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MAPPING IDEA & LITERATURE FORMAT | RESEARCH ARTICLE

Mapping Global Internal Control Research: A Bibliometric Analysis of Publication Trends, Emerging Themes, and Collaboration Patterns in Scopus (2022–2025)

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ABSTRACT

Internal control has become increasingly important as organizations integrate governance, enterprise risk management, and digital transformation into organizational decision making. The COSO Integrated Framework establishes internal control as the foundation of governance and risk management, while digital transformation has fundamentally reshaped organizational processes and control systems (COSO, 2013 ; Vial, 2019). This study maps the global development of internal control research using a bibliometric approach based on Scopus-indexed publications from 2022 to 2025. Data were analyzed using Biblioshiny after a systematic screening process that resulted in 934 eligible articles in the Business, Management and Accounting subject area. The analysis examined publication growth, influential authors, source journals, country collaboration, citation performance, and keyword evolution. The findings reveal a substantial increase in global research productivity during the study period, accompanied by stronger international collaboration and the emergence of new thematic areas. China emerged as the leading contributor to global internal control research, while corporate governance, digital transformation, risk management, audit quality, environmental, social and governance (ESG), and artificial intelligence emerged as the dominant research themes. The bibliometric evidence further demonstrates a clear shift from conventional internal control systems toward digitally enabled governance and intelligent control mechanisms. This study contributes by providing a comprehensive knowledge map of recent internal control research, identifying emerging research directions, and offering practical references for researchers interested in governance, auditing, and organizational control systems.

Keywords: Internal Control, Bibliometric Analysis, Corporate Governance, Digital Transformation, Scopus.

I. Introduction

Internal control has become a fundamental component of organizational governance, ensuring operational effectiveness, reliable financial reporting, regulatory compliance, and effective risk management (COSO, 2013). As organizations operate in increasingly complex business environments characterized by

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digital transformation, technological innovation, and sustainability challenges, the role of internal control has expanded beyond traditional financial oversight toward supporting strategic decision-making and organizational resilience (Vial, 2019). Contemporary organizations increasingly integrate internal control into enterprise risk management, corporate governance, cybersecurity, environmental, social, and governance (ESG) initiatives, and digital decision-making processes. Consequently, internal control has evolved into a strategic organizational capability that strengthens accountability, transparency, organizational resilience, and sustainable organizational performance (COSO, 2013; Tricker, 2019). Recent empirical evidence also shows that internal control has become increasingly integrated with sustainability reporting, digital governance, and ESG disclosure practices (Yan et al., 2024; Moffitt et al., 2024), highlighting its strategic role in contemporary organizational governance.

Recent developments in accounting and auditing research demonstrate that internal control is increasingly investigated in relation to digital transformation, artificial intelligence, enterprise risk management, sustainability reporting, corporate governance, cybersecurity, and organizational resilience. This evolution reflects the increasing integration of governance, risk, and compliance (GRC) principles with digital technologies, which have significantly reshaped organizational control systems and internal audit practices (Vial, 2019; Tricker, 2019). Consequently, the volume of scientific publications on internal control has grown substantially, reflecting its emergence as an interdisciplinary research domain spanning accounting, information systems, strategic management, and corporate governance.

The continuous increase in scientific publications creates new challenges for researchers attempting to understand the intellectual structure of the field. As publication volume grows, identifying influential authors, leading journals, collaborative research networks, and emerging thematic areas becomes increasingly difficult through conventional literature reviews. Bibliometric analysis provides a systematic and quantitative approach to overcome these challenges by examining publication patterns, citation relationships, collaboration networks, and keyword evolution. According to (Donthu et al., 2021), bibliometric analysis enables researchers to evaluate the development of scientific knowledge objectively while revealing the intellectual foundations and future directions of a research field. Similarly, (Zupic & Čater, 2015) emphasize that bibliometric techniques provide valuable insights into knowledge structures and research evolution through science mapping methods.

Several bibliometric studies have investigated related topics, including internal auditing, audit quality, fraud prevention, credit risk management, digital auditing, and internal control in specific organizational contexts. (Aryawati et al., 2024) conducted a bibliometric analysis of internal control research in higher education institutions using Scopus data, while (Samara et al., 2025) demonstrated the growing convergence of corporate governance research with artificial intelligence through bibliometric analysis. Nevertheless, these studies remain limited to specific domains and do not provide a comprehensive mapping of global internal control research across the broader Business, Management and Accounting discipline. Consequently, a comprehensive bibliometric analysis of recent global internal control research remains limited. However, existing studies generally concentrate on specific subtopics or national contexts rather than providing a comprehensive overview of global internal control research. Furthermore, previous bibliometric investigations frequently employ datasets covering broader historical periods, making it difficult to capture the most recent developments associated with digital transformation, environmental, social and governance (ESG) implementation, artificial intelligence, and digital governance.

This limitation reveals an important research gap. To date, limited bibliometric evidence specifically maps the global development of internal control research using recent Scopus-indexed publications within the 2022–2025 period. Although previous bibliometric studies have examined related topics such as internal auditing, audit quality, and fraud prevention, no recent study has comprehensively mapped global internal control research within the Business, Management and Accounting discipline using a recent Scopus dataset covering the 2022 to 2025 period. Consequently, evidence regarding publication growth, international collaboration, thematic evolution, and intellectual structure remains fragmented (Aryawati et al., 2024; Donthu et al., 2021). Accordingly, this study addresses the following research questions:

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a. RQ1: How has global internal control research evolved during the 2022–2025 period?
b. RQ2: Who are the most influential authors, countries, journals, and publications in global internal control research?
c. RQ3: What collaboration patterns and thematic developments characterize global internal control research?
d. RQ4: What emerging research themes and future research directions can be identified from recent bibliometric evidence?

Based on these research questions, this study aims to map the global development of internal control research through a bibliometric analysis of Scopus-indexed publications published between 2022 and 2025. Specifically, the study examines publication trends, leading journals, influential authors, international collaboration networks, citation performance, and keyword evolution to identify emerging research themes and future research opportunities. This study makes three primary contributions to the existing literature. First, it provides an updated bibliometric overview of global internal control research during a period characterized by rapid digital transformation, artificial intelligence adoption, ESG implementation, and governance innovation. Second, it identifies emerging thematic developments and international collaboration patterns, thereby enriching the understanding of knowledge evolution within the internal control domain. Third, the findings offer practical guidance for researchers, practitioners, and policymakers by highlighting promising research directions and supporting the evidence-based development of governance and internal control practices in contemporary organizations **(**(Yan et al., 2024; Samara et al., 2025)**.**

Recent bibliometric studies have examined several governance-related topics, including internal auditing, audit quality, fraud prevention, and internal control within specific organizational contexts. These studies have contributed to understanding the evolution of specialized research domains by identifying publication trends, collaboration networks, and thematic developments. However, their analytical scope remains concentrated on particular sectors or governance topics, rather than providing a comprehensive mapping of global internal control research across the Business, Management and Accounting discipline. Despite the growing number of bibliometric studies in accounting and auditing, comprehensive evidence focusing specifically on global internal control research remains limited. Existing bibliometric studies have predominantly examined related domains, including internal auditing, audit quality, fraud prevention, corporate governance, and internal control within specific organizational contexts, rather than investigating internal control as an independent and comprehensive research field. Moreover, most previous studies focus on particular sectors or thematic areas and rarely integrate publication performance, collaboration networks, intellectual structure, citation impact, and thematic evolution within a single bibliometric framework. Consequently, a comprehensive understanding of the recent global development of internal control research remains fragmented, particularly during the period characterized by rapid digital transformation, artificial intelligence adoption, ESG implementation, and governance innovation (Vial, 2019**;** Yan et al., 2024**;** Samara et al., 2025)**.**

This study addresses these gaps by providing an updated and comprehensive knowledge map based on 934 Scopus-indexed journal articles published between 2022 and 2025, thereby offering a broader understanding of the intellectual structure, emerging research themes, and future directions of global internal control research. Unlike previous studies focusing on specific accounting subfields, this study positions internal control as an independent research domain and provides an updated intellectual map reflecting recent developments in digital governance, ESG, and artificial intelligence (Donthu et al., 2021). This integrated approach provides a comprehensive and up-to-date knowledge map of the intellectual structure, emerging research themes, and collaboration patterns within the global internal control literature. Consequently, the study not only advances the bibliometric understanding of internal control research but also offers evidence-based directions for future research and practical insights for researchers, practitioners, and policymakers in strengthening governance and organizational control systems.

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II. Literature Review and Conceptual Background

2.1. Internal Control as an Evolving Research Domain

Internal control has evolved from a mechanism primarily designed to safeguard organizational assets into a comprehensive governance system that supports strategic decision-making, accountability, and organizational sustainability. The Committee of Sponsoring Organizations of the Treadway Commission (COSO, 2013) defines internal control as a process designed to provide reasonable assurance regarding the achievement of organizational objectives in operational effectiveness, financial reporting reliability, and regulatory compliance. As organizations increasingly operate in dynamic and technology-driven environments, internal control has become closely integrated with enterprise risk management, corporate governance, digital transformation, and organizational resilience (Tricker, 2019; Vial, 2019). Recent developments indicate that the scope of internal control has expanded considerably beyond traditional accounting and auditing functions. Organizations now employ internal control frameworks to manage cybersecurity risks, support environmental, social, and governance (ESG) initiatives, improve organizational transparency, and strengthen strategic decision-making. Consequently, internal control has become an interdisciplinary research domain involving accounting, finance, management, information systems, public administration, and organizational studies.

2.2. Bibliometric Analysis in Accounting and Auditing Research

The rapid growth of scientific publications has increased the complexity of understanding research developments within specific disciplines. Traditional literature reviews often rely on subjective selection of studies and therefore may not adequately represent the intellectual structure of an entire research field. Bibliometric analysis addresses this limitation by applying quantitative techniques to evaluate publication performance, citation relationships, collaboration networks, and thematic evolution (Donthu et al., 2021; Zupic & Čater, 2015). According to Donthu et al. (2021), bibliometric analysis provides a systematic approach for identifying influential publications, productive authors, leading journals, and emerging research themes. Similarly, Zupic and Čater (2015) argue that science mapping techniques enable researchers to visualize the evolution of scientific knowledge and reveal hidden relationships among research topics. (Aria & Cuccurullo, 2017) further demonstrate that Bibliometrix and Biblioshiny facilitate comprehensive bibliometric analysis through reproducible statistical procedures and visual mapping techniques. Because of these advantages, bibliometric methods have been widely adopted in accounting, auditing, finance, corporate governance, and management research to evaluate scientific development objectively and identify future research opportunities (Firdausi et al., 2025).

2.3. Recent Bibliometric Studies on Internal Control and Related Research

The application of bibliometric analysis within accounting and auditing has increased substantially during recent years. Previous studies have examined research trends in internal auditing, audit quality, fraud prevention, risk management, sustainability reporting, and artificial intelligence in accounting. These investigations consistently demonstrate that accounting research is undergoing rapid transformation through digitalization and multidisciplinary collaboration. Recent bibliometric studies consistently indicate that accounting and auditing research is becoming more interdisciplinary. (Kuswara et al., 2024b) demonstrated the convergence of internal auditing with governance and digital technologies, whereas (Nurachman et al., 2025) reported a similar shift in audit quality research toward sustainability and digital transformation. However, neither study specifically examined internal control as an independent research field. This distinction provides the primary justification for the present bibliometric analysis.

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2.4. Positioning of the Present Study

To address these limitations, the present study provides a comprehensive bibliometric analysis of global internal control research using Scopus-indexed publications published between 2022 and 2025. Unlike previous bibliometric studies that focus on individual accounting subtopics, this study integrates publication performance, author productivity, international collaboration, citation analysis, thematic evolution, and conceptual structure analysis within a unified analytical framework. This integrated approach enables a more comprehensive understanding of the intellectual structure, emerging research themes, and future research directions in the field of internal control. The study further emphasizes the identification of emerging research themes related to digital transformation, artificial intelligence, corporate governance, enterprise risk management, and sustainability. By systematically mapping the recent evolution of global internal control research, this study contributes not only to the advancement of bibliometric knowledge but also provides evidence-based insights that support future academic research, organizational governance, auditing practices, and policy development.

Building upon the identified research gap, the present study adopts a bibliometric approach to provide a comprehensive and systematic overview of contemporary global internal control research. Specifically, the study identifies publication trends, influential authors, leading journals, collaboration networks, highly cited publications, and thematic evolution to establish the current intellectual structure of the field and to highlight promising directions for future research. By integrating publication performance, intellectual structure, collaboration networks, citation relationships, and thematic evolution within a unified analytical framework, this study seeks not only to describe the current state of knowledge but also to identify emerging research directions and future opportunities. Accordingly, the following section explains the research design, data collection procedures, and bibliometric analytical techniques employed to ensure methodological transparency and reproducibility. Accordingly, this study is expected to enrich the bibliometric literature on internal control by providing an updated evidence base derived from recent Scopus-indexed publications. The findings are expected to assist researchers in identifying emerging research opportunities while supporting practitioners and policymakers in understanding the evolving role of internal control within contemporary organizational governance.

III. Research Method

3.1. Research Design

This study employed a quantitative bibliometric research design to systematically examine the global evolution of internal control research. Bibliometric analysis enables researchers to evaluate scientific literature objectively through quantitative indicators, citation relationships, collaboration networks, and science mapping techniques (Donthu et al., 2021; Aria & Cuccurullo, 2017). Unlike traditional literature reviews, bibliometric analysis minimizes subjective interpretation by utilizing publication metadata to identify intellectual structures, influential contributors, thematic evolution, and emerging research trends. The present study focuses on mapping recent developments in global internal control research published between 2022 and 2025. The 2022 to 2025 period was selected because it captures the most recent phase of post-pandemic organizational transformation, during which digital governance, artificial intelligence, ESG reporting, and technology-enabled internal control systems became increasingly prominent in accounting and governance research (Vial, 2019; Donthu et al., 2021).

3.2. Data Source

The bibliographic dataset was obtained from the Scopus database, which is widely recognized as one of the most comprehensive and reliable multidisciplinary scientific databases for bibliometric research.

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Scopus provides extensive bibliographic information, including authors, affiliations, abstracts, keywords, citations, and references, making it particularly suitable for large-scale science mapping and bibliometric analysis. Compared with other academic databases, Scopus offers broad international journal coverage, standardized metadata, and high-quality indexing, thereby enabling reliable bibliometric mapping, citation analysis, and cross-country comparisons.

3.3. Data Collection Procedure

The bibliographic data were retrieved systematically from the Scopus database in **January 2026** using the search keyword. To ensure the relevance and quality of the dataset, several screening stages were subsequently applied. The screening procedure consisted of the following stages:

a. Stage 1: Initial search using the keyword "Internal Control", resulting in 3,812 documents.
b. Stage 2: Restriction by Subject Area: Business, Management and Accounting, resulting in 965 documents.
c. Stage 3: Restriction by Document Type: Article, resulting in 965 documents.
d. Stage 4: Restriction by Language: English, resulting in a final dataset of 934 journal articles.

The final dataset comprised 934 Scopus-indexed journal articles, which formed the basis of the bibliometric analyses conducted in this study. The screening procedure is illustrated in Figure 1 and consisted of four sequential stages. In the first stage, an initial search of the Scopus database using the keyword "Internal Control" identified 3,812 documents. The second stage restricted the results to the Business, Management and Accounting subject area, reducing the dataset to 965 documents. In the third stage, only journal articles were retained, while the fourth stage limited the dataset to publications written in English. After applying all screening criteria, the final dataset comprised 934 Scopus-indexed journal articles, which served as the basis for the bibliometric analyses conducted in this study. The screening procedure consisted of:

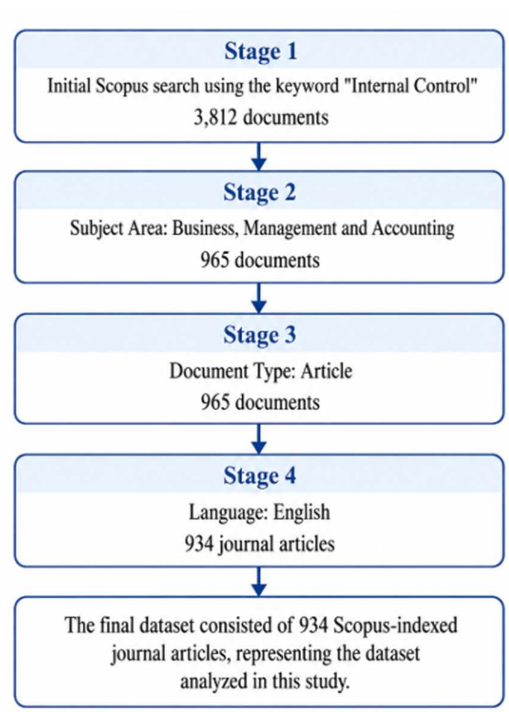

Figure 1. Research Workflow

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Prior to bibliometric analysis, the retrieved records underwent a systematic data cleaning and validation process to improve dataset consistency and analytical reliability. Duplicate records were identified and removed during the Scopus export verification process. Records containing incomplete bibliographic metadata, such as missing author information, publication year, or source title, were excluded from further analysis. In addition, keyword inconsistencies resulting from variations in spelling, singular and plural forms, abbreviations, and synonymous terms were standardized before conducting science mapping analyses. This preprocessing stage ensured that the co-occurrence analysis, thematic mapping, and citation analysis accurately represented the intellectual structure of global internal control research.

3.4. Data Analysis

Bibliometric analysis was conducted using the Bibliometrix package (Version 5.4.0) through the Biblioshiny web interface under R Version 4.6.0 (R Foundation for Statistical Computing). Biblioshiny facilitates comprehensive bibliometric analysis through an interactive interface while ensuring methodological transparency and analytical reproducibility (Aria & Cuccurullo, 2017). To achieve the research objectives, several complementary bibliometric techniques were employed, including:

a. descriptive bibliometric analysis;
b. annual scientific production analysis;
c. source analysis;
d. author productivity analysis;
e. country productivity analysis;
f. citation analysis;
g. co-authorship network analysis;
h. keyword co-occurrence analysis; and
i. thematic evolution analysis.

The integration of these analytical techniques provides a comprehensive understanding of the intellectual structure, collaboration patterns, and thematic evolution of global internal control research. The bibliometric network analyses were generated using the default normalization procedures implemented in Biblioshiny. Threshold values for keyword occurrence, citation frequency, and collaboration networks were determined automatically according to the selected visualization functions, thereby ensuring consistent representation of the bibliographic dataset while minimizing subjective parameter adjustments.

3.5. Bibliometric Indicators

Several bibliometric indicators were employed to evaluate the scientific development of global internal control research. Publication productivity was analyzed to identify annual publication trends. Citation analysis was conducted to determine influential publications and authors. Country analysis examined the geographical distribution of research output and international collaboration. Source analysis identified the journals contributing most actively to the field. Keyword co-occurrence analysis was used to identify dominant research topics and emerging themes, while thematic evolution analysis explored changes in research interests throughout the observation period.

3.6. Research Workflow

The overall research procedure consisted of five sequential stages:

a. Identification of the research topic.

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b. Retrieval of bibliographic data from the Scopus database.
c. Data screening, cleaning, and validation.
d. Bibliometric analysis using Bibliometrix through the Biblioshiny interface.
e. Interpretation of the bibliometric findings and identification of future research directions.

IV. Results and Discussion

4.1. Descriptive Bibliometric Overview

Figure 2 summarizes the general characteristics of the bibliographic dataset analyzed in this study. The dataset comprises Scopus-indexed journal articles on internal control published between 2022 and 2025. Following the screening procedure, a total of 934 journal articles from 308 publication sources were included in the bibliometric analysis. The dataset involves 2,216 contributing authors, indicating broad scholarly engagement in internal control research across diverse academic communities. Only 93 publications were authored by a single researcher, whereas the average number of co-authors per document reached 3.01, suggesting that collaborative research has become the dominant pattern within this field. International collaboration is also evident, with an international co-authorship rate of 25.37%. This finding indicates that approximately one-quarter of the publications involved researchers from multiple countries, reflecting the increasingly global nature of internal control research and the growing exchange of knowledge across institutions.

The annual publication growth rate reached 28.45%, confirming the rapid expansion of internal control research during the observation period. Furthermore, the dataset contains 52,327 cited references and an average of 7.865 citations per document, indicating that the field is supported by a well-established and continuously expanding scientific knowledge base. Overall, the descriptive bibliometric indicators demonstrate that internal control has evolved into a mature and internationally connected research domain characterized by sustained publication growth, extensive scholarly collaboration, and increasing scientific influence. Collectively, these characteristics suggest that internal control has become a strategic area of research extending beyond its traditional accounting and auditing functions to encompass corporate governance, enterprise risk management, digital transformation, and organizational sustainability. This scientific landscape provides a strong foundation for interpreting the subsequent bibliometric mapping results presented in this study.

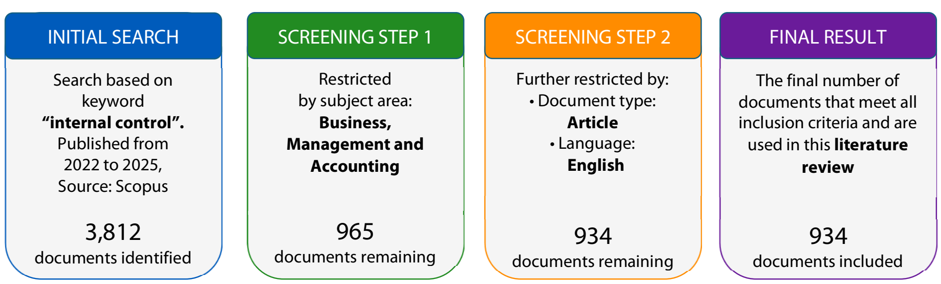

Figure 2. Research Data Screening Process

Figure 3. Main Information about the Bibliographic Dataset

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Provides an overview of the bibliometric dataset analyzed in this study. The descriptive indicators reveal rapid publication growth, increasing international collaboration, and strong scholarly participation, confirming the dynamic development of global internal control research.

4.2. Annual Scientific Production

Figure 4 presents the annual scientific production of Scopus-indexed publications on internal control between 2022 and 2025. The figure illustrates the yearly publication trend and reflects the growing scholarly attention devoted to internal control during the observation period. The sustained increase in annual publication output indicates that internal control has become an increasingly important interdisciplinary research topic. This pattern suggests that organizational challenges associated with digital transformation, governance reform, and enterprise risk management have generated continuous scholarly attention rather than temporary research interest (Donthu et al., 2021). The most substantial increase occurred during the latter years of the observation period, suggesting an expanding research interest in digital governance, technology-enabled control systems, and organizational resilience. The increasing publication volume also reflects stronger scholarly collaboration and broader international engagement in addressing issues related to accountability, transparency, and effective organizational governance. Overall, the annual publication trend demonstrates that internal control has evolved beyond its traditional role as an accounting and compliance mechanism. It has increasingly emerged as a multidisciplinary research domain that integrates governance, information systems, strategic management, auditing, risk management, and digital innovation. These findings are consistent with the descriptive bibliometric indicators presented earlier and further confirm the growing scientific relevance of internal control in contemporary organizational research.

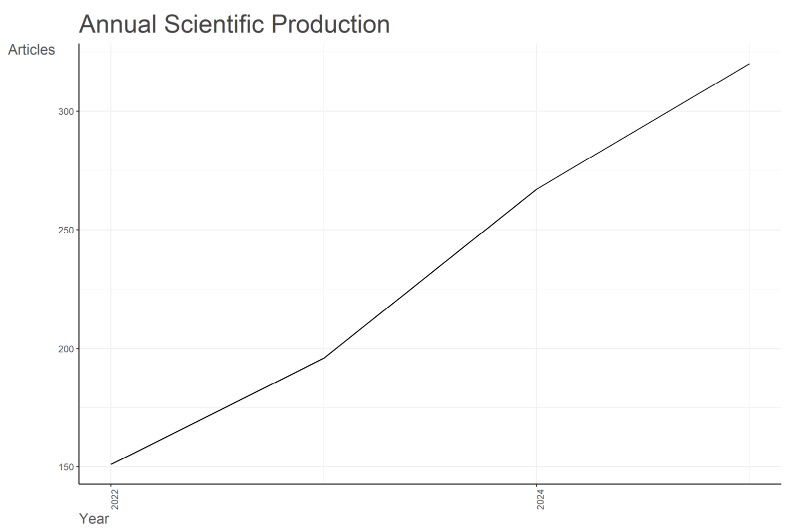

Figure 4. Annual Scientific Production

Figure 4 illustrates a consistent increase in annual scientific production throughout the observation period. This upward trend indicates that internal control has become an increasingly important area of international scholarly research. The sustained growth in publication output reflects the expanding academic interest in internal control within the broader contexts of corporate governance, digital transformation, enterprise risk management, and organizational accountability. Collectively, these findings suggest that internal control research has evolved beyond its traditional focus on financial reporting and regulatory compliance into a multidisciplinary field encompassing governance, risk management, information systems, and organizational sustainability.

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The observed growth in publication output is consistent with previous bibliometric studies showing that accounting and auditing research has increasingly been influenced by technological advancement, governance reform, and digital transformation. This consistency suggests that the expansion of internal control research represents a sustained international research trend rather than a temporary increase in publication activity. Recent developments indicate that digital transformation, environmental, social, and governance (ESG) implementation, artificial intelligence, and enterprise risk management have become increasingly interconnected, broadening the scope and application of internal control research. Consequently, the sustained increase in annual publication output reflects not only growing academic interest but also the increasing organizational demand for internal control systems that support resilience, digital governance, and effective risk management in rapidly changing business environments.

The continuing growth in publication output also highlights the expanding strategic role of internal control within contemporary organizational research. Rather than being viewed solely as a mechanism for financial reporting and regulatory compliance, internal control is increasingly recognized as a multidisciplinary field that integrates corporate governance, enterprise risk management, digital transformation, sustainability, and organizational resilience. This evolution suggests that future research will continue to become more interdisciplinary by incorporating perspectives from accounting, information systems, public administration, sustainability, and strategic management to address increasingly complex governance challenges.

Figure 5 presents the most relevant publication sources contributing to global internal control research between 2022 and 2025. The analysis identifies the journals that published the largest number of articles within the dataset, thereby reflecting their contribution to the advancement of internal control research. The findings indicate that publication output is concentrated within a relatively small group of journals specializing in accounting, auditing, corporate governance, management, and financial reporting. These journals serve as the principal channels for disseminating scientific knowledge and play a central role in shaping the development of contemporary internal control research.

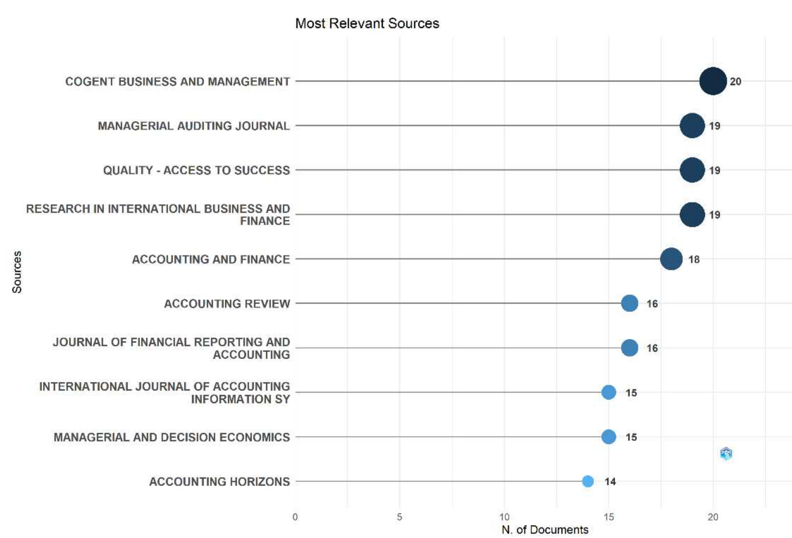

Figure 5. Most Relevant Sources

Figure 5 illustrates the distribution of publication productivity across Scopus-indexed journals. The concentration of publications within a relatively small group of leading journals confirms the existence of core publication outlets that play a central role in shaping the intellectual development of global internal control research. The dominance of these core journals suggests that internal control research has developed a well-established publication ecosystem. At the same time, the presence of journals representing interdisciplinary fields indicates that internal control research is increasingly connected with broader organizational issues,

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including sustainability, enterprise risk management, information systems, public governance, and digital transformation. The observed distribution of publication sources is consistent with Bradford's Law, which posits that scientific literature within a particular discipline tends to concentrate in a limited number of highly productive journals, while the remaining publications are dispersed across a larger number of journals with lower publication frequencies. This pattern suggests that although internal control research continues to expand into new disciplinary areas, a relatively small group of journals remains the principal platform for disseminating scientific knowledge within the field. The bibliometric analysis indicates that the most productive journals consistently publish research on corporate governance, auditing, financial reporting, risk management, and organizational control systems. Their prominent position demonstrates the growing maturity of internal control research and confirms the existence of specialized publication outlets that support the continuous development and dissemination of scientific knowledge in this field.

The concentration of publications within a relatively small number of highly productive journals indicates that knowledge dissemination in internal control research follows a structured pattern of scientific communication. This finding is consistent with previous bibliometric studies in accounting and auditing, which demonstrate that mature research domains typically develop a core group of journals serving as the principal venues for scholarly communication and knowledge dissemination. Moreover, the growing prominence of journals emphasizing digital governance, sustainability, organizational resilience, and technology-enabled control systems reflects an important transformation in the internal control literature. Rather than focusing primarily on financial reporting and regulatory compliance, contemporary research increasingly integrates corporate governance, digital transformation, enterprise risk management, environmental, social, and governance (ESG) implementation, and information systems into the study of internal control. This evolution further confirms that internal control has developed into a multidisciplinary research domain that responds to increasingly complex organizational and governance challenges.

4.3. Most Relevant Authors

Figure 6 presents the most productive authors contributing to global internal control research during the 2022–2025 observation period. Author productivity was measured based on the number of publications indexed in the Scopus dataset. Identifying the most productive authors provides insight into the scholars who have made the most significant contributions to the intellectual development of internal control research and who continue to influence subsequent scientific inquiry. The bibliometric results indicate that publication productivity is concentrated among a relatively small group of researchers who consistently publish studies on internal control and related topics. These authors have contributed substantially to the advancement of knowledge in corporate governance, internal auditing, enterprise risk management, financial reporting, and organizational accountability. Their sustained publication activity demonstrates continuous scholarly engagement and establishes them as influential contributors within this research domain.

The concentration of publications among leading authors is also consistent with the cumulative nature of scientific knowledge, whereby experienced researchers often develop specialized research agendas, participate in international collaborations, and produce highly cited publications that serve as important references for subsequent studies. Consequently, their influence extends beyond publication productivity and contributes to shaping emerging research themes and methodological developments within the field. Furthermore, the observed distribution of author productivity is consistent with Lotka's Law, which states that a relatively small number of researchers produce a large proportion of scientific publications, whereas most researchers contribute only a limited number of articles. This pattern is commonly observed across mature scientific disciplines and suggests that internal control research has developed a stable and active scholarly community that supports the continuous advancement of knowledge.

The analysis indicates that a relatively small group of authors consistently accounts for the highest publication productivity during the observation period. Their research primarily addresses corporate governance, internal auditing, organizational control systems, enterprise risk management, sustainability, and

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digital transformation. The recurrence of the same author names across multiple publications suggests the presence of well-established research groups and sustained collaboration networks that contribute significantly to the development of global internal control research. The concentration of publication productivity among a relatively small number of authors suggests that scientific leadership plays a central role in advancing internal control research. This finding is consistent with previous bibliometric studies showing that mature research domains typically develop stable groups of highly productive scholars who contribute to theoretical development, methodological advancement, and the diffusion of scientific knowledge.

Moreover, the collaborative activities of leading researchers reflect the increasingly interdisciplinary nature of contemporary internal control research. Rather than focusing exclusively on accounting and auditing, recent studies integrate perspectives from management, information systems, sustainability, digital governance, artificial intelligence, and organizational resilience. This interdisciplinary collaboration broadens the scope of internal control research, promotes knowledge exchange across disciplines, and enhances the international visibility of the field. Identifying the most productive authors provides valuable guidance for future researchers in locating influential publications, identifying potential research collaborators, and recognizing emerging research directions. In addition, mapping author productivity contributes to a better understanding of the intellectual leadership within the field and provides a useful foundation for future bibliometric analyses, systematic literature reviews, and collaborative research initiatives.

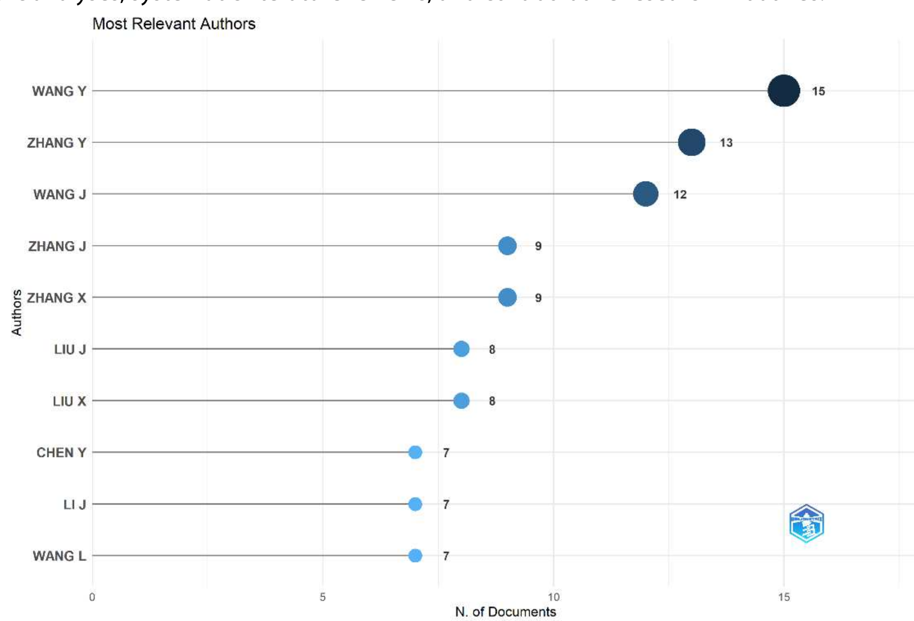

Figure 6. Most Relevant Authors

Figure 6 illustrates the distribution of author productivity within the Scopus dataset. The results indicate that scientific publications are concentrated among a relatively small group of highly productive authors, suggesting that these scholars play a pivotal role in shaping the intellectual structure and future development of global internal control research. Their sustained publication records demonstrate continuous scholarly engagement and establish them as influential contributors to the advancement of knowledge within the field . The concentration of scientific productivity among a limited number of authors is also consistent with the bibliometric principle commonly described by Lotka's Law, which explains that only a small proportion of researchers account for the majority of scientific publications within a particular discipline. The pattern observed in this study indicates that internal control research has developed an identifiable community of active scholars whose continuous contributions have supported the expansion and consolidation of knowledge in this field (Lotka, 1926; Donthu et al., 2021).

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The observed pattern is consistent with previous bibliometric studies (Donthu et al., 2021), which indicate that mature scientific fields are typically characterized by a relatively small group of highly productive scholars who make substantial contributions to knowledge development and influence future research directions. Likewise, the concentration of publications among leading authors in this study reflects the existence of intellectual leadership that plays an important role in advancing the development of global internal control research.

4.4. Country Scientific Production

Figure 7 illustrates the geographical distribution of scientific publications on internal control based on the corresponding authors' countries. The distribution of country scientific production provides an overview of the global landscape of internal control research and identifies the countries that make the greatest contributions to scientific knowledge during the 2022–2025 observation period. This analysis also reflects differences in national research capacity, institutional support, international collaboration, and scientific productivity across countries.

The bibliometric results reveal substantial disparities in publication productivity among countries. A relatively small number of countries account for most of the scientific output, indicating a concentration of research capacity within nations that possess well-established higher education systems, stronger research funding, extensive international collaboration networks, and greater institutional support for scientific innovation. In contrast, many other countries contribute fewer publications, reflecting differences in research capacity and scientific productivity across countries. This geographical concentration is a common pattern observed in bibliometric studies and highlights the importance of research infrastructure, institutional support, and international collaboration in shaping scientific productivity (Donthu et al., 2021).

The concentration of publications in a limited number of countries should be interpreted as bibliometric evidence of unequal research productivity rather than evidence of superior internal control practices. Differences in publication output more likely reflect disparities in research capacity, funding availability, international collaboration, and publication infrastructure (Donthu et al., 2021). The findings also indicate that scientific productivity is no longer concentrated exclusively in traditionally dominant Western countries. Several Asian economies have emerged as important contributors to internal control research, reflecting growing investments in research and development, digital governance, financial technology, corporate sustainability, and enterprise risk management. This trend suggests that the global intellectual landscape of internal control research is becoming increasingly diverse and internationally connected. From a bibliometric perspective, the observed geographical distribution indicates that scientific productivity is closely associated with national research capacity and international knowledge exchange. Countries that actively participate in global research networks tend to achieve higher publication productivity because international collaboration facilitates access to multidisciplinary expertise, research resources, and broader scientific visibility.

The country productivity analysis indicates that a relatively small number of countries account for the largest share of global publications on internal control. Research from these countries predominantly addresses corporate governance, auditing, digital transformation, enterprise risk management, environmental, social, and governance (ESG), and organizational resilience. Their sustained publication productivity reflects strong institutional support and active engagement in international research collaboration. The concentration of scientific publications within a limited number of leading countries indicates that internal control research has become increasingly globalized while remaining strongly influenced by differences in national research capacity. This finding is consistent with previous bibliometric studies showing that countries with stronger research infrastructure and more extensive international collaboration generally achieve greater scientific productivity and impact. International collaboration not only enhances publication output but also facilitates knowledge exchange, improves citation performance, and promotes interdisciplinary research. The growing contribution of Asian countries further reflects an important

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transformation in the global research landscape. Rapid economic development, financial sector modernization, digital transformation initiatives, and governance reforms have stimulated increasing research on contemporary internal control issues. As a result, scientific knowledge production is becoming more geographically diverse, gradually reducing the historical concentration of research within North America and Western Europe.

Understanding country scientific production provides valuable insights into global research capacity and international knowledge networks. These findings can assist researchers in identifying strategic collaboration opportunities, comparing national research priorities, and exploring underrepresented regions with strong potential for future investigation. In addition, they may support policymakers and research institutions in strengthening international partnerships and promoting more inclusive global research collaboration in the field of internal control.

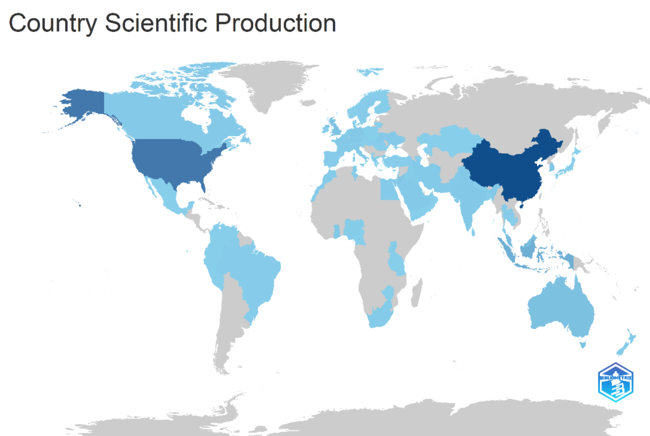

Figure 7. Country Scientific Production

Figure 7 illustrates the geographical distribution of internal control research across countries. The concentration of publications within a relatively small number of leading countries demonstrates the unequal distribution of global research productivity while also highlighting the growing contribution of emerging economies and the increasing importance of international scientific collaboration. This pattern suggests that the global research landscape is becoming progressively more diverse, with expanding participation from countries beyond the traditional centers of scientific production.

4.5. Most Globally Cited Documents

Figure 8 presents the most globally cited publications within the internal control dataset. Citation analysis is one of the most widely used bibliometric indicators for evaluating the scientific influence of published research. Unlike publication productivity, which measures research output, citation analysis reflects the extent to which a publication has influenced subsequent scientific knowledge and has been recognized by the broader academic community.

The bibliometric results indicate that a relatively small number of publications receive substantially higher citation counts than the remaining articles. This distribution suggests that scientific influence is concentrated in a limited number of landmark studies that provide important theoretical foundations, methodological contributions, or practical insights into internal control research. These highly cited publications have become key references for studies on corporate governance, auditing, enterprise risk management, financial reporting, organizational accountability, and digital governance. The observed citation distribution is also consistent with the cumulative development of scientific knowledge. Highly cited publications often introduce influential concepts, theoretical frameworks, or methodological approaches that

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are subsequently adopted, refined, and extended by later studies. Consequently, citation performance reflects not only academic recognition but also the dissemination of knowledge across disciplines and research communities. Furthermore, the growing citation impact of recent publications suggests that internal control research continues to evolve rapidly. Studies addressing artificial intelligence, digital transformation, environmental, social, and governance (ESG), cybersecurity governance, continuous auditing, and technology-enabled internal control systems have attracted increasing scholarly attention, indicating the field's responsiveness to emerging organizational and technological challenges.

The citation analysis indicates that a relatively small group of publications consistently receives substantially higher citation counts than other articles within the dataset. These influential studies provide the theoretical and methodological foundations of contemporary internal control research and continue to shape subsequent investigations in accounting, auditing, governance, and enterprise risk management. The analysis further demonstrates that highly cited publications frequently address interdisciplinary themes rather than focusing solely on traditional internal control mechanisms. This finding suggests that scientific influence is increasingly associated with research integrating corporate governance, sustainability, digital innovation, enterprise risk management, and organizational resilience.

The concentration of citations within a relatively small number of publications is consistent with the Matthew Effect, which explains how influential studies tend to accumulate citations as they become widely recognized within a scientific field. As a result, landmark publications increasingly shape theoretical development, methodological advancement, and subsequent research agendas, reinforcing their scientific influence over time. The findings also indicate that contemporary internal control research is becoming increasingly interdisciplinary. Rather than focusing primarily on financial reporting and regulatory compliance, highly cited studies increasingly integrate digital governance, artificial intelligence, environmental, social, and governance (ESG), cybersecurity, enterprise risk management, and organizational resilience. This transformation reflects the evolving role of internal control in addressing complex organizational, technological, and governance challenges. Identifying the most globally cited publications provides researchers with a clear understanding of the foundational literature that has shaped the intellectual development of internal control research. These influential studies offer an important starting point for theory development, facilitate the identification of emerging research themes, and support future bibliometric analyses, systematic literature reviews, and interdisciplinary research on internal control.

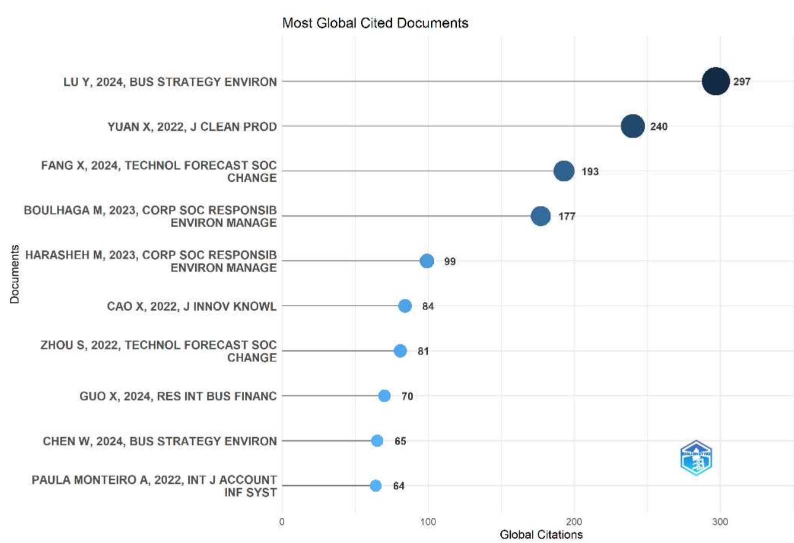

Figure 8. Most Globally Cited Documents

Figure 8 illustrates the distribution of citation impact among publications included in the dataset. The concentration of citations within a relatively small number of influential studies confirms the existence of

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foundational publications that have played a central role in shaping the intellectual development of global internal control research. The observed citation pattern is consistent with previous bibliometric studies (Donthu et al., 2021; Kuswara et al., 2024; Nurachman et al., 2025), indicating that contemporary accounting and auditing research increasingly converges with corporate governance, digital transformation, sustainability, and interdisciplinary collaboration.

4.6. Keyword Co-occurrence Network

Figure 9 presents the keyword co-occurrence network generated from authors' keywords using Biblioshiny. Keyword co-occurrence analysis is one of the principal science mapping techniques because it reveals the conceptual structure of a research field by identifying how keywords appear together across scientific publications. Unlike publication productivity or citation analysis, keyword co-occurrence analysis focuses on conceptual relationships among research topics and provides insights into the evolution of scientific knowledge over time. The bibliometric network reveals several interconnected clusters representing the major thematic areas within global internal control research. Each cluster consists of keywords that frequently co-occur, indicating closely related research topics. The proximity between keywords reflects conceptual relatedness, whereas node size represents the frequency of keyword occurrence. Larger nodes indicate well-established research themes, while smaller nodes represent emerging or more specialized topics.

The visualization indicates that internal control functions as the central concept connecting multiple interdisciplinary research domains. In addition to traditional accounting and auditing topics, the network demonstrates strong conceptual connections with corporate governance, enterprise risk management, audit quality, fraud prevention, sustainability, environmental, social, and governance (ESG), artificial intelligence, digital transformation, blockchain, cybersecurity, and organizational resilience. This pattern suggests that internal control research has expanded beyond its traditional emphasis on financial reporting and regulatory compliance toward broader governance and technology-oriented perspectives. Several emerging keywords are positioned at the periphery of the network while remaining conceptually connected to the central cluster. Their presence indicates the continuous evolution of internal control research in response to technological innovation, regulatory change, organizational digitalization, and sustainability-related challenges.

The keyword co-occurrence network demonstrates that internal control remains the central concept linking multiple research themes. The strongest conceptual relationships are observed between internal control and corporate governance, auditing, enterprise risk management, fraud prevention, financial reporting, and organizational accountability. Together, these interconnected themes constitute the intellectual core of contemporary internal control research. Additional thematic clusters indicate increasing scholarly attention to digital transformation, artificial intelligence, environmental, social, and governance (ESG), cybersecurity governance, continuous auditing, and technology-enabled control systems, reflecting organizations' increasing reliance on robust internal control systems to mitigate cyber risks and strengthen governance in digital environments (Zhou & Huang, 2024).

The observed keyword structure indicates the continuing conceptual evolution of internal control research from a predominantly compliance-oriented field toward a broader governance and organizational management perspective. Rather than focusing solely on accounting controls, contemporary research increasingly examines the interaction between internal control, digital technologies, sustainability, enterprise risk management, and organizational resilience. From a bibliometric perspective, the observed network structure is consistent with the principles of Co-word Analysis, which interpret frequently co-occurring keywords as indicators of conceptual relationships and the intellectual organization of a research field. Highly connected keywords generally represent well-established research themes, whereas smaller peripheral clusters often indicate emerging topics with considerable potential for future development.

Overall, the keyword network demonstrates that internal control research continues to diversify conceptually while maintaining a coherent intellectual foundation centered on governance, accountability,

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risk management, and organizational performance. Keyword co-occurrence analysis provides a comprehensive understanding of dominant research themes, conceptual relationships, and emerging topics within the internal control literature. The resulting knowledge map can assist researchers in identifying future research opportunities, establishing interdisciplinary collaborations, and exploring underrepresented areas that warrant further investigation.

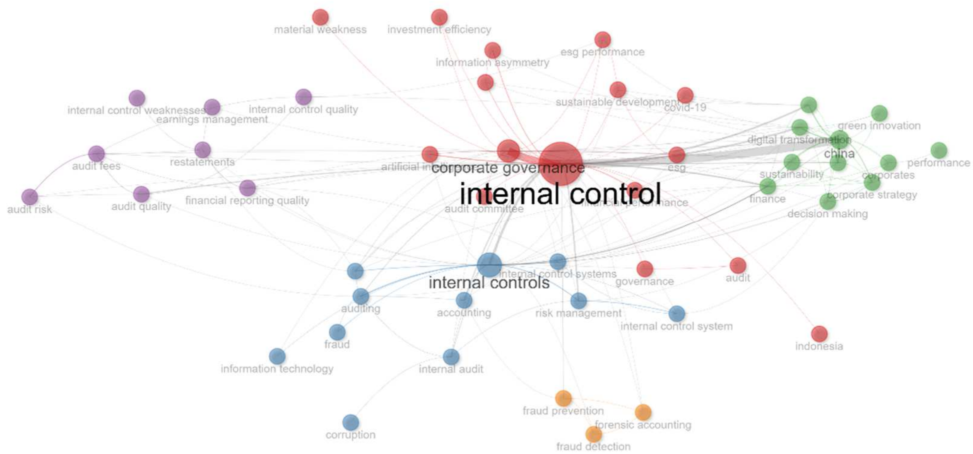

Figure 9. Keyword Co-occurrence Network

Figure 9 illustrates the conceptual structure of internal control research based on the co-occurrence of authors' keywords. The network demonstrates that **internal control** functions as the central concept linking corporate governance, auditing, enterprise risk management, sustainability, digital transformation, and artificial intelligence, highlighting the increasingly interdisciplinary nature of contemporary internal control research. The observed conceptual structure is consistent with previous bibliometric studies (Donthu et al., 2021; Kuswara et al., 2024a; Nurachman et al., 2025), which indicate that accounting and auditing research has increasingly converged with corporate governance, digital transformation, sustainability, and interdisciplinary collaboration.

4.7. Thematic Map

Figure 10 presents the thematic map generated using Biblioshiny based on the co-occurrence of authors' keywords. The thematic map classifies research themes according to two bibliometric dimensions: centrality and density. Centrality reflects the degree to which a theme is connected to other themes within the research field, whereas density indicates the level of internal development and cohesion of a theme. Together, these dimensions distinguish well-developed research domains from emerging, declining, or highly specialized topics. The thematic map organizes the conceptual structure of internal control research into four quadrants. Motor themes, located in the upper-right quadrant, represent topics that are both highly developed and central to the field. Niche themes, positioned in the upper-left quadrant, denote specialized topics with strong internal development but relatively limited connections to the broader research field. Emerging or declining themes, located in the lower-left quadrant, generally represent either newly developing topics or areas receiving decreasing scholarly attention. Finally, **basic themes**, positioned in the lower-right quadrant, form the conceptual foundation of the field because they maintain strong relationships with numerous other themes despite relatively lower internal development.

The thematic map indicates that internal control, corporate governance, enterprise risk management, and audit quality constitute the fundamental conceptual structure of contemporary internal control research. These themes remain strongly interconnected with numerous other research topics and continue to serve as the intellectual foundation of the field. Several technology-oriented themes—including artificial intelligence,

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digital transformation, environmental, social, and governance (ESG), blockchain, and cybersecurity—are positioned within or moving toward the motor theme quadrant. Their increasing centrality suggests that internal control research is expanding beyond its traditional emphasis on compliance toward broader issues related to digital governance, organizational resilience, and technology-enabled organizational control. At the same time, several themes remain within the emerging or niche quadrants, indicating promising opportunities for future investigation. These include integrated reporting, sustainable governance, digital assurance, and technology-enabled internal control systems.

The thematic structure indicates that the intellectual evolution of internal control research is characterized by a gradual transition from conventional control mechanisms toward integrated governance supported by digital technologies. This pattern is consistent with the principles of thematic mapping in bibliometric analysis, which describe how mature research fields diversify into interconnected thematic clusters while maintaining a stable conceptual core. The growing prominence of digital transformation, artificial intelligence, and sustainability-related themes reflects the increasing need for organizations to address technological innovation, regulatory complexity, cybersecurity risks, and evolving governance expectations. Accordingly, internal control is increasingly understood as a strategic governance mechanism that supports organizational resilience, effective risk management, and sustainable organizational performance. Furthermore, the coexistence of mature and emerging themes demonstrates the continuing conceptual expansion of internal control research. This diversification strengthens interdisciplinary collaboration across accounting, auditing, information systems, corporate governance, strategic management, and sustainability studies, thereby creating new opportunities for future research and methodological innovation.

The thematic map provides a strategic overview of both mature and emerging research themes within the internal control literature. By distinguishing well-established topics from rapidly developing areas, it offers valuable guidance for researchers in identifying future research priorities, establishing interdisciplinary collaborations, and exploring underrepresented themes. In particular, future studies may further investigate the integration of internal control with artificial intelligence, digital governance, environmental, social, and governance (ESG), cybersecurity, enterprise risk management, and organizational resilience.

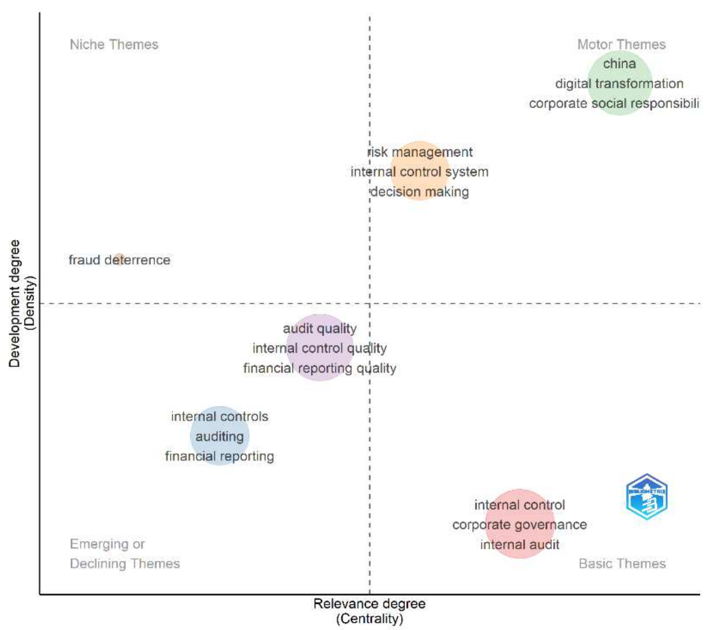

Figure 10. Thematic Map of Internal Control Research

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Figure 10 illustrates the conceptual positioning of research themes according to their levels of centrality and density. The visualization indicates that internal control research is anchored by corporate governance, auditing, and enterprise risk management while progressively expanding toward digital transformation, artificial intelligence, sustainability, and technology-enabled governance systems. This thematic configuration highlights the continuing evolution of internal control research toward a broader and increasingly interdisciplinary knowledge domain. The observed thematic structure is consistent with previous bibliometric studies (Donthu et al., 2021; Kuswara et al., 2024; Nurachman et al., 2025), which demonstrate the growing convergence of accounting research with corporate governance, digital transformation, sustainability, and interdisciplinary collaboration.

4.8. Integrated Discussion and Knowledge Evolution

The bibliometric findings collectively indicate that internal control research underwent substantial conceptual development during the 2022–2025 period. Rather than evolving through isolated research streams, publication trends, collaboration networks, citation patterns, keyword relationships, and thematic structures reveal an increasingly interconnected body of scientific knowledge. The growth in annual scientific production reflects increasing international attention to internal control as an important component of organizational governance. This development coincides with advances in digital technologies, enterprise risk management, corporate governance reforms, sustainability reporting, and organizational resilience. Consequently, contemporary internal control research extends beyond its traditional accounting orientation and increasingly incorporates multidisciplinary perspectives on organizational governance and performance.

The collaboration analysis further indicates that the expansion of international research networks has facilitated knowledge exchange across accounting, information systems, management, finance, and public administration. Productive authors and leading institutions contribute not only to publication output but also to the diffusion of emerging concepts and interdisciplinary research agendas. Citation analysis demonstrates that the intellectual foundation of internal control research continues to be grounded in corporate governance, risk management, auditing, and organizational accountability. At the same time, the keyword co-occurrence network and thematic map reveal a growing emphasis on digital governance, artificial intelligence, cybersecurity, environmental, social, and governance (ESG), blockchain, and technology-enabled assurance systems. Compared with earlier bibliometric studies that primarily examined internal auditing, fraud prevention, audit quality, or corporate governance separately, the present study suggests a more integrated conceptual landscape. Rather than replacing traditional internal control concepts, emerging technologies appear to complement established governance mechanisms by supporting organizational transparency, continuous monitoring, predictive risk assessment, and informed decision-making. This interpretation is consistent with previous bibliometric studies (Donthu et al., 2021; Zupic & Čater, 2015) while extending their observations specifically to contemporary internal control research.

The thematic evolution identified in this study further indicates that internal control research is entering a phase of increasing digital convergence. Traditional governance-related themes remain the intellectual foundation of the field, whereas technology-oriented themes have become progressively more central within the conceptual structure. The coexistence of mature and emerging themes reflects the continuous diversification of scientific knowledge while maintaining a coherent conceptual foundation. Overall, the integration of publication performance, collaboration patterns, citation structures, keyword relationships, and thematic mapping indicates that internal control research has evolved into a multidisciplinary governance domain that increasingly incorporates digital transformation, sustainability, organizational resilience, and technology-enabled organizational control.

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V. Conclusion

This study provides a comprehensive bibliometric mapping of global internal control research based on 934 Scopus-indexed journal articles published between 2022 and 2025. The findings indicate a substantial increase in scholarly interest in internal control, accompanied by expanding international collaboration, increasingly diverse publication sources, and continuous thematic development. Overall, the bibliometric evidence demonstrates that contemporary internal control research is characterized by sustained publication growth, expanding international collaboration, and increasing thematic convergence with digital governance, enterprise risk management, sustainability, and artificial intelligence. These findings directly answer the four research questions and provide an updated intellectual map of global internal control research.

The citation patterns, keyword co-occurrence network, and thematic map further indicate that corporate governance, enterprise risk management, audit quality, and organizational accountability remain the intellectual foundation of the field, while technology-oriented themes are becoming progressively more central to future research. Compared with earlier bibliometric studies, the present study highlights a stronger convergence between governance mechanisms and digital innovation, suggesting that future internal control research will increasingly emphasize intelligent technologies, organizational resilience, and technology-enabled governance. From a theoretical perspective, this study contributes to the bibliometric literature by integrating publication performance, collaboration networks, citation patterns, conceptual structures, and thematic mapping into a comprehensive knowledge map of contemporary internal control research. Rather than examining individual bibliometric indicators separately, the study demonstrates how the intellectual structure of the field has diversified while maintaining a coherent conceptual foundation. From a practical perspective, the findings provide valuable insights for researchers, practitioners, auditors, regulators, organizational leaders, and policymakers seeking to understand current research priorities and emerging scientific trends. The resulting knowledge map may also support universities, research institutions, and policymakers in developing future research agendas, strengthening interdisciplinary collaboration, and promoting evidence-informed governance practices.

Several limitations should be acknowledged. First, this study relied exclusively on the Scopus database, which, although providing extensive international coverage, may not include all relevant publications indexed in other scholarly databases such as Web of Science, Dimensions, or Crossref. Second, the analysis was limited to English-language journal articles published between 2022 and 2025, which may have excluded earlier foundational studies and relevant research published in other languages. Third, the bibliometric analysis was conducted using publication metadata rather than full-text content; therefore, the conceptual interpretations are derived primarily from publication characteristics, citation relationships, and keyword structures. Accordingly, the findings should be interpreted as representing the intellectual landscape of the selected dataset rather than the entirety of global internal control research.

Future research should expand the present findings by integrating multiple international databases to improve dataset coverage and enable cross-database validation. Comparative bibliometric analyses across developed and developing countries could provide a deeper understanding of regional differences in the evolution of internal control research. In addition, future studies should further investigate the emerging themes identified in the thematic map, particularly artificial intelligence, digital governance, environmental, social, and governance (ESG), blockchain-enabled internal control, cybersecurity, continuous auditing, intelligent assurance systems, and organizational resilience (Weber et al., 2024). Future research may also combine bibliometric techniques with systematic literature reviews, content analysis, or empirical investigations to provide more comprehensive theoretical and practical insights into the continuing evolution of internal control research.

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