologies such as AI, RPA, ML, NLP and blockchain are reshaping the accounting field. Each cluster focuses on a distinct aspect of automation, ranging from enhancing financial reporting and auditing processes to improving corporate governance, sustainability and decision-making through advanced data analytics and sentiment analysis.

These findings contribute to the body of knowledge by highlighting the central role that data-driven decision-making and automation technologies play in modern accounting practices. The analysis reveals that the field is becoming increasingly interdisciplinary, integrating advanced computational techniques to address challenges such as regulatory compliance, transparency and ethical corporate behavior. This study highlights the need for further research into the ethical implications of these technologies and their potential to shape the future of the accounting profession.

The findings from this co-occurrence analysis provide critical insights into the current state of research on hyperautomation and accounting. By identifying key thematic clusters, the study reveals major trends in the field, such as the increasing adoption of AI and RPA for automating accounting and auditing tasks, the growing use of ML and big data in financial analysis, and the

emerging importance of NLP and sentiment analysis in analyzing unstructured data sources like social media.

This study contributes to the literature by mapping the intellectual structure of the field and identifying key research areas that are shaping the future of accounting in the context of technological advancements. It highlights how automation technologies are not only improving the efficiency and accuracy of financial processes but also promoting ethical business practices, corporate transparency and sustainability. Furthermore, the study highlights the increasing significance of real-time data analysis in financial decision-making, providing valuable insights that can inform future research and practice.

5. Discussion

5.1 Summary of Key

The bibliometric analysis reveals a substantial increase in academic interest in hyperautomation within accounting between 2019 and 2024. Publications rose from 54 in 2019 to 302 in 2024, reflecting the expanding relevance of technologies such as AI, RPA and ML. The United States and China emerged as leading contributors. Co-occurrence analysis identified four thematic clusters: (1) AI and RPA in accounting and auditing; (2) ML and big data in financial analytics; (3) hyperautomation's integration into corporate governance and sustainability; and (4) NLP and sentiment analysis for unstructured data in financial decision-making.

5.2 Interpretation of Findings

The exponential increase in publications over the past few years can be attributed to the rapidly advancing technological landscape and the widespread recognition of the potential of AI and RPA to automate routine accounting tasks. This rise parallels broader trends in the automation of financial processes, where organizations increasingly rely on advanced AI tools to streamline operations, reduce human error and ensure compliance with regulatory standards. The co-occurrence analysis reveals that AI and RPA are central themes in the automation of accounting, particularly in enhancing audit processes, detecting anomalies in financial data, and improving the accuracy of real-time reporting. According to the research of Judijanto *et al.,* [63], the complementary roles of AI and RPA in improving organizational outcomes and employee well-being are emphasized.

Additionally, the prominence of keywords related to ML, big data and data analytics demonstrates that data-driven decision-making is a crucial aspect of modern accounting. Big data analytics, particularly through ML and DL, is increasingly applied to enhance financial reporting quality by detecting fraud, identifying earnings management and analyzing narrative disclosures [64]. Moreover, DL, as a cutting-edge technique for forecasting monthly total sales, enables business leaders to develop more informed and strategic business plans [65]. Automation is increasingly vital for regulatory compliance and ethical transparency in corporate governance, especially as sustainability reporting standards become more stringent. As De Silva *et al.,* [66] note, technologies like AI and blockchain support ESG reporting, circular economy planning and strategic decision-making to promote sustainable development. The use of NLP and sentiment analysis in financial decision-making further highlights how unstructured data, such as social media or market sentiment, is becoming a valuable resource for financial analysts seeking real-time insights into market trends.

5.3 Implications for Practice

The findings from this study suggest several key implications for practice in the accounting field. First, the integration of AI and RPA into accounting processes can significantly improve operational efficiency, reduce costs and enhance the accuracy of financial reporting. These technologies enable real-time auditing and compliance checks, allowing firms to respond more quickly to regulatory demands and reduce the likelihood of financial discrepancies. Furthermore, the application of ML and big data analytics in accounting can provide deeper insights into financial performance and market conditions, helping organizations make more informed strategic decisions.

For corporate governance, the use of AI in tracking and reporting ESG metrics can ensure that companies meet the growing demand for sustainability disclosures. This not only enhances transparency but also improves a firm's reputation among investors and stakeholders. Additionally, the increased application of NLP and sentiment analysis tools provides opportunities for accountants and financial professionals to assess public sentiment and predict market movements, allowing for more dynamic and real-time decision-making.

5.4 Recommendations for Future Research

Despite notable advances, further research is needed to address the challenges and opportunities posed by the rapid evolution of hyperautomation in accounting. First, future studies could explore how hyperautomation can be effectively adopted by small- and medium-sized enterprises (SMEs). Most existing implementations are concentrated in large firms with abundant resources [67]. Future studies may investigate modular and cost-effective automation solutions for SMEs, as well as barriers such as a lack of technical expertise and concerns over initial investments. Longitudinal studies on return on investment, productivity gains and error reduction in SME contexts would provide valuable insights.

Second, ethical considerations surrounding hyperautomation demand greater attention. Issues such as algorithmic bias, opacity in decision logic, data privacy, and labor displacement are critical [68]. Scholars may develop ethical frameworks to guide responsible implementation. This includes ensuring algorithmic transparency, securing sensitive data, and creating upskilling pathways for displaced accounting professionals.

Third, the use of NLP and sentiment analysis in financial contexts remains underexplored. With the proliferation of unstructured data, these tools are expected to revolutionize financial forecasting, risk detection, and reporting [69]. However, current NLP models often struggle to process context-rich financial language [70]. Research should focus on enhancing language models to improve accuracy and explore their practical applications in areas such as real-time reporting, fraud detection, and ESG sentiment tracking. Additionally, the ethical risks associated with using sentiment data, including potential manipulation or biased interpretation, should be thoroughly explored.

Fourth, broader socioeconomic impacts of hyperautomation in accounting warrant further investigation. Beyond operational improvements, hyperautomation is reshaping job roles, skill requirements, and employment patterns. Comparative studies across regions and industries can shed light on how regulatory, cultural and economic factors influence adoption. For example, research could investigate how the uptake of hyperautomation differs between developed and emerging economies, and its implications for competitiveness and employment. These insights can support the development of inclusive policies and effective workforce planning.

Lastly, as highlighted in recent publications from 2024 and 2025, the integration of generative AI into accounting workflows is rapidly emerging as a new frontier [71-74]. Future bibliometric and empirical research should capture this trend and investigate how generative models affect assurance, financial reasoning and ethical oversight. Together, these directions will support the development of a more adaptive, inclusive and ethically grounded accounting profession in the era of hyperautomation.

6. Conclusion

This study has mapped the academic landscape of hyperautomation in accounting from 2019 to 2024 through a comprehensive bibliometric analysis. The findings reveal exponential growth in publications on key technologies such as AI, RPA, ML and NLP, with the United States and China leading contributions. Co-occurrence analysis identified four dominant thematic clusters: AI and RPA in accounting, ML and big data analytics, the role of automation in governance and sustainability, and the growing relevance of NLP and sentiment analysis in financial contexts.

By illuminating how these technologies are reshaping accounting practices, the study makes both theoretical and practical contributions to the field. The findings offer actionable insights for practitioners seeking to enhance operational efficiency, compliance and decision-making through automation. However, critical gaps remain, particularly in the adoption of automation among SMEs and the ethical implications of AI. Addressing these issues through future research is essential for ensuring that hyperautomation is deployed responsibly and equitably. In light of emerging trends such as generative AI, the study calls for sustained inquiry into the evolving frontiers of automation in accounting.

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