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A bibliometric review of scientific research on the significance of information technology relating to sustainable development reporting practice

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Abstract

Sustainable development, a prominent issue in the twenty-first century, is significantly influenced by the rapid global IT revolution. This study employs bibliometric analysis to explore the role of scientific research in sustainable development reporting, aligning with international standards and utilizing IT tools. It assesses countries' awareness of sustainable development reporting's importance in achieving socio-

economic and environmental goals. The study examines article frequency, source countries, authors, co-authorship, citations, key term co-occurrences, and bibliometric coupling. The result concludes that active engagement among research work of academic institutions, government organizations, and industries of emerging countries on the development and role of information technology in sustainable development reporting practices can foster cost-effective ways for sustainable development reporting which may play a vital and crucial role in sustainable development reporting for middle- and low-income countries to ensure a green and sustainable future. This work can benefit middle- and low-income nations in their pursuit of a green and sustainable future. The research highlights the significance of academic institutions in enhancing sustainable development reporting, especially for Micro, Small, and Medium-Sized Enterprises (MSMEs) in middle and low-income countries, offering valuable insights for future actions, which in turn may help these countries to put more effort into this domain through their academic establishments.

Keywords: information technology (IT), sustainable development reporting (SDR), Scopus database, VOS viewer, bibliometric analysis

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Introduction

In the era of the 21st century, environmental preservation and sustainable development are no longer just topics of expert discussion or current fashion. The environmental, social and governance (ESG) sustainable development specifications are rapidly evolving, driven by increasing demands from investors, regulators, and other stakeholders. The need for high-quality disclosures and better use of data and key performance indicators (KPIs) is expected to be critical for a company's future. The imperative to build resiliency and sustainability has never been stronger; from the global push to reduce carbon emissions, the real impact of climate change on our lives, to the availability of funds to enable companies to meet their obligations and the technological advances that now support the ability to meet their ESG goals.

According to the UN's [1], sustainable development is one that "satisfies the demands of our time without jeopardizing the chances of coming generations from getting their resource requirements in future." Since then, the discussion of sustainable development and corporate behavior has gained momentum, with demands for innovative performance techniques, environmentally friendly company models and integrated reporting systems [2–4]. The Sustainable Development Goals (SDGs) advocated by the United Nations (UN), which establish the world's goals and aspirations for 2030, are encouraged by responsible corporate behavior, according to the 2030 Agenda.

Corporations play a crucial part in this process and may hold the key to success or the reason why this challenge fails [5]. Therefore, sustainability reporting has gotten a lot of attention from corporate management and national leadership during the last couple of years and numerous theoretical and empirical studies have been focusing on the sustainability reporting area. Companies are moving to go beyond financial performance in order

to drive business because of the shifting global environment. Company executives are becoming more aware of the need to incorporate environmental and social issues into their overall company strategy. Hence, the SDGs are being included into organisations' thinking and reporting using integrated sustainability reporting, which has been described as a promising strategy for disclosing the business journey towards SDG achievement [6]. Therefore, large, multinational corporations and international organizations now routinely report on sustainability. Leading standards in the industry, such as the Global Reporting Initiative (GRI), Science-Based Targets Initiative for Net Zero or TCFD for disclosures, have made companies report progress towards goals with underlying information harvested from various data points across their value chain.

After extensive debate over the nature, constraints and challenges of integrating reporting, it has come to be widely acknowledged as one of the most important management and accounting developments across the corporate sector and other organizations, and it is getting wide acceptance across the globe [7, 8]. The International Integrated Reporting Council (IIRC) introduced integrated reporting in 2011 with the goal of providing a succinct and comprehensive report on how an organization's strategy, governance, performance, and prospects contribute to the creation of sustainable value over the short, medium, and long term.

For the purpose of creating non-financial reports, the Global Reporting Initiative (GRI) Guidelines and the Institute of Social and Ethical Accountability Standard (Accountability 1000, AA1000) have both been formed. Several organizations and businesses are using the widely accepted and implemented Guidelines for Sustainability Reporting standard established by the Global Reporting Initiative for presenting non-financial reports. However, in many low- and middle-income nations in Asia, Africa, and Latin America, there are a handful of firms or organizations that generate social and environmental reports. These non-financial reports increasingly need to be prepared by even medium- and small-sized firms due to the increased demand for them by national governments and other international bodies for monitoring sustainable development growth of respective countries and the world. Nevertheless, challenges persist in sustainable reporting, such as varying standards, limited resources, required skills, technology for interpreting diverse sustainability metrics and a lack of management support. Furthermore, disclosing environmental efforts might impact an organization's market image, causing some with weak environmental performance to avoid reporting. The ESG framework, with multiple organizations offering guidance and evaluation, lacks a unified structure due to the absence of mandatory standards. Instead, various organizations provide voluntary standards encompassing both quantitative and qualitative disclosures. International guidelines offer overarching frameworks, focusing on areas and governance processes for consideration. Rating agencies use data from self-disclosed and third-party ESG information to calculate ratings, contributing to an organization's score. According to [9], sustainability reporting is a sophisticated information system that reflects the costs associated with the enterprise's and organization's sponsorship and charitable programs, as well as the costs associated regarding environmental and ecological conservation measures that affect the enterprise's and organization's shareholders, clients and regulators. According to [10, 11], in order to allow stakeholders to objectively evaluate the enterprise's or organization's performance during the reporting period, the details provided in the report must be comprehensive to show the impact of their activities on the economy, environment and society. Using information technology to automate accounting operations is the most efficient approach for supplying financial and non-financial data. Information technology is defined as the method utilized to store, process, transmit, secure and display information with the goal of enhancing activity efficiency. It is important to consider the fact that the data is provided by the company's accounting department when setting up an automated sustainability reporting system. As a result, they choose which primary sources will be used to create the reports. According to [9], social activity accounting is a series of activities with the goal of producing a report using data from primary accounting. Automation of accounting operations using information technology is the most efficient method of supplying accounting data [12]. It is crucial that a structured process to govern internal and external communications, including regulatory and

mandatory communications (e.g., SEC filings, CRA reports, 10-K forms) is in place to enable automated sustainability reporting system. As a result, they select the primary sources that will be combined to create the reports [13]. AI finds widespread use in sustainability, especially in operational aspects and diversity, equity, and inclusion (DEI) efforts. Additionally, AI assists biodiversity start-ups in safeguarding and restoring forests.

The primary aim of this research is to look into scholarly work done within the academic realm around the role of information technology in sustainable development reporting and understanding the trajectory of development. This investigation also delves into the extent of this trend in middle- and lower-income countries. Given that the subject of "information technology's impact on sustainable development reporting" is still relatively new, this study seeks to explore and analyze key inquiries outlined in *Table 1* of the methodology section. This study has employed the Scopus Database as the primary resource for gathering information. The database was utilized to collect data encompassing research articles, conference proceedings, reviews, book chapters and books related to the keywords "information technology" and "sustainable development reporting." The data collected spanned the years from 1989 to 2023. Additionally, a bibliometric investigation was conducted, encompassing both descriptive and network visualization analyses, using the data extracted from the Scopus database.

1. Literature review

As sustainability is being embedded into corporate strategy, ESG reporting is no longer a voluntary activity; it is becoming a strategic opportunity to transform their value chain to create competitive advantage.

The implications of this decision extend well beyond publishing an annual report or complying with mandatory regulatory requirements, such as the SEC's forthcoming climate disclosure rule or the European Union's Corporate Sustainability Reporting Directive (CSRD). Companies can use this technology to gain insights into their supply chains, to spot methods for reducing a product's carbon footprint or to track progress on net zero targets. Over time, these efforts can potentially have a positive impact on financial performance. One important step toward sustainability reporting in the EU is the Non-Financial Reporting Directive (2014/95/EU) [14] passed in 2014 and applied for the first time in 2017. In 2021, approximately 11,700 large European public-interest companies were required to publish a sustainability report, formally labelled a "non-financial statement" [14]. However, a majority of lower-middle income and lower income countries either do not have a similar kind of regulatory framework or if they have something like this, it is poorly implemented and practiced.

Regulatory bodies are recommending new climate-related disclosures that will steer major transformations and conformity for uplifting the standard of disclosures that registrants make about climate-related risks, their climate-related targets and goals, their greenhouse gas (GHG) emissions and how the board of directors and management handle climate-related risks. The proposal would also require registrants to quantify the effects of certain climate-related events and transition activities in their audited financial statements. They are having major implications for businesses. There has been an increased rigor for process and controls related to GHG measurement and reporting: to include risk assessment that looks into future impacts on strategy and outlook. Enhanced transparency about how the business plans to achieve climate-related goals and details about the specific governance model to drive towards those goals are increasingly being embedded in the corporate vision. The auditing requirement of the financial statements has been expanded to include climate-related impact on Third-party assurance of Scope 1 and Scope 2 emissions required.

Generally, there has been a lack of research on sustainability reporting and this can be attributed to difficulty in parsing unstructured data and the lack of standards for the disclosure. In 2021, the International Sustainability Standards Board (ISSB) was established to create a global baseline of sustainability-related disclosure standards. Along with that, regulatory authorities in countries are also introducing mandatory ESG requirements for certain types of companies. One of the explicit objectives of the ISSB is "to facilitate the addition of requirements that are jurisdiction-specific or aimed at a broader group of stakeholders" [15]. Despite making headway, ESG reporting remains a challenging subject. While mandatory disclosure might seem beneficial from an investor's point

of view, there are costs associated with that. The key costs are the preparedness cost to gather the essential data, the proprietary cost of disclosing private information and the costs associated with litigation. On the other hand, voluntary disclosure gives firms the option to be selective with the information that is revealed, often painting an incomplete picture. ESG data providers play an important role for the time being but face the same challenges.

There is a wide range of governance structures and ESG owners vary from one company to another. They can include the general counsel office, chief sustainability officer, investor relations, communications, etc. The data that goes into ESG reports comes from systems that are not SOX controlled, and this data is often disorganized. To meet reporting requirements, the quality of the information will need to be increasingly higher, where the entire value chain is involved to find data, process data, compile data, and control data, even if they are not subject matter experts in ESG.

Given rapid regulatory changes, many companies are digitizing their sustainability data to better understand the current state across ESG metrics, risks and develop a robust reporting framework. It is critical to understand metrics reported today and anticipated future reporting needs (e.g., Scope 1,2,3 emissions, energy usage, water usage, waste, living wages, lost time incident rate, human rights violations, etc.) to define in-scope communication channels (e.g., ESG report, proxy and annual report, publicly disclosed investor presentation, etc.). It helps them understand expected insights to enable management to monitor the metric by validating data sources and collection processes (e.g., external vendor, internal, or a mix) for assessing performance. This approach ensures remediation planning and a roadmap for ESG processes while controlling deficiencies and enhancements based on industry leading practices. Companies that look holistically at their external disclosures and align them to their corporate strategy, data and communications will achieve a competitive advantage. Hence, it is quite clear that due to evolution in the regulatory framework imposed by international agencies and countries, it has been imperative for both corporations and organizations, as well as technology providers to combine, connect and link financial and non-financial view metrics into one holistic reporting. While going through different reports published by the concerned parties, it can be observed that many multinational companies operating in developed markets and technology consulting companies are working on sustainability reporting in a systemic manner as opposed to what is observed in a majority of local companies of middle income, lower middle income and low-income countries.

In the academic domain, research work on the role of information technology in sustainable development reporting is rather descriptive. Less than 300 serious pieces of literature have been indexed in the SCOPUS database from 1989 to 2023. However, since the last decade, research work in this domain has been showing a good increment, as companies all around the world are adopting sustainability reporting obligations as part of their operations to address stakeholder demands. Researchers and authors such as [16–22], underscored the role of corporate sustainable development reporting in companies and published their work concerned with this domain. It is similar in the area of socially and environmentally sustainable development reporting which encompasses the non-financial reporting practice for both corporate and government organizations. A few researchers and academicians such as [23–26], focused on this area and published serious literature. There are many other articles which have been published in the last decade, however, as per the urgency of the curbing climatic degradation for improving the condition of the economy, society and the environment, it is imperative to boost and strengthen research in information technology for developing viable and cost-effective tools for sustainable development monitoring and reporting for companies, academic institutions and government bodies in the low and emerging economies. The present day challenge is to understand how to go from commitment to action and master the complexity of your sustainable transformation. Various business sustainability programs at leading institutions are helping organizations at every step of the way, from "Risk Identification & Assessment," to "Policies, Framework, & Governance," "Risk Reporting," "Data & Technology Strategy and Planning of Execution and Management of Sustainable Reporting". In a variety of company areas, look for prospects for sustainable business models. Discover best practices from renowned, international sustainability firms. Utilize the most up-to-

date resources, frameworks, and technologies to place sustainability at the core of your company. With the assistance of instructors, coaches, and peers, create your individual sustainable transformation strategy.

2. Methodology

The Analytical Framework in the Methodology part serves as an analysis manual, making it easier for students to comprehend the entire research process. Each step that must be taken for this investigation is described in this section. This research aims to conduct descriptive and bibliometric analysis in the area of research work on the development and the role of information technology on sustainable development reporting. The research questions are listed in *Table 1* alongside the justifications and analysis methods. In order to give scholars a better understanding of the development in connected subjects, the descriptive analysis gives general information on the annual production, annual citations, and performance of countries, journals, authors and keywords. Apart from descriptive analysis, Bibliometric analysis has also been employed. This is a quantitative method for assessing the bibliographic data in articles and journals. The method is frequently employed to look-into the references to scientific papers that are cited in a journal, to map the journal's scientific field and to categorize research articles by research area. It uses a scientific computer-assisted review process to examine all the publications on a particular subject or area in order to find key authors or pieces of research, as well as their connections [27]. Bibliometric analysis is applicable to various research domains across multiple subject matter by deploying various search approaches and data analysis algorithms. The bibliometric analysis's findings are then provided, including the co-author, co-word and bibliographic coupling analyses, as well as general patterns in publication.

The bibliometric analysis method can alternatively be described as one that follows suggestions [28]. The procedure is used purposefully and adheres to predetermined stages, making it possible for other researchers to replicate it. Bibliographic analysis focuses on quantitative methods to analyse books, journal articles and other written materials. It is frequently used across a wide range of fields [29]. The bibliometric approach includes the application of quantitative techniques on bibliometric data and gathers the bibliometric and intellectual structure of a topic by examining the relationships between several research components [30]. With the use of such data, it is possible to highlight the contributions of a particular field of study, spot links and information silos, as well as trends and prospective gaps [31].

Below is a thorough explanation of each subsection of bibliometric analysis:

1. **Publication analysis.** Estimating the authors' contributions in related disciplines using the complete counting methodology, which correlates full recognition for related contributions [32].
2. **Citation analysis.** Determines an article's popularity by counting how often it is mentioned [33].
3. **Co-authorship analysis.** Analyzes the frequency of joint publications to track national cooperation efforts [34].
4. **Co-word / co-occurrence analysis.** Discover research hotspots via the degrees of keywords co-occurrence [35].
5. **Bibliographic coupling.** Find the bibliographic connections between two publications [36].

In this study, a procedure was established for choosing the search words, database to use, selection criteria for the search, software to use for analysis and results analysis. *Figure 1* below illustrates these steps, and the following paragraphs go into greater depth about them.

Definition of search terms. The purpose of the current article, as stated in the introduction, is to (I) identify and analyze the nature and evolution of literature related to information technology and cohesion with sustainable development reporting, and (II) provide a comprehensive systematic review on the development of the research work related to information technology and cohesion with sustainable development reporting and their connection to specific disciplines.

Selection of database and data collection strategy. The subsequent keywords were searched under the criteria of Title, Keywords and Abstract of the publications by using the search strings connected to information technology and sustainable development reporting: TITLE-ABS-KEY ("information technology") and TITLE-ABS-KEY ("sustainable development reporting") to collect articles' data in an electronic database.

Table 1.

Overview of the research development in this study

Descriptive / Bibliometric analysis			Research methodology
No.	**Research question(s)**	**Research objective(s) and aims**	
1	What is the publication trend of literature on the role of IT on SDR?	To understand how the development and role of IT in the area of SDR study has evolved over the years. This objective is essential to assist researchers in visualizing the potential of IT in the evaluation of SDR.	Descriptive analysis (publication analysis; citation analysis).
2	Which countries contributed to the development and the role of IT on SDR?	To identify the countries that contributed the most and received the most citations for their work. To promote international research collaboration, it is essential to achieve this goal.	Descriptive analysis (publication analysis; citation analysis).
3	Which journals led in the field of the development and the role of IT on SDR research?	To identify the journals that published the most articles on the relationship between IT and SDR. This goal is crucial in assisting researchers in selecting platforms for releasing and communicating their findings.	Descriptive analysis (publication analysis; citation analysis).
4	Which are the influential authors on the development and the role of IT on SDR research?	Find out which papers in the linked field are the most read. This goal is important since it might help researchers identify the research gaps in the associated papers.	Descriptive analysis (citation analysis).
5	How is the countries' collaboration structure in the area of the development and the role of IT on SDR research?	To assess the countries' collaboration trend in the development and role of IT in the area of SDR. This objective aims to help researchers decide which country is suitable for collaborating in publishing in this research area.	Co-authorship analysis.
6	What is the conceptual structure of keywords in the area of the development and the role of IT on SDR research?	To identify the research hotspots that evolved in the field. This objective helps researchers to understand the new research topics.	Conceptual structure analysis (co-occurrence analysis of words).
7	What is the countries' coupling structure in the area of the development and the role of IT on SDR research?	Presenting information on commonalities between two countries. This goal helps to assess the degree to which these countries' ideas and literary works are alike.	Intellectual structure analysis (bibliographic coupling).
8	Which are the research fronts of the development and the role of IT on SDR research study?	To identify papers in the field that have a similar theme. This goal gives scholars a sense of the topics covered in the papers, which helps them when they are creating new research projects.	Intellectual structure analysis (bibliographic coupling).

The search process was conducted based on the above-mentioned keywords. Since the Scopus database is one of the largest and most widely accepted scientific databases and has an extensive number of literary materials including peer reviewed articles, conference proceedings, reviews, book chapters, books, etc., it became the primary choice for the current course of investigation. Searching for "information technology" and "sustainable development reporting" in the Scopus database showed up total of 259 documents. Since only popular types of documents were included in this study such as articles from journals, review articles, conferences proceedings, book chapters, and conference reviews, subsequent filtering of the search results was needed. After filtering out short surveys (one document), Note (one document), and Erratum (one document), only 256 documents were retrieved. The first document related to the chosen search string appeared in 1989 and was included in the Scopus database. Hence, the time frame criterion from year 1989 to 2023 was selected for the data collection. While using the Scopus database, the aforementioned measures were followed, and bibliographic data was exported in CSV format without further data cleansing.

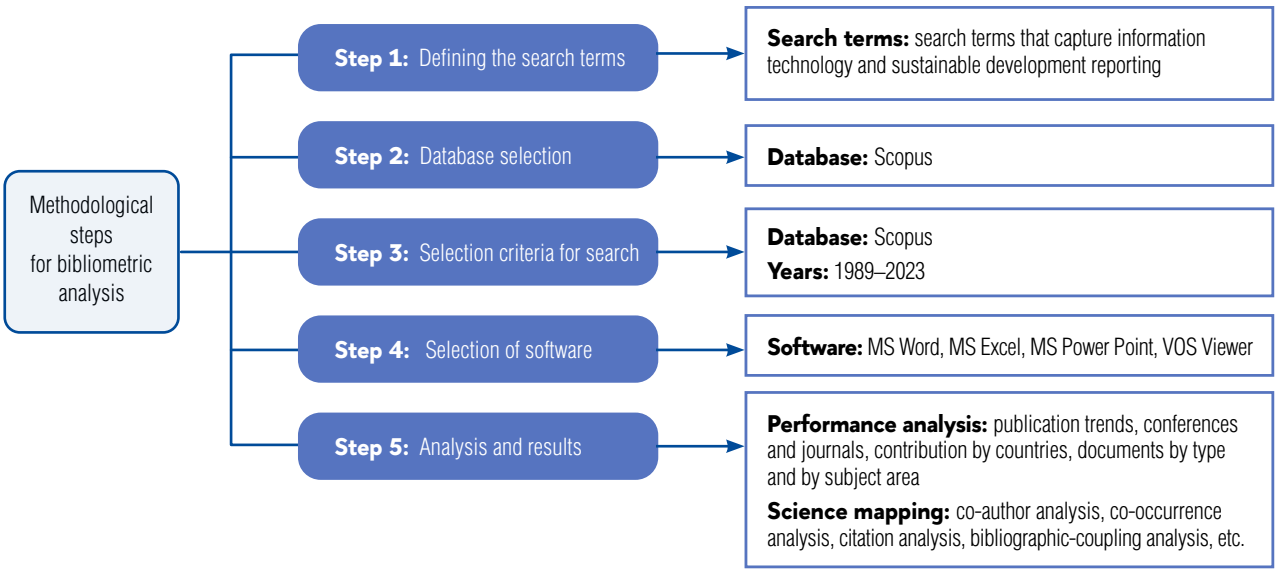

Fig. 1. Methodological scheme for the bibliometric analysis.

Software selection and data analysis. This article's preparation involved the use of numerous Microsoft Office programs. Nevertheless, the management and analysis of the collected data was primarily supported by the using two software programs, namely Microsoft Excel 2020, a popular spreadsheet, and VOS Viewer, a freeware data-visualization program. The search information was examined and categorized based on the annual number of publications, publication journals, contributing authors and productive nations. The next step was visualizing the data on "information technology" and "sustainable development reporting" in terms of documents by year, documents by country, documents per year by source, documents by authors, co-authorship–related countries, co-occurrence–related author keywords, and bibliographic coupling in terms of country and publication.

3. Results

The bibliometric analysis utilizes a tremendous amount of studies to identify popular trends in the development and role of information technology in the domain of sustainable development reporting. Therefore, this section emphasizes the results generated via bibliometric analytic tools.

3.1. Descriptive analysis

In order to analyze current trends in the research of the development and role of information technology on sustainable development reporting, this subsection offers a thorough overview of publication trends and citation performance on this study, followed by the most productive nations and the most important journals and articles. The number of papers on "information technology" and "sustainable development reporting" that were published in Scopus was the first finding based on data extracted from the Scopus database. The total number of documents retrieved was 256.

3.1.1. Documents per year

The following figure (*Fig. 2*) shows the number of documents published annually. The first document related with "information technology" and "sustainable development reporting" was published in 1989. From year 1990 to 2000, the average number of articles published annually was less than five. However, from 2001 to 2010, there was a growth in published research work and this can be observed with one deflection that occurred in 2010. From 2011 onwards, the number of published documents has

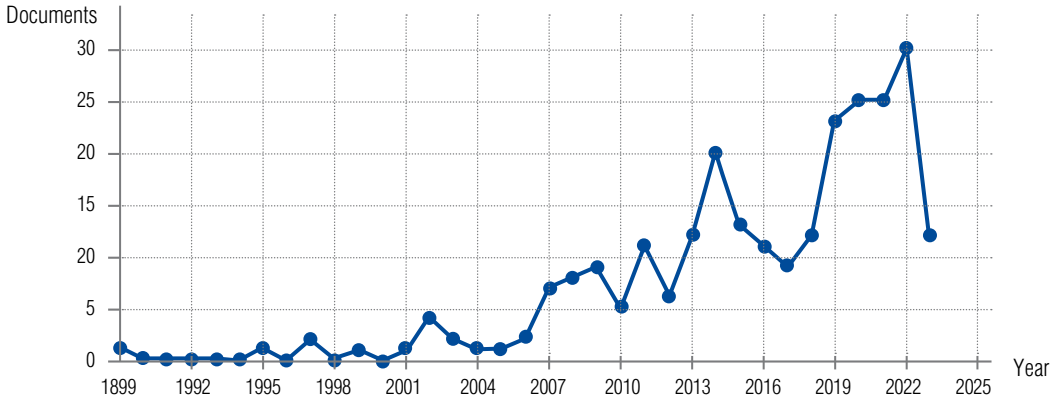

Fig. 2. Documents published annually.

increased by three times as compare to 2010. However, some downturn can be seen in year 2014, 2015 and 2016.

3.1.2. Document by country

As per the following *Table 2*, there are variations in research output and impact among different countries, with factors such as the number of publications, total citations, and average citation indicating the prominence of their research in the given field. It is quite clear that developed countries such as the USA, UK, Canada, Australia lead in both the number of publications and total citations, indicating a strong research output and impact in the field. The high average citation rate suggests that their research is frequently cited by others. On the other hand, despite a lower number of publications, China, amongst the developing countries, has a high total citation count and an exceptionally high average citation, suggesting a significant impact of their research.

3.1.3. Documents per year by source

Table 3 and *Fig. 3* shows the top ten peer-reviewed journals with the most publications in the field of information technology and sustainable development reporting. This analysis indicates variations in publication and citation statistics, average citation and scientific journal rankings among these sources. The SJR values give an idea of how these sources are ranked in terms of their scientific impact within their respective fields. The journal with the most such publication numbers is Sustainability from Switzerland. This source has a moderate number of publications and citations, along with a reasonable average citation. The SJR indicates a moderate journal ranking. This journal Sustainability was published by MDPI AG, then followed by Environmental Science and Engineering Subseries Environmental science and Journal of cleaner production, then followed by Technological forecasting and social change.

Table 2.

The top 10 most productive countries

No.	Country	TP	TC	AC
1	United States of America	39	2461	63.1
2	United Kingdom	31	1889	60.9
3	Canada	20	1574	78.7
4	Australia	20	572	28.6
5	Germany	17	429	25.2
6	India	17	165	9.7
7	Russia	14	50	3.5
8	Italy	13	193	14.8
9	China	12	1696	141.3
10	Spain	12	96	8

Note:
TP indicates the complete publication of articles according to countries; TC is the total citation, while AC is the ratio of total citation per total publication.

Table 3.

The top 10 most influential journalsbased on number of publications

No.	Source	TP	TC	AC	SJR
1	Sustainability (Switzerland) MDPI AG	12	190	15.8	0.664
2	Journal of Cleaner Production	5	355	71	1.981
3	Environmental Science and Engineering (Subseries: Environmental Science)	5	34	6.8	0.125
4	Lecture Notes in Networks and Systems	3	0	0	0.151
5	Technological Forecasting and Social Change	2	18	9	2.644
6	Science of the Total Environment	2	39	19.5	1.946
7	Frontiers In Public Health	2	23	11.5	1.125
8	Sage Open	2	41	20.5	0.462
9	Procedia Engineering	2	22	11	0.185
10	Acta Universitatis Agriculturae Et Silviculturae Mendelianae Brunensis	2	59	29.5	0.169

Note:
TP indicates the complete publication of articles according to countries, TC is the total citation, while AC is the ratio of total citation per total publication,
SJR is Scientific Journal Rankings

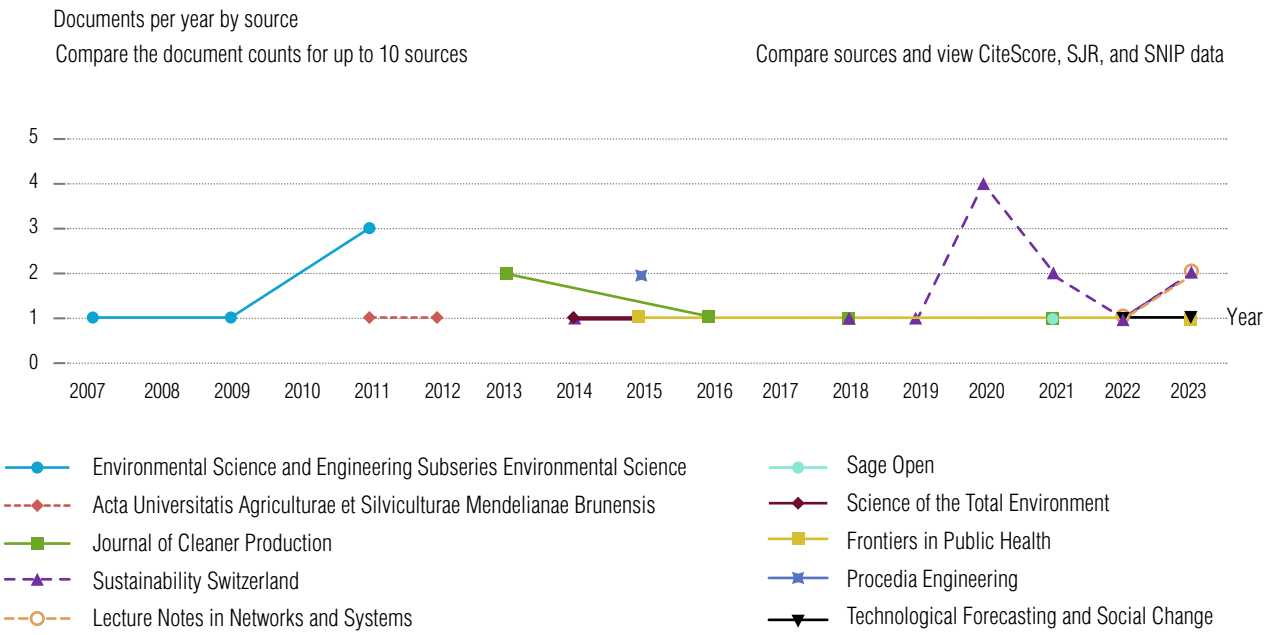

Fig. 3. The top 10 most influential journals based on number of publications.

3.1.4. Documents by authors

Table 4, indicates the top ten contributing authors with published articles in peer-reviewed journals in information technology and sustainable development reporting fields. The top four authors produced three articles each, whereas the bottom six authors produced two articles on this field individually. However, it can be seen that these authors have worked together on the same articles; therefore, the number of articles or proceedings are not increasing significantly.

3.2. Network visualization

Network visualization reflects the co-authorship of countries, co-words, and bibliographic coupling. Network analysis provides researchers with a better graphical visualization on collaboration, co-occurrences, and bibliographic coupling, where the relations between selected items is illustrated using nodes size, nodes color, and the thicknesses of connecting lines [37].

Table 4.

The top 10 most influential authors

No.	Author	Article Name / Conference Proceedings; Year; Total Citation
1	Gómez, J.M.	"Sustainable online reporting model – A web-based sustainability reporting software"; 2011; 1 "Concept and implementation of a flexible and differentiated shopping cart functionality for creating personalized sustainability reports"; 2008; 3 "Conception of system supported generation of sustainability reports in a large-scale enterprise"; 2007;1
2	Süpke, D.	"ProPlaNET – Collaborative sustainable project planning – A comparison with existing approaches"; 2011; 0 "Sustainable online reporting model – A web-based sustainability reporting software"; 2011; 1 "Concept and implementation of a flexible and differentiated shopping cart functionality for creating personalized sustainability reports"; 2008; 3
3	Trenz, O.	"Corporate performance indicators for agriculture and food processing sector"; 2012; 20 "Corporate performance evaluation and reporting"; 2011; 3 "Integration of economic, environmental, social and corporate governance performance and reporting in enterprises"; 2011; 39
4	Štencl, M.	"Corporate performance indicators for agriculture and food processing sector"; 2012; 20 "Corporate performance evaluation and reporting"; 2011; 3 "Integration of economic, environmental, social and corporate governance performance and reporting in enterprises"; 2011; 39
5	Arsenault, A.	"Integrated modelling software platform development for effective use of ecosystem models"; 2015; 3 "Integrated modelling software platform development for effective use of ecosystem models"; 2014; 8
6	Bhatti, J.	"Integrated modelling software platform development for effective use of ecosystem models"; 2015; 3 "Integrated modelling software platform development for effective use of ecosystem models"; 2014; 8
7	Braun, P.	"Intelligent mortality reporting with FHIR"; 2018; 8 "Intelligent mortality reporting with FHIR"; 2017; 5
8	Chokkavarapu, N.	"Role of drone technology in sustainable rural development: Opportunities and challenges"; 2023; 0 "Role of drone technology in sustainable rural development: Opportunities and challenges"; 2022; 0
9	Glebkova, I.Y.	"Technology application of the concept of market-oriented reporting in accounting and statistics"; 2019; 0 "Technology for determining the effectiveness of representative offices of the companies abroad"; 2019; 1
10	Hartcher, M.G.	"A governance framework for data audit trail creation in large multi-disciplinary projects"; 2013; 1 "Driving data management cultural change via automated provenance management systems"; 2013; 1

3.2.1. The co-authorship network of documents

Table 5 and *Fig. 4* display the co-authorship map in the "information technology" and "sustainable development reporting" articles. There were 91 countries according to VOS viewer. However, when a filter was applied to sources having at least one document per country with a minimum of one citation, then 72 documents met the threshold. The USA, along with the UK, Canada and Australia have a high publication count and a substantial number of links, indicating strong research collaboration with a significant link strength. On the other end, Russia has a lower publication count and zero links and link strength, with no collaboration in this dataset. The other counties in the scope, showed a moderate publication count and link strength, suggesting active research participations. Overall, the analysis indicates variations in publication count, research collaboration through links, and link strength among different countries. Countries with higher publication counts and stronger link strengths are likely more active in research collaboration within the dataset. The absence of links and link strength for Russia suggests limited representation in this specific dataset's collaborative network. The network visualization result also shows a number of nodes and clusters. The distance between the nodes and the link thickness reveals the degree of cooperation between countries, while the links between the nodes represent the relationships between the countries, for example, a red cluster showing strong connection among Canada, China, Indonesia, etc. Similarly, a green cluster shows strong connection among Greece, Turkey, Romania, etc.

3.2.2. The co-occurrence network of keywords in documents

Keywords co-occurrence analysis is a popular platform used in bibliometric analysis, since it helps reveal the core research topic. To do so, a VOS viewer was employed and the analysis result displayed the keyword distribution map in the "information technology" and "sustainable development reporting" articles based on the author keywords. Once 852 keywords were filtered using a minimum appearance criterion of three times, the output returned 35 keywords. Keywords that are

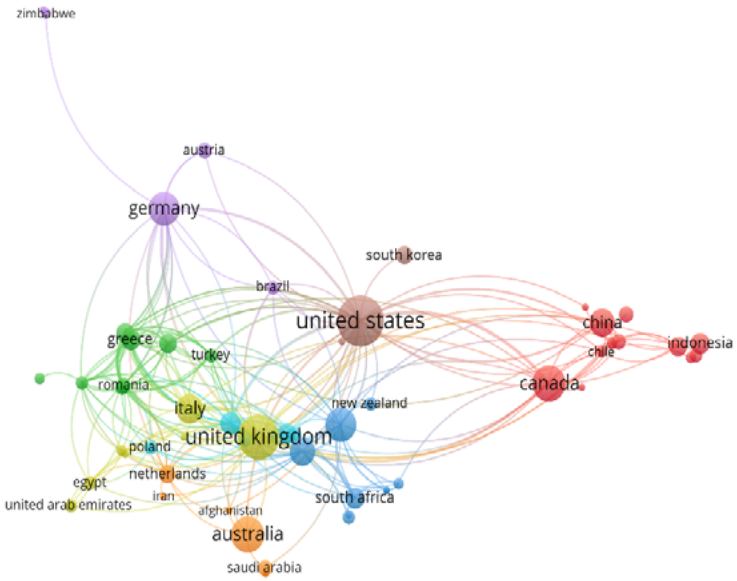

Fig. 4. The co-authorship network of articles on "information technology" and "sustainable development reporting" in terms of countries.

Table 5.

The top 10 most influential countries in terms of co-authorship network of articles on "information technology" and "sustainable development reporting"

No.	Country	TP	Link	TLS
1	United States of America	39	34	52
2	United Kingdom	31	35	55
3	Canada	20	16	21
4	Australia	20	6	7
5	Germany	17	20	25
6	India	17	19	24
7	Russia	14	0	0
8	Italy	13	23	33
9	China	12	11	13
10	Spain	12	22	28

Note:
TP indicates the complete publication of articles according to countries, TLS indicates Total Link Strength

Table 6.

The co-occurrence network of keywords in articles on "information technology" and "sustainable development reporting"

No.	Keywords	Occurrence	Link	TLS
1	Sustainable development	18	11	19
2	Sustainability	17	10	11
3	Sustainability reporting	14	10	24
4	Information technology	11	5	6
5	Reporting	9	10	14
6	GIS	5	1	1
7	GRI	4	7	19
8	Digitalization	4	5	7
9	Information systems	4	5	5
10	Climate change	4	3	3

Note:
TLS indicates Total Link Strength

unconnected to each other were not included in the analysis. *Table 6* highlights the top 10 authors' keywords arranged according to the occurrence and total link strength. "Sustainable development" recorded the highest occurrence (18) and total link strength (19), followed by "sustainability" (17) and (11). After that, "sustainability reporting" appeared (14) times with total link strength of (24), followed by "information technology" (11) and (6), and finally keyword "reporting" with (9) appearances and having (14) total link strength. These keywords also ranked as the top five most popular authors' keywords as seen in the descriptive analysis. Overall, the analysis reveals variations in the occurrence of keywords, their linkages and link strength. Some terms have stronger linkages and connections, while others occurred on account of their stronger mutual associations within the dataset. The significance of these observations depends on the context in which the keywords are being analyzed.

Concurrently, the co-occurrence of authors' keywords can be visualized via network mapping, as shown in *Fig. 5*. The size and color of nodes play different roles in the co-occurrence analysis, where the sizes reflect the frequency of the authors' keywords on the role of information technology in sustainable development reporting. It can be seen in *Fig. 5*, that keyword "sustainable development"; belongs to biggest node followed by "sustainability," "sustainability reporting," "information technology," "reporting," etc. A link connecting two terms shows that they appeared together, and the thickness of the link shows how frequently they occurred together. Additionally, the distance between nodes indicates the degree of their interaction between keywords.

3.2.3. Bibliographic coupling

According to [38], bibliographic coupling was initially used by [39] to identify the connections between two articles. Bibliographic coupling plays a prominent role in determining the relatedness of selected items such as

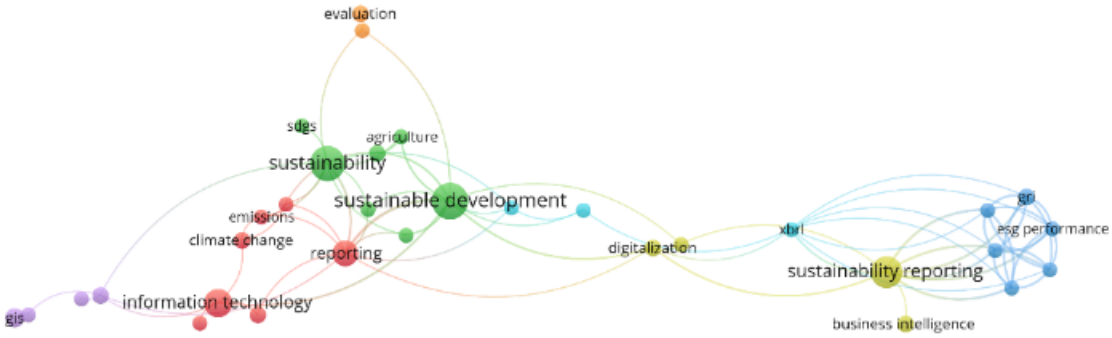

Fig. 5. The co-occurrence network of keywords in articles on "information technology" and "sustainable development reporting".

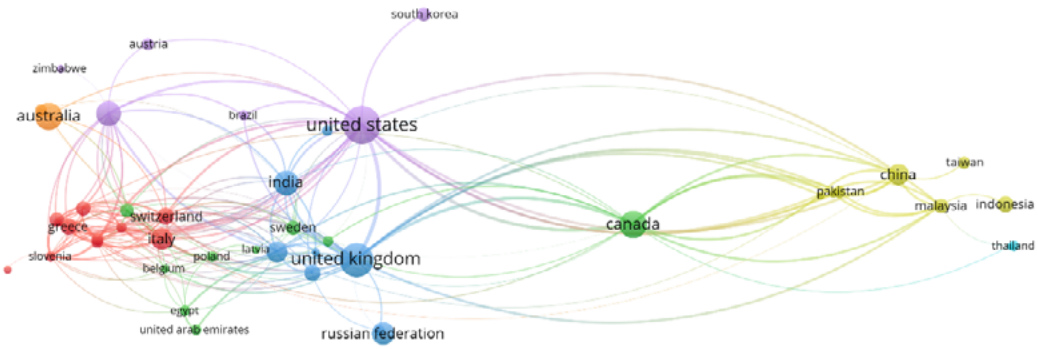

Fig. 6. The bibliographic coupling network of countries on "information technology" and "sustainable development reporting".

countries and publications. In this work, the bibliographic coupling of geographic regions and publications was carried out.

3.2.3.1. Bibliographic coupling of countries

Bibliographic coupling of countries occurs when an article from two countries cites another document in its reference list [40]. Bibliographic coupling illustrates the frequency with which these countries have common references in their bibliographies, enabling us to gauge the resemblance between these publications. The graphical representation of bibliographic coupling can be displayed using different combinations of colors and sizes of nodes. The colors signify the quantity of clusters identified in this analysis, while the size of nodes depict the contributions of each country – larger nodes denote more noteworthy contributions from the respective country. The investigation of bibliographic coupling was the most recent meta-analysis. 47 of the 91 countries met the requirement of having at least two documents and one citation per country.

Similar to the results in *Table 2*, the coupling analysis showed that the United States of America, United Kingdom, Canada, Australia and Germany are the top five countries in studies involving the research on the development and role of information technology on sustainable development reporting. The bibliographic coupling of countries involved seven clusters with distinct colors

as seen in *Fig. 6*. The Italy leads the densest cluster (red cluster) and is closely coupled with Switzerland, France, Greece, Slovenia, etc. United Kingdom leads the second-dense cluster (blue cluster) and is strongly coupled with India, Spain, Russia and South Africa. The United States of America (purple cluster), China (yellow cluster) and Canada (green cluster) also act as the leading countries in terms of cluster size. However, if in terms of overall analysis of coupling networks, it can be inferred that United States of America, United Kingdom, and Canada play the vital role in the research on the development and role of information technology in the sustainable development reporting, as many countries are coupled with these countries. However, despite a lower number of publications, China, too, is seen emerging as an active country in this area of research.

3.2.3.2. Articles

Bibliographic coupling occurs when two publications share a common reference article. This implies that articles with similar research focuses can be identified by examining the bibliographic coupling of their respective publications. The exploration of bibliographic coupling was carried out in the most recent meta-analysis. Out of 256 documents, 153 fulfilled the criterion of having at least two citations per document. In this analysis, the relationship between the information technology and developments in areas of sustainable development reporting is represented by colors and node sizes. The node colors indicate that clusters existed on this topic, while node sizes represent the total citations gained by a paper. As per the *Fig. 7*, the role of information technology in sustainable development reporting publications were grouped into two clusters by red and green node colors. The red cluster comprises five publications and a total of 76 citations, with an average of 15 citations per article whereas the green cluster has 4 publications and a total of 72 citations, with an average of 18 citations per article. The most cited publication in this (red) cluster focuses on "Internet-supported sustainability reporting: Developments in Germany" [40] (51 citations), followed by "Corporate sustainability reporting and disclosure on the web: An exploratory study" [20] (7 citations). The most cited publication in the green cluster focuses on the "Integration of economic, environmental, social and corporate governance performance and reporting in enterprises" [19] (39 citations), followed by "Corporate performance indicators for agriculture and food processing sector" [41] (20 citations).

Although the publications covered diverse topics, these clusters generally have comparable research areas. Therefore, it can be said that the "Development and role of information technology in sustainable development reporting" publications are ideal for use in sustainable socio-economic and environmental development.

4. Discussion

The above findings offer a detailed analysis of bibliographic traits in globally recognized Scopus-indexed journals. These articles center around "information technology" and "sustainable development reporting," alongside related fields such as "machine learning" and "sustainable development reporting" and "big data" and "sustainable development reporting." These areas have attained significant and at times unprecedented traction, especially in the private sector, though academic explora-

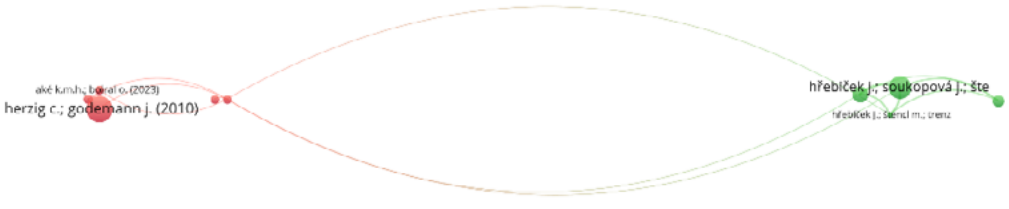

Fig. 7. The bibliographic coupling network of publications on "information technology" and "sustainable development reporting".

tion is rather limited, which is evident by scarce articles and conference presentations. The journals and conferences selected underscore the global scientific community's limited interest in these subjects and this trend can be seen in the descriptive and network visualization results obtained in the current course of research work. Co-authorship relationships analysis scope involved researchers from 90+ countries, with intense collaborations. However, the major collaborators belong to developed countries such as the United States of America, the United Kingdom, Australia, Canada, Germany, etc. Keyword co-occurrence patterns reveal associations, pivotal in guiding new research trends. Recent research topics are shown to emphasize "sustainable development," followed by "sustainability," "information technology" and "reporting" for future work. This signifies a close relationship between role of IT in sustainable development and the growing importance of transparent ESG reporting addressing interests of investors and regulators. Despite the number of publications, there is no direct correlation between them and citations. Notably, Sustainability (Switzerland), The Journal of Cleaner Production, and Environmental Science hold citation prominence. A few authors have been found to show high co-citation frequency, indicating widespread sources of information. However, limitations exist – this study focuses on specific units and high-level ESG terms, which might have potentially excluded other relevant articles. Future studies could diversify units, incorporate specific keywords and expand searches across broader databases for a wider research scope.

Conclusion

The study's statistical findings reveal a notable increase in the number of articles focused on sustainability reporting published in Scopus-indexed journals, especially in the last decade. The research emphasizes growing opportunities for collaboration among authors from different countries. Additionally, the study points out the abundance of easily accessible sources related to Environmental, Social, and Governance (ESG) reporting, indicating a potential for future research. As climate change impact become more tangible globally, all topics impacting sustainability will become crucial for both corporations and society. The analysis indicates that research on the role of information technology in sustainable development reporting is concentrated in countries with higher income levels, while middle and lower-middle-income countries have contributed less. The study underscores the need for comprehensive ESG reporting that creates a coherent narrative for various stakeholders. Future research frameworks should focus on sustainability goals, standardizing reporting content according to guidelines, and exploring links between ESG practices and United Nations Sustainable Development Goals (SDGs). To achieve a sustainable future, active IT consulting firms, companies, organizations, and governments must provide expertise and affordable solutions for sustainable development reporting. Encouraging middle and lower-middle-income countries to adopt such approaches can contribute to sustainable development. Increased research in this field can enhance the understanding and impact of sustainable business practices, influencing positive environmental, social, and governance outcomes, and creating long-term stakeholder value. This assistance will facilitate the participation of these countries, encouraging them to invest in technological infrastructure and non-financial accounting frameworks for effective and standardized sustainable development reporting practices. ■

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