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CASE STUDY

ECOLOGICAL SCIENCE

Exploring Global Research Trends in Sustainability and Balanced Scorecard: A Bibliometric Analysis

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ABSTRACT

The Balanced Scorecard is a strategic management tool that integrates financial and non-financial performance metrics to align organisational goals. Sustainability focuses on balancing economic, social, and environmental objectives, and integrating it with the Balanced Scorecard helps organisations achieve long-term, holistic growth. Understanding research trends in any field is crucial for identifying unexplored areas. To examine the global research trends related to the Balanced Scorecard and Sustainability, a bibliometric analysis was conducted using the Scopus database. The keywords "Balanced Scorecard" and "Sustainability" were employed for the document search, covering 20 years from 2004 to 2024. The data reveals a steady increase in annual research output, particularly after 2020. Network maps were generated using VoS Viewer, highlighting a gap in integrating the Balanced Scorecard into broader sustainability frameworks, with only 247 articles published in this area over the past 20 years.

Keywords: Bibliometric Analysis, Balanced Scorecard, Sustainability, Performance Indicators

The global discourse on sustainability highlights integrating environmental, social, and economic goals to ensure a balanced future for humanity and the planet. At the same time, businesses are increasingly aligning their strategies with frameworks such as the United Nations' Sustainable Development Goals, which advocate a holistic approach to development. The Balanced Scorecard (BSC), developed by Kaplan and Norton in 1992, has turned out to be a highly influential tool in strategic management, allowing an organisation to translate vision into action by making financial and nonfinancial metrics balanced.

Recent studies establish the growing importance of integrating sustainability with the BSC approach to address environmental and social dimensions. Schaltegger and Wagner 2006 cite the importance of

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sustainability BSC models in enhancing organisational accountability and innovation capability. Figge *et al*. 2002 introduced the idea of adapting a traditional BSC to comprise sustainability metrics, which emphasises its ability to drive long-term strategic alignment. The bibliometric analysis depicted a gradual increase in this intersection by research interest, including trends to themes such as integrated SDG, sustainability performance assessment, and causal linkage between sustainability practices and economic prosperity (Wagner, 2011; Pava and Krausz, 1996).

The intersection of sustainability and the Balanced Scorecard (BSC) has gained significant attention in academic and corporate research. Sustainability, as defined by the Brundtland Report 1987, focuses on meeting present needs without compromising future generations. The SDGs, adopted in 2015, provide a universal framework for promoting sustainable economic, environmental, and social development. Businesses increasingly view these goals as strategic imperatives, prompting a shift toward sustainability-oriented performance measurement systems (Schaltegger and Figge, 2000).

Research on the integration of the Balanced Scorecard (BSC) with Sustainability is vital in addressing contemporary challenges like climate change, social inequality, and corporate accountability. The BSC provides a structured framework for linking sustainability goals with organisational performance, enabling firms to measure and achieve long-term value creation (Kaplan and Norton, 1992). In the modern era, stakeholders increasingly demand that businesses align operations with sustainable development principles (Elkington, 1997). By bridging this gap, such research fosters innovation and resilience, ensuring organisations contribute positively to economic, social, and environmental well-being.

Sustainability issues are gaining increased attention among organisations across the globe because stakeholders want explanations and accountability for environmental, social, and governance (ESG) issues (Freeman, 1984; Carroll, 1991). It is possible to fact that the BSC assists the business to align sustainability objectives to the strategies through its dimensions of focus: financial, customer, internal processes and learning and growth (Kaplan and Norton, 2001). It has been pointed out by researchers that it is necessary to broaden these dimensions and include also sustainability performance indicators, which transform BSC into SBSC, components of sustainability scores, balanced scorecard. (Schaltegger and Wagner, 2006; Sidiropoulos *et al.* 2004).

Conducting a bibliometric analysis on the integration of the Balanced Scorecard (BSC) and Sustainability is crucial for understanding research trends, identifying knowledge gaps, and shaping future directions. Bibliometric methods help track the evolution of this interdisciplinary field, highlighting key publications, influential authors, and emerging research themes (Donthu *et al.* 2021). They also provide insights into collaborative networks and citation patterns, offering a comprehensive view of scholarly contributions (Aria & Cuccurullo, 2017). Such analysis is especially relevant today as organisations seek frameworks like the BSC to embed sustainability into performance management (Kaplan and Norton, 1992). Moreover, it reveals the growing emphasis on sustainability reporting and corporate accountability (Elkington, 1997; Rajeev *et al.* 2017), driving innovative practices in strategic decision-making.

The scientific community is experiencing a rapid and significant increase in publications in various fields. Therefore, bibliographic analysis is essential for the systematic evaluation and analysis of existing publications on a particular topic. This approach allows for a comprehensive understanding of the research landscape and its importance, facilitating the organisation and evaluation of a huge amount of data. It also provides insights into the current state of a particular research field, guides future research directions and the development of new concepts.

The current analysis raised the following questions that needed to be answered:

- ❒ What trends in publication patterns, country participation, and collaborative efforts can be identified in the research on Balanced Scorecard and Sustainability?
- ❒ What are the key concepts that have been explored in the research on Balanced Scorecard and Sustainability?

MATERIALS AND METHODS

Objective of the Study

1. To review and analyse existing publications systematically in order to provide a full overview of the current research environment, identify research gaps, and propose future research directions on "balanced scorecard and sustainability" using bibliometric analysis.

Data Collection

The bibliometric data for this study were sourced from the Scopus database, renowned for its extensive and multidisciplinary coverage of peer-reviewed literature. Scopus was selected due to its reliability, wide-ranging indexing, and robust inclusion of high-quality academic publications across diverse fields such as business, environmental science, and social sciences. Its advanced search capabilities and comprehensive metadata ensure the retrieval of relevant, credible, and up-to-date research, making it an ideal choice for analysing scholarly trends. Additionally, Scopus provides detailed citation data and analytics, enabling researchers to map intellectual landscapes and track the impact and evolution of key research areas effectively.

Search Parameters

Delimitation of the search has been undertaken with the following parameters —

1. **Language:** The analysis included only articles published in English to maintain consistency and ensure a clear understanding of the literature. English is widely recognised as the dominant language in academic publishing, particularly in the fields of business and sustainability research. By focusing exclusively on English-language publications, the study avoided potential challenges associated with translation errors or varied interpretations of non-English texts. This approach enhanced the comparability of findings and ensured that key concepts and methodologies were interpreted uniformly, thereby upholding the integrity and reliability of the bibliometric analysis.
2. **Time Frame**: The study analysed publications from the period 2004 to 2024, offering a comprehensive 20-year overview of the field's development. This timeframe captures the evolution of research trends, highlighting key milestones and emerging themes over two decades, thereby providing valuable insights into the progression and growing significance of the topic.
3. **Regional Scope:** No regional restrictions were imposed to ensure the dataset represented a comprehensive and globally diverse perspective.

Search Strategy

The search strategy for this study employed a systematic combination of carefully selected keywords to identify relevant literature on the Balanced Scorecard (BSC) and its integration with sustainability. Primary terms such as "Balanced Scorecard," "Sustainability," and "Sustainable Balanced Scorecard (SBSC)" were central to the search, complemented by secondary terms including "Performance Management," "Key Performance Indicators (KPIs)," "Organisational Performance," and "Efficiency Measurement." The main Steps in the Search Strategy are as follows:

1. Initial Broad Search: A comprehensive initial search using the broader set of keywords identified 461 documents. This step ensured that no significant studies were overlooked in the initial phase.
2. Keyword Refinement: To focus on the core research objective, specific terms like "Sustainability and Balanced Scorecard" were applied, narrowing the dataset to 318 papers.
3. Subject Area Filters: Further refinement targeted relevant disciplines such as Business, Management, Environmental Science, Social Sciences, and Economics. This filter reduced the dataset to 250 papers, ensuring the analysis aligned with the study's thematic focus.
4. Language Restriction: Only English-language publications were included to maintain consistency and comprehension across the selected literature, resulting in a final dataset of 247 papers.

This methodological approach ensured a systematic and thorough selection process, filtering out irrelevant material while preserving the richness and diversity of the relevant academic discourse. By focusing on high-quality, discipline-specific research, the dataset robustly supports the study's objectives and contributes meaningful insights to the field.

Data Analysis and Software Used

Bibliometric analysis was conducted to explore the relationships, emerging trends, and key influential contributions within the selected dataset, by using VOSviewer (Version 1.6.20), a specialized software tool designed for visualizing and mapping bibliometric data. VOSviewer was chosen for its advanced capabilities in creating clear and insightful visual representations of complex bibliometric networks, which helps identify patterns, relationships, and clusters within large datasets. This tool enables the effective analysis of citation networks, co-authorship, and keyword co-occurrence, making it particularly useful for exploring the structure and evolution of research in the Balanced Scorecard and sustainability fields. Its intuitive interface and powerful visualization features enhance the interpretation of bibliometric findings, providing a deeper understanding of research trends and influential contributions.

Analytical Techniques Employed

The following analytical techniques were applied in this study to gain insights into the research landscape and identify key patterns within the dataset:

1. Co-Authorship Analysis: This technique focuses on identifying the key researchers and mapping their collaboration networks. By analysing co-authorship patterns, the study revealed influential researchers and research groups that play a central role in advancing the field. This analysis also highlighted the collaborative nature of research on the Balanced Scorecard and sustainability, shedding light on prominent academic partnerships and potential interdisciplinary connections.

2. Co-Citation Analysis: Co-citation analysis was used to identify the most influential papers and authors within the research domain. By examining which articles were frequently cited together, the analysis provided insights into foundational and highly cited works in the field. This technique helped pinpoint core publications that have shaped the development of the Balanced Scorecard and sustainability research, revealing seminal studies that researchers continue to build upon.
3. Keyword Co-occurrence Analysis: This technique analysed the frequency and relationships of keywords across the selected literature. By mapping how often specific keywords appeared together, the analysis uncovered dominant research themes and emerging trends in the field. It provided a comprehensive view of the evolving focus areas, such as the integration of sustainability within the Balanced Scorecard framework, and highlighted areas of future research exploration.

These analytical techniques allowed for a holistic understanding of the research domain. Co-authorship and co-citation analyses revealed the influential researchers and key publications, establishing a network of scholarly contributions. Meanwhile, the keyword co-occurrence analysis illuminated the evolving themes in the literature, pointing to growing interest in aligning organisational performance with sustainability goals. Together, these techniques facilitated the identification of both established knowledge and emerging research trends, ensuring that the analysis was comprehensive and reflective of the dynamic nature of the field.

RESULTS AND DISCUSSION

Publication Output and Growth Trend

The bar chart (Fig. 1) illustrates the number of research papers published annually from 2004 to 2024, revealing a marked increase in recent years. The data shows that research activity was relatively low and steady from 2004 to around 2015, with a gradual rise thereafter. A significant surge is evident from 2020 onwards, peaking around 2023, where the annual publication count approaches 30 papers. This recent growth suggests a heightened interest in the field, possibly due to new trends, innovations, or policy changes that have amplified its relevance. Over the entire period, the average number of publications per year is 10.4, while the last five years (2020-2024) show a much higher average of 25.4, underscoring the recent surge in research contributions. This trend reflects both the growing engagement and the increasing scholarly impact of the field in recent years.

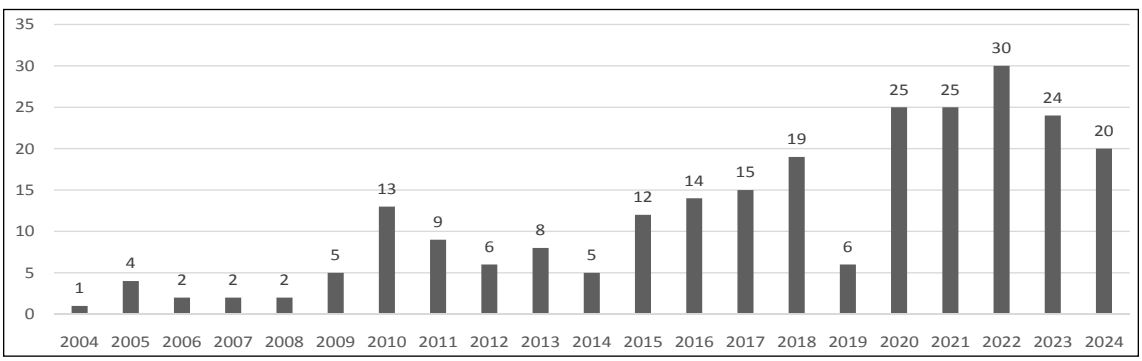

Fig. 1: Distribution of Research Papers Publications, period-wise

Document Type and Subject Categories

The pie chart (Fig. 2) displays the distribution of research documents by subject area, with Business and Management leading at 21.8%, followed by Environmental Science at 17.1%, and Social Sciences at 16.1%. These areas dominate the research focus, reflecting an interdisciplinary emphasis on management, environmental issues, and societal studies. Energy (12.3%) also holds a significant portion, indicating interest in sustainability and resource management. Secondary fields like Engineering (8.7%), Computer Science (8.4%), and Economics (5.8%) add technological and economic perspectives. The lower representation in Decision Sciences (4.6%) and minimal focus in Medicine and Earth Sciences (0.9% each) may suggest under-explored areas. This breakdown provides insight into research trends and potential gaps, useful for bibliometric analysis in identifying high-impact and emerging fields.

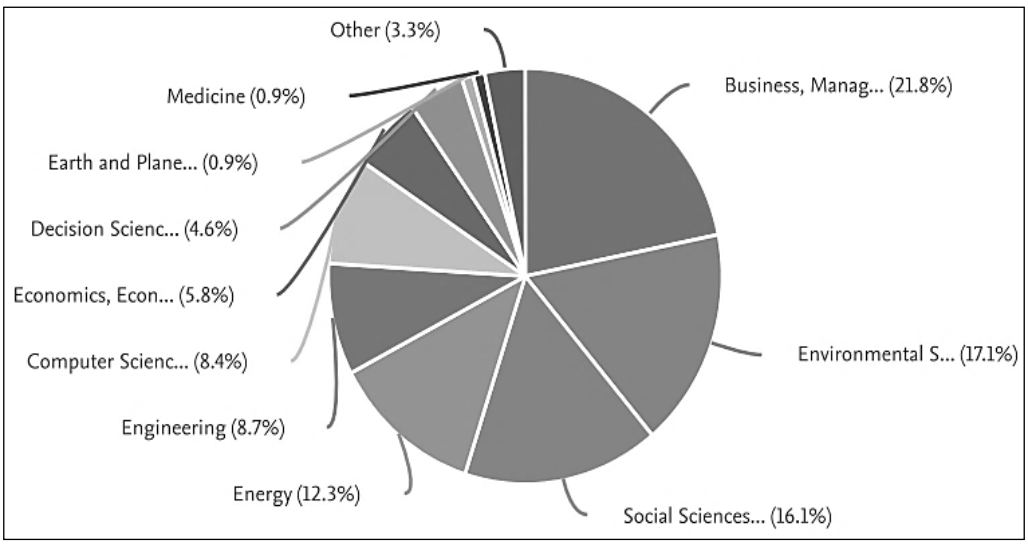

Fig. 2: Document Type and Subject Categories

Keywords Co-occurrence Analysis

One key aspect of the bibliometric map is the centrality of the Balanced Scorecard (BSC) around which the research developed, with 61 out of 1274 words selected as keywords based on minimum keyword occurrences of 5 (Fig. 3). Many research cross-sections are observed through 3 distinct clusters. The green cluster tackles sustainability issues as well as strategic approaches, as it boasts of keywords such as "sustainability balanced scorecard", "strategic approach", and "stakeholders", highlighting the inclusion of the environmental and social dimensions into the traditional performance evaluation models and practices. The red cluster on corporate social responsibility (CSR) strategic planning and benchmarking demonstrates what areas of BSC applicability are in integrating strong corporate strategies to sustainability goals. Areas of application include finance, supply chains, and service providers, amongst others. The blue cluster contains topics that focus on measurable metrics such as KPIs and organisational performance reporting, highlighting BSC operational applications in facilitating the organisational decision-making process.

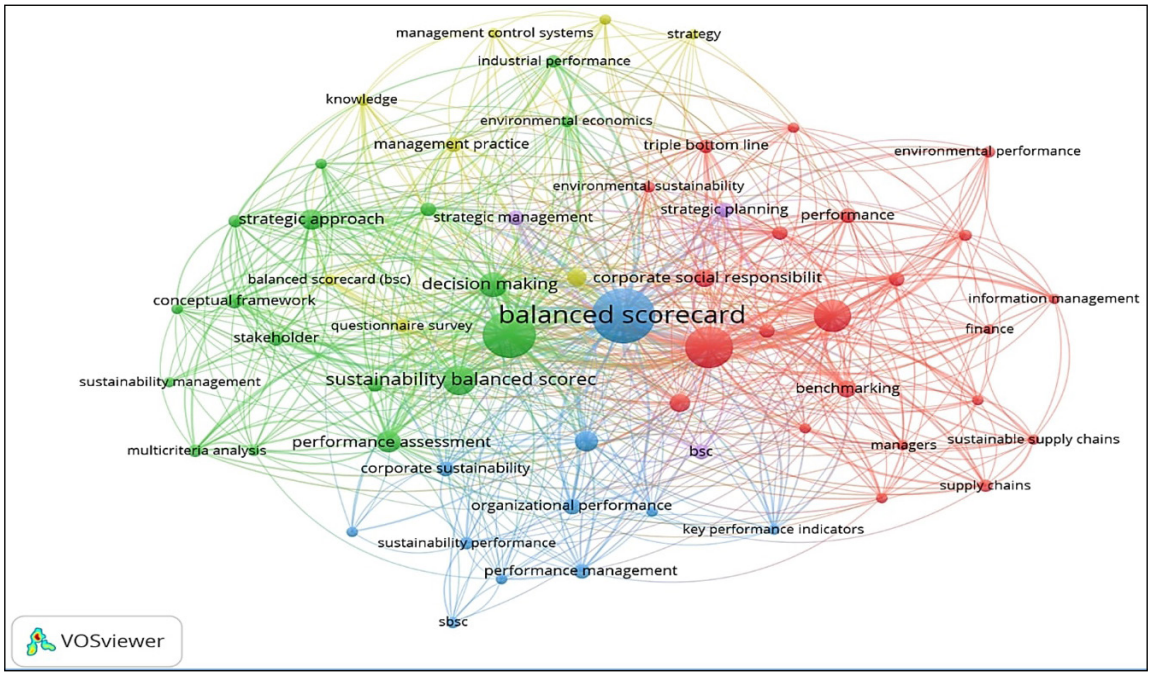

Fig. 3: Key word Co-occurrence map

There are strong relations between some of the keywords, for example, the use of "balanced scorecard" in the same context as "corporate social responsibility", suggesting the interdisciplinary facet of the research. Emerging terms as "triple bottom line" and "sustainability management" suggest that there is increasing concentration towards achieving the integration of economic, social and environmental. Nonetheless, some of the areas linking traditional management control systems to sustainability may be rather undeveloped but are also some of the opportunities that await further exploration. There are opportunities to investigate how other aspects of the existing systems can be enhanced in the Years, as the map highlights areas that have not been widely researched. This is done by the use of how sustainability, CSR, and performance objectives can be integrated into a broader framework, and how the BSC enclaves international impact.

Co-authorship among countries: The co-authorship network map (Fig. 4) highlights global research collaborations among 61 countries, with 21 meeting the threshold of participating in papers involving at least 25 countries. The map is divided into four clusters. The yellow cluster, including India, Australia, Malaysia, and France, reflects strong regional collaborations, particularly in the Asia-Pacific and South Asian context, emphasising shared priorities like climate change, renewable energy, and public health. The green cluster, featuring Brazil, Spain, Portugal, and Iran, showcases partnerships in Latin America, Europe, and the Middle East, often in agriculture, sustainability, and energy research. The blue cluster, comprising the United Kingdom, China, Taiwan, and Turkey, highlights strong connections in technology, manufacturing, and innovation-driven domains. The red cluster, which includes New Zealand, South Africa, Indonesia, and Thailand, represents partnerships in biodiversity, conservation, and resource management, reflecting the needs of the Southern Hemisphere. The United States is central, acting as a global research hub connecting all clusters.

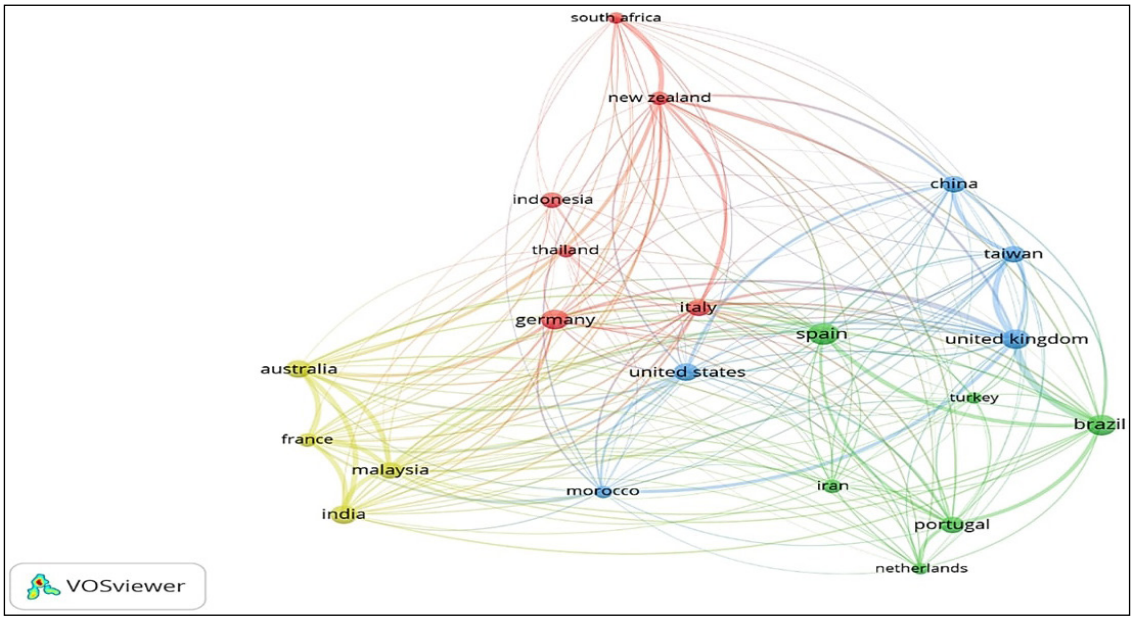

Fig. 4: Co-authorship among Countries

Research Exploration in the Indian Context

India's 7th position underscores its pivotal role in global and regional research collaborations, particularly within the yellow cluster. India's partnerships with countries like Australia and Malaysia often focus on areas such as renewable energy (for example, solar energy technologies), agricultural innovations, and information technology. The country is also heavily involved in addressing sustainable development challenges, including water resource management, climate resilience, and urban planning. With its burgeoning research output, India collaborates extensively with countries in other clusters, such as the United Kingdom and the United States, in domains like artificial intelligence, healthcare technologies, and space research. This growing international engagement reflects India's strategic focus on leveraging global expertise to drive national innovation and sustainable development.

Sources Analysis

The co-citation network map (Fig. 5) depicts the most influential sources in sustainability-related research; the number of sources having a minimum of two documents per source equals 21 out of a total of 135. The map is divided into clusters, and "Sustainability (Switzerland)" and "Journal of Cleaner Production" appear as central nodes for the broad influence and the interdisciplinary relevance. Green-clustered Sustainability (Switzerland) emphasises environmental sustainability and clean production practices. The red cluster includes the International Journal of Production and Sustainability Accounting, Management and Policy Journal, and its focus is on production management and sustainability accounting. The blue cluster finds its representation in Benchmarking journals, which have a big emphasis on performance evaluation and improvement of strategies in the sustainability track. Journal of Business Ethics and Sustainable Development act somewhat as a bridge between the clusters representing ethical, developmental, as well

as operational aspects. This map highlights the significance of these key journals in driving collaborative and impactful research in the sustainability domain.

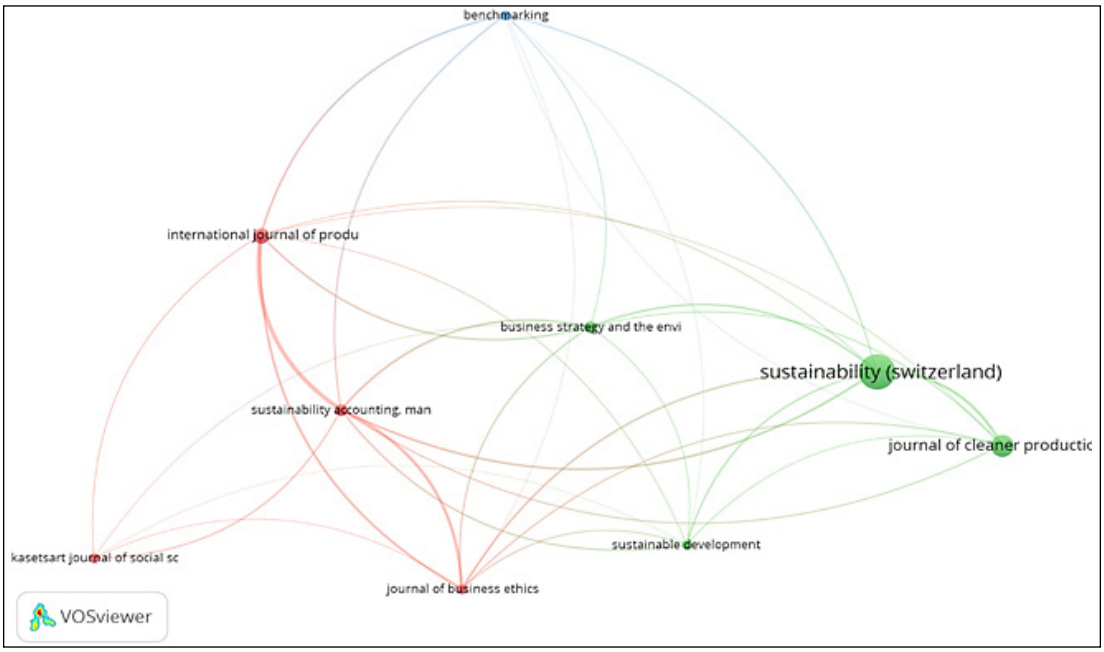

Fig. 5: Sources Analysis

Co- Citation Analysis

Co-citation analysis is a key bibliometric technique used to examine the intellectual structure of a research domain by analysing how frequently two documents are cited together in other scholarly works. In the submitted paper, co-citation analysis was employed to identify the most influential references and authors in the field of sustainability and the Balanced Scorecard (BSC).

1. Co-Cited References Analysis: The co-citation network identified 12 highly influential references out of 13,072 with a minimum threshold of 10 citations (Fig. 6).
    a. Three distinct clusters emerged, such as —
        - Red Cluster (Foundational Works): Includes seminal texts such as Freeman's Strategic Management: A Stakeholder Approach (1984) and Elkington's Cannibals with Forks (1997), which introduced the Triple Bottom Line concept. These works focus on the alignment of business strategy with stakeholder interests and environmental concerns.
        - Green Cluster (Sustainability Performance Measurement): Includes authors like Journeault and Epstein, emphasising sustainability accounting and integrated performance measurement systems for corporate sustainability evaluation.
        - Blue Cluster (Balanced Scorecard and Strategy): Centres around Kaplan and Norton's Balanced Scorecard framework, demonstrating how performance management integrates with strategic sustainability goals.

b. The central role of the Balanced Scorecard framework suggests that research in sustainability and performance measurement is heavily influenced by Kaplan and Norton (1992, 1996), bridging strategic management with sustainability concerns.

c. The network also highlights gaps in research, particularly in integrating dynamic sustainability metrics into BSC models, presenting future research opportunities.

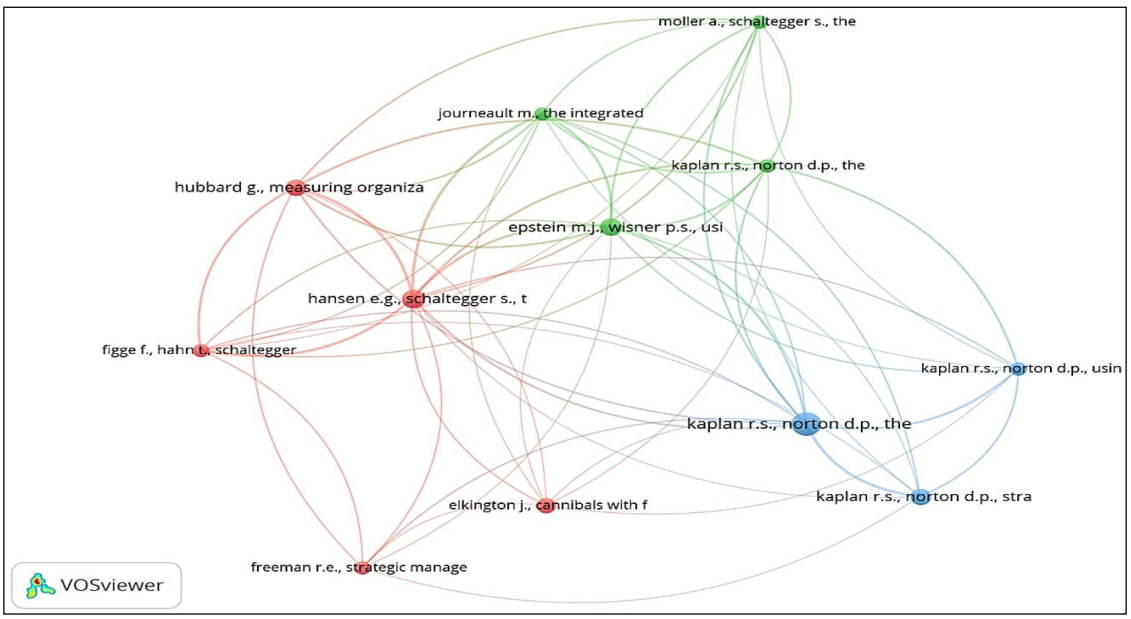

Fig. 6: Co-Cited references

2. Co-Cited Author Analysis (Fig. 7):

a. The most influential authors based on co-citation frequency include:

- Robert S. Kaplan and David Norton – Pioneers of the Balanced Scorecard approach.
- Stefan Schaltegger and Roger Burritt – Key contributors to sustainability performance measurement.
- John Elkington – Developed the Triple Bottom Line concept linking sustainability and business performance.
- Archie Carroll – Known for research on corporate social responsibility (CSR) and business ethics.

b. The co-citation map (Fig. 7) reveals a structured research landscape with well-defined clusters, but also indicates that certain sustainability-related aspects of the Balanced Scorecard remain under-explored.

c. The key Findings from Co-Citation Analysis are:

- Balanced Scorecard (BSC) research is a central node in sustainability-related performance management studies.

- Three major intellectual traditions – the stakeholder theory, sustainability accounting, and performance management- intersect in this field.
- A limited number of core studies dominate citations, reflecting strong foundational works but also potential gaps for further exploration.
- Emerging themes like integrating environmental, social, and governance (ESG) metrics with traditional financial measures are becoming more relevant.

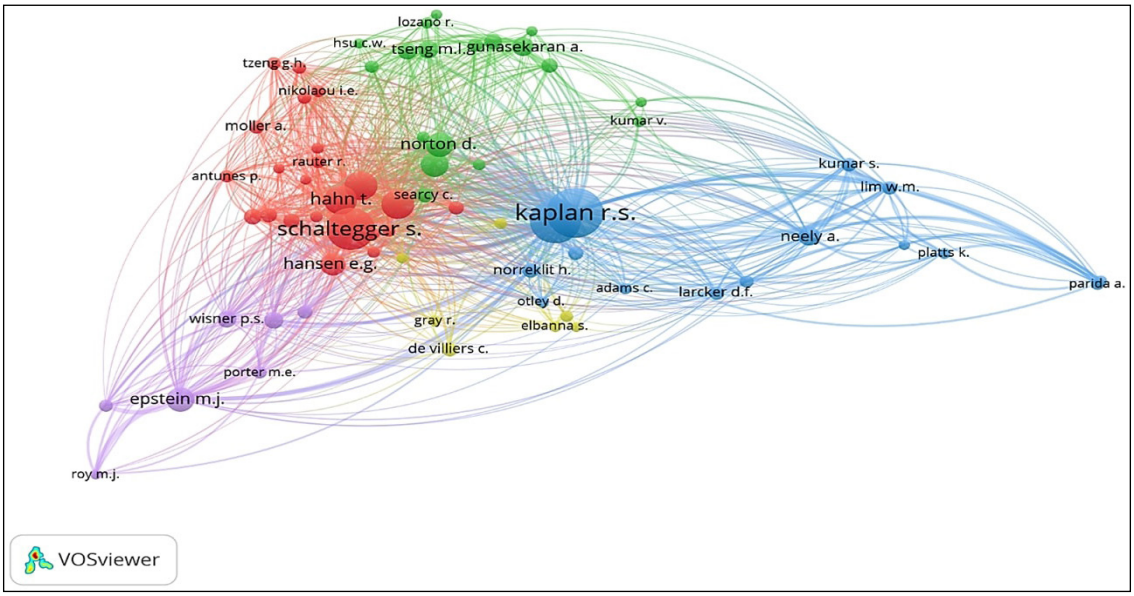

Fig. 7: Co-Cited Authors

CONCLUSION

This article provides an all-encompassing bibliometric analysis of global research trends in integrating the Balanced Scorecard with sustainability. Using 247 peer-reviewed articles over 20 years from 2004–2024 on the Scopus database, the paper points out dominant themes, collaboration, and trends that represent this field, which cuts across disciplines. This would not only show the trend for a larger and growing interest in aligning the performance measurement framework with the objectives of sustainability, but would also show some significant gaps that present an opportunity for further research.

The trend analysis of the publications shows a steady growth in the volume of research, particularly after 2020, representing a raised scholarly and corporate interest in sustainability. This correlates with broad initiatives at the global level, including the United Nations' Sustainable Development Goals (SDGs) and the heightened interest in ESG metrics. The impressive growth notwithstanding, the analysis did find underexplored themes, particularly in how best to integrate advanced sustainability metrics into traditional BSCs, indicating plenty of ground for further research.

Applying keyword co-occurrence analysis, three clear thematic clusters emerged. First and foremost, the strategic inclusion of sustainability in the organisational performance framework through tools such

as the SBSC is highlighted. The second cluster associates CSR with strategic planning, highlighting the BSC's use in linking business goals with societal expectations. The third cluster deals with performance measurement, bringing out the operationalisation of sustainability through KPIs. Terms such as "triple bottom line" and "sustainability management" are coming onto the horizon, reflecting the growing inter-disciplinarity within the discipline.

Co-authorship maps analysis further reveals a strong global network of researchers. The United States, the United Kingdom, and India are playing major roles in driving research in those countries. This trend from India is more of an indication of its strategic move to leverage global expertise to handle sustainability challenges. Some regions and disciplines have a lower representation, thus necessitating more inclusive and diverse collaborations.

Source and co-citation analysis have revealed seminal works by individuals like Kaplan and Schaltegger whose work has essentially set the intellectual foundation to this day. The emergence of Sustainability of Switzerland and the Journal of Cleaner Production as vehicles driving impact research is evident, and in the co-citation network, the work reveals that the Balanced Scorecard has indeed been a key adaptation in integrating sustainability considerations into organisational strategy.

In summary, this paper presents a trend of consonance between sustainability and performance management frameworks. The Balanced Scorecard represents the epicentre of this trend. Much has been done to bring the two different worlds closer together; however, findings of the study underscore the fact that further studies are badly needed as regards filling gaps in the integration of dynamic metrics for sustainability, examining underrepresented regions, and adopting emerging technologies. This ongoing conversation between sustainability and strategic management promises to shape innovative solutions for achieving long-term economic, social, and environmental goals. Based on the findings of the paper, several promising future research domains have emerged:

1. Integration of Advanced Sustainability Metrics: Although significant work has been done on the Balanced Scorecard (BSC) and sustainability, the study highlights a clear gap in incorporating dynamic sustainability indicators, such as ESG measures and triple-bottom-line approaches, into traditional BSC frameworks. Future research should focus on developing models that effectively integrate these advanced metrics to enhance both strategic and operational performance.
2. Underexplored Geographical and Disciplinary Perspectives: The analysis reveals that while research output has surged in recent years, certain regions and disciplines remain underrepresented. Expanding bibliometric studies to include emerging economies and diverse academic fields could provide a more balanced, global perspective on sustainability practices, thereby uncovering unique challenges and opportunities in different contexts.
3. Adoption of Emerging Technologies: With the growing impact of digital transformation, there is significant potential for emerging technologies, such as big data analytics, IoT, and AI, to refine sustainability measurement and reporting. Future investigations could explore how these technologies can be integrated into performance management systems to capture real-time, multi-dimensional sustainability data.
4. Interdisciplinary Approaches and Collaborative Models: The paper underscores the need for interdisciplinary research that bridges gaps between strategic management, sustainability reporting, and performance evaluation. Future studies may focus on collaborative models that combine

insights from business management, environmental science, and social studies, leading to more comprehensive frameworks for sustainable development.

5. Impact of Global Policy and Sustainability Initiatives: Given the increasing emphasis on the United Nations' Sustainable Development Goals (SDGs) and other policy frameworks, further research could examine how global initiatives influence the evolution of performance measurement tools like the BSC. Understanding these dynamics could help tailor performance frameworks to meet both corporate and societal sustainability objectives.

Together, these findings point to a rich field for future inquiry that not only refines existing performance management tools but also paves the way for innovative, technology-enabled, and globally inclusive approaches to sustainability.

NOMENCLATURE

Table 1: List of Abbreviations used

Sl. No.	Abbreviations	Descriptions
1	BSC	Balanced Scorecard
2	SDGs	Sustainable Development Goals
3	ESE	Environmental, Social and Governance
4	KPI	Key Performance Indicators
5	CSR	Corporate Social Responsibility
6	IoT	Internet of Things
7	AI	Artificial Intelligence
8	SBCS	Sustainable Balanced Scorecard

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