

Clarifying the Conceptual Framework of Sustainable Finance and Periodising Research in the Field*

Balázs Sárvári  – Izabella Kuncz  – Petra Németh 

The topic of sustainable finance has become a rapidly developing field of research in recent decades, positioned at the intersection of market, regulatory and academic perspectives. In this article, we review the conceptual frameworks and the historical development of the literature. On the one hand, we systematise the key concepts (namely environmental, carbon, climate, green and sustainable finance), highlighting their overlaps and hierarchical relationships. On the other hand, we propose a periodisation approach that distinguishes three main phases: the forerunners of sustainable finance research (from the 1970s to 2010), early research (2010–2021), and the era of mature research (from 2021 onwards) – all broken down into sub-periods and aligned with landmark international developments. The conclusions highlight the interactions between market innovations, policy decisions and scientific research, as well as the temporal shifts between them. With this article, we aim to contribute to conceptual clarification and to lay the foundations for future research directions.

1. Introduction

The topic of sustainable finance has become one of the most dynamically developing areas of economic and financial thought over the past two decades. The economic impacts of climate change, the rise in physical and transitional risks, and new challenges to the stability of the financial system have collectively contributed to making the integration of environmental and sustainability considerations into financial decision-making a priority at both the academic and policy levels. This rapid development, however, has been accompanied by considerable conceptual diversity, which continues to shape the discourse within the field to this day. Our article is based on a corpus comprising 4,436 academic publications, covering the literature from 2001 to 2024 as indexed in Scopus and the Web of Science

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Balázs Sárvári: Magyar Nemzeti Bank, Senior Researcher; Corvinus University of Budapest, Assistant Professor. Email: sarvarib@mnbb.hu

Izabella Kuncz: Corvinus University of Budapest, Assistant Professor. Email: izabella.kuncz@uni-corvinus.hu

Petra Németh: Corvinus University of Budapest, Assistant Professor. Email: petra.nemeth@uni-corvinus.hu

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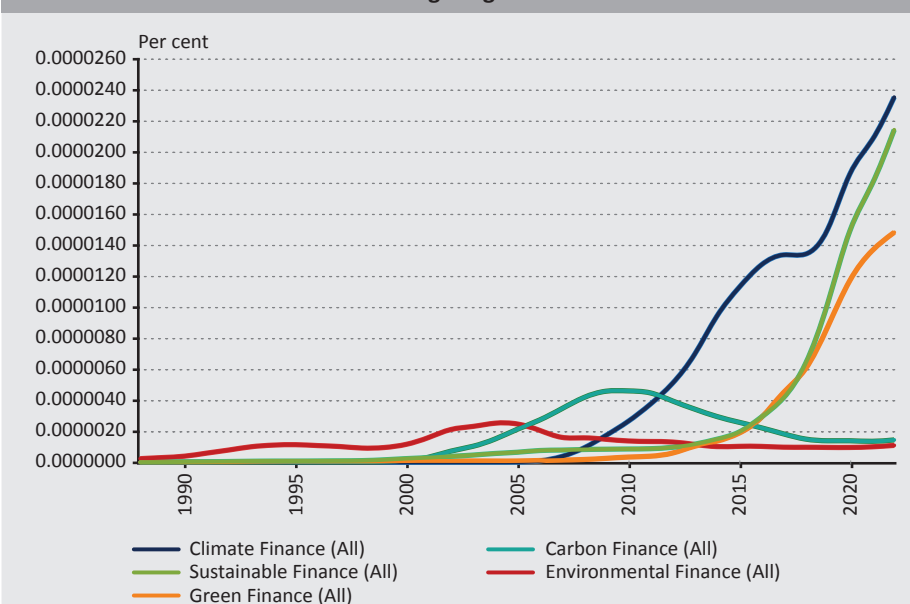
(see Sárvári 2024; Sárvári et al. 2026). This article presents the concepts in detail, clarifies their interrelationships, compares the main bibliometric analyses and briefly summarises the periodisation already outlined in the previous analysis.

2. The conceptual framework of sustainable finance

One of the most striking features of the literature on sustainable finance is the coexistence of various concepts that partially overlap. This is the result, on the one hand, of the fact that research topics have changed frequently over a short period of time, and, on the other hand, of the fact that researchers have approached environmental and economic phenomena through the lens of their own taxonomies.

While *Figure 1* illustrates this conceptual diversity, it also demonstrates the fact that distinct periods can be identified for each concept. The starting date of the graph is 1988, the year the Intergovernmental Panel on Climate Change (IPCC) was established, whilst the end date is the most recent year available on the platform. It is important to note that this Figure reflects the content of books analysed by Google Ngram, rather than that of scientific journal articles.

Figure 1
The rise of various terms based on Google Ngram between 1988 and 2022



Note: We used refinement level 2 to create the figure and did not distinguish between upper- and lower-case letters. For the selected period, 2022 is the most recent available closing value.

Source: Google Books Ngram Viewer (https://books.google.com/ngrams/graph?content=climate+finance%2Cenvironmental+finance%2Ccarbon+finance%2Cgreen+finance%2Csustainable+finance&year_start=1988&year_end=2022&corpus=en&smoothing=2&case_insensitive=true)

According to *Figure 1*, the term *environmental finance* was the first to gain prominence in books (1987–2001), followed by the emergence of the term *carbon finance* as the dominant designation. The term *climate finance* began to spread rapidly after 2006, and at the same time, the *carbon finance* concept also declined in significance and frequency. The terms *green finance* and *sustainable finance* became significantly more common after 2015. Given their significance, it became clear after 2020 that the term *sustainable finance* was emerging as a central concept. Meanwhile, use of the term *climate finance* continued to gain prominence and retained its dominant role in the literature throughout this period.

The classification of these concepts is justified on two grounds: one is the conceptual hierarchy (which concept is a subset of the other), and the other is the period-based classification (which periods the various conceptual frameworks were characteristic of). The former is covered in this section, whilst the latter is discussed in *Section 4*.

Few studies have undertaken a comprehensive attempt to define the concepts or to determine their relationships to one another. *Table 1* presents a comparison of three of these few examples. *Bhatnagar – Sharma (2022)* only carried out a conceptual comparison, but did not construct a conceptual hierarchy; therefore, the table follows the order of the conceptual hierarchies in the other two studies, and uses merged cells to represent categories that did not appear as separate entries in the study in question.

Table 1			
Comparison of the interpretation of sustainable finance concepts in the literature			
	Bhatnagar – Sharma (2022)	Singhania et al. (2024)	Sárvári et al. (2026)
Carbon finance	Mitigation of greenhouse gas emissions		
Climate finance	Mitigation activities and climate change adaptation		
Green finance	Renewable energy, green investments, environmentally friendly infrastructure	The concept of climate finance is expanded to include further environmental objectives	Integration of further environmental considerations (pollution prevention, biodiversity, resource efficiency)
Environmental finance	Addressing the negative impacts of environmental damage		A broader ecological approach; challenges the primacy of economic growth
SDG* finance	Socially, economically and environmentally inclusive development	The concept of green/ environmental finance is complemented by non-environmental SDGs	The concept of environmental finance is complemented by the social and corporate governance dimensions of ESG
Sustainable finance		SDG finance is supplemented by the governance dimension of ESG	
Note: * Sustainable Development Goals (SDGs).			

The concept of environmental finance also demonstrates that, in the literature, financial concepts relating to environmental sustainability form interrelated categories that partly overlap, whilst their meanings are not uniform. Some interpretations use it as a synonym for green finance (IFC 2016), whilst other approaches regard it as a broader category that also encompasses “finance and investment regarding the ecological environment (Air, water, soil, etc.)” (Noh 2018:4). The term originally referred to the financial applications of environmental economics; however, it was later narrowed to focus more on the impact of environmental costs and environmental risks on financial decisions (Cowan 1998; Linnenluecke et al. 2016; Németh-Durkó 2020).

The narrowest category is carbon finance, which focuses on financial mechanisms linked to the mitigation of greenhouse gas emissions. According to the World Bank’s definition, carbon finance “is a generic term used for the revenue streams that can be generated by low-carbon projects and activities from sale of their global greenhouse gas (GHG) emission reductions by sources, or GHG emission removals by sinks, or from trading in carbon credits” (World Bank 2018:xiii). Essentially, all financial measures necessary to combat greenhouse gases fall under this category (including the Clean Development Mechanism) (Lewis 2010; Mohsin et al. 2020). Mosharrafa and Mahmuda (2014) define carbon finance as a subset of environmental finance.

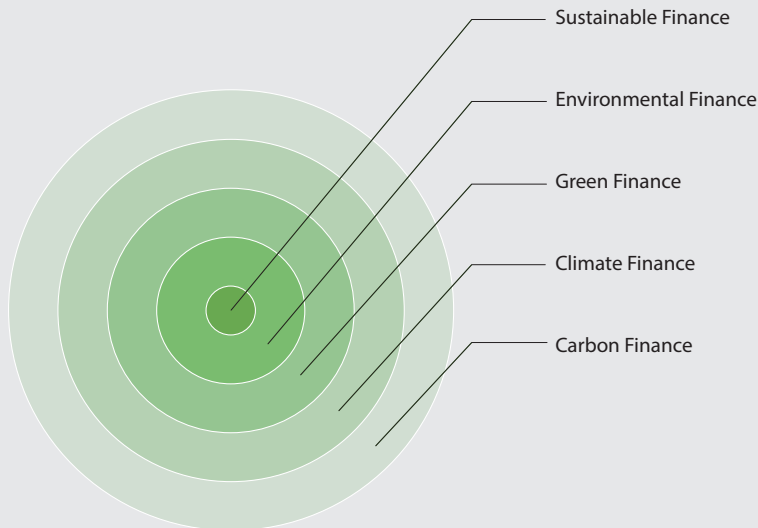
This focus is broadened by the concept of climate finance, which, in addition to mitigation actions, now also encompasses climate change adaptation (Hong et al. 2020; Zadek 2011). According to the United Nations Framework Convention on Climate Change (UNFCCC), “Climate finance aims at reducing emissions and enhancing sinks of greenhouse gases and aims at reducing vulnerability, and maintaining and increasing the resilience of human and ecological systems to negative climate change impacts” (UNFCCC 2018:25). The United Nations Environment Programme (UNEP) treats this as a sub-category of green finance (UNEP 2015).

Green finance has become a key concept since the 2010s and represents a broader approach than previous forms of targeted financing. It is aimed not only at supporting individual projects, but also at transforming the financial system as a whole from an environmental perspective, and in particular at supporting the transition towards a low-carbon and resource-efficient economy (Soundarrajan – Vivek 2016). This includes the financing of climate and environmental projects and the “greening” of resource flows; however, social sustainability goals do not yet form part of the concept (Rashid – Uddin 2019; Lindenberg 2014).

The broadest category within this conceptual framework is the concept of sustainable finance, which, in addition to environmental considerations, also integrates social and governance dimensions (ESG) and is linked to the more comprehensive framework of the SDGs (Lindenberg 2014; Singhania et al. 2024; European Commission 2025). Sustainable finance can thus be understood as a comprehensive framework that does not replace earlier concepts, but rather encompasses them as interrelated sub-categories.

This conceptual diversity is not merely a question of terminology, but also reflects differences in research focus, methodologies and policy objectives. As discussed above, we followed the order of Figure 1, but the hierarchy of the conceptual framework (Figure 2) shows that *carbon finance* is the narrowest concept, relating specifically only to the mitigation of greenhouse gas emissions, which *climate finance* extends to include adaptation. The concept of *green finance* integrates additional environmental considerations (e.g. pollution prevention and the conservation of biodiversity) into the remit of the financial system, whilst the concept of *environmental finance* – which is sometimes used synonymously with it – questions the primacy of economic growth. The term *sustainable finance*, however, also encompasses social and governance considerations. The current discourse on sustainable finance seeks to harmonise these different approaches; henceforth, we regard all the previous terms as part of this concept.

Figure 2
Thematic hierarchy of concepts



Note: Umbrella terms at a higher level are denoted by a darker shade.

The term “sustainable finance” is an umbrella term encompassing all the concepts listed above. The various terms cover, in part, different subject areas. Following this overview of the conceptual development of the term, we first present the most important bibliometric analyses below.

3. Background to bibliometric analysis of sustainable finance research

In recent years, the bibliometric analysis of sustainable finance has become a distinct research field, the aim of which is to map the development of the academic discourse, its main themes and key publications. Based on a review of the literature, previous bibliometric studies can be categorised into four main groups: analyses focusing on green finance; climate finance and ESG-oriented studies; works analysing the relationship between the financial system and sustainability; and general bibliometric reviews of sustainable finance. (The *Appendix* provides a comprehensive overview of the bibliometric analyses presented below.)

The first group comprises studies that specifically examine the development of green finance. This includes *Bhatnagar and Sharma (2022)*, who analysed research trends and the financing of renewable energy based on 666 Scopus publications, identifying green bonds and regulatory incentives as key themes. A similar approach is taken by *Debrah et al. (2022)*, who highlighted the growth in research and the role of sustainable investment mechanisms. *Muchiri et al. (2022)* also mapped out trends in development, whilst *Desalegn and Tangl (2022)* focused on the relationship between green finance and economic development. These studies identify important thematic clusters; however, their analysis is typically based on a single database and a relatively limited number of publications.

The second group comprises a bibliometric mapping of climate finance and ESG-oriented research. *Carè and Weber (2023)* examined the structure of the climate finance literature and highlighted research trends in mitigation actions and climate change adaptation. *Kouwenberg and Zheng (2023)* analysed the global development and geographical distribution of climate finance based on 1,347 publications, emphasising the growing role of renewable energy financing. *Kashi and Shah (2023)* mapped the ESG-oriented literature on sustainable finance, highlighting the relationships between banking performance, sustainability indicators and ESG criteria. *Khan et al. (2024)* and *Naeem et al. (2023)* analysed the bibliometric patterns of sustainable investments and ESG-based portfolios. These studies already adopted a broader perspective, but their time frames typically end around 2021.

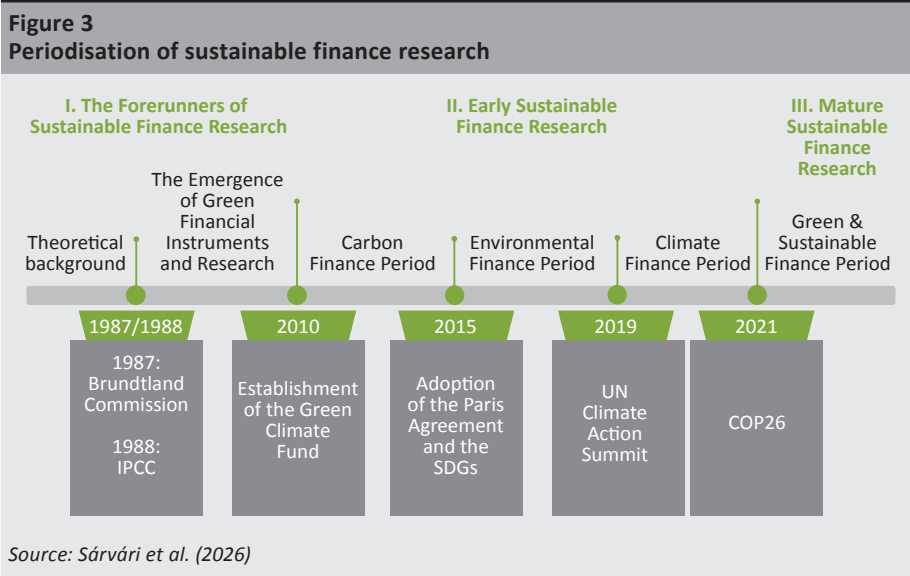
The third group comprises studies that analyse the relationship between the financial system and sustainability using bibliometric tools. *Linnenluecke et al. (2020)* explored the relationship between climate risks and financial stability, whilst *Kumar et al. (2022)* and *Luo et al. (2022)* examined the links between financial markets and sustainability risks. *Tao et al. (2022)*, *Yu et al. (2021)* and *Zhang et al. (2019)* published further analyses on the development of a sustainable financial system, with particular regard to the growing role of sustainable investments and financial innovations. These studies reveal important connections, but do not aim to provide an integrated overview of the entire literature on sustainable finance. The study by *Sárvári et al. (2026)*, which uses a corpus comprising 4,436 publications, also falls into this category. Based on a combined analysis of the Web of Science and Scopus databases, this corpus is significantly larger than that of the other analyses cited here. The study covers the period from 2001 to 2024, which allows for the inclusion of the latest trends in sustainable finance. The start of this period is more recent than in some other analyses because the authors did not thematically classify older studies, which other authors had categorised as sustainable finance, into this group. The study provides a systematic overview of developments in this field through a combined analysis of publication trends, co-citation networks, keyword mapping and geographical distribution.

The fourth group comprises general bibliometric reviews of sustainable finance. *Cai and Guo (2021)* presented a scientometric analysis of research trends in environmental finance, whilst *Cunha et al. (2021)* examined the development of sustainable financial instruments. *Akomea-Frimpong et al. (2022)* analysed the literature on green finance in banking, highlighting the role of regulatory and institutional factors. *Singhania et al. (2024)* and other studies reviewed the growth of the sustainable finance literature and its key players. Whilst these studies provide a more comprehensive picture, they typically examine between 50 and 1,300 publications and, in most cases, rely on a single database.

Following this review of bibliometric analyses, we summarise below the sub-themes typically examined in academic research and how these aligned to major policy decisions and institutional changes over time. We associate the concepts presented in *Section 2* with the periodisation of this developmental trajectory.

4. Eras of research into sustainable finance

Based on the above conceptual distinction and landmark international decisions, Sárvári *et al.* (2026) proposed a periodisation of research into sustainable finance, as illustrated in Figure 3. Periodising this field of study is not merely a historical exercise: it helps to explain how market innovations, regulatory turning points and academic interest interact with one another at different speeds and at different points in time. This segmentation also highlights that the scientific literature often reacts belatedly to regulatory and market influences (Cziráki *et al.* 2024; Vancsura – Bareith 2025). Periodisation is particularly justified in a field where concepts are diverse, institutional changes are rapid, and where academic discourse is closely intertwined with policy and regulatory developments. The names of the three main periods reflect the extent to which the research characteristic of each period reflects a comprehensive, system-level approach to sustainable finance, as currently understood.



The era of the pioneers of sustainable finance research spans from the 1970s to 2010. The turning point was the publication of the Brundtland Commission's report (1987) and the establishment of the Intergovernmental Panel on Climate Change (IPCC) in 1988. Alongside the *UNFCCC* (1992) and the 1997 Kyoto Protocol,¹ these examples also illustrate that the emergence of normative and institutional

¹ <https://unfccc.int/process-and-meetings/the-kyoto-protocol>

frameworks preceded innovation in market-based instruments. During this period, financial economics did not fundamentally consider the environmental dimension as part of its field, and addressing environmental problems was primarily regarded as the responsibility of government regulation and environmental economics. Towards the end of this period, the first green bonds were issued (by the European Investment Bank² in 2007 and the World Bank in 2008), representing a qualitative innovation in the financial instruments market. At the same time, researchers also began to pay increasing attention to the subject, however, the literature at this stage was predominantly characterised by qualitative, conceptual, and framework-oriented contributions.

Early research into sustainable finance covers a shorter period (2010–2021), but due to the rapid development of the field, it can be divided into three distinct phases: carbon finance (2010–2012), environmental finance (2015–2019) and climate finance (2019–2021). In the first period, which began with the establishment of the Green Climate Fund, the focus was primarily on investor behaviour and risk-return relationships (e.g. weather derivatives). Following the Paris Agreement, during the environmental finance phase, both market and regulatory interest in the topic grew significantly (e.g. reporting procedures were developed; in 2016, Poland issued its first sovereign green bond, and in 2019, Italy issued its first sustainability-linked bond). Towards the end of this era, following the 2019 UN Climate Summit, key milestones in the climate finance period included the EU Taxonomy (from 2020) and preparations for COP26.³ Research focused on the fields of CSR,⁴ ESG and risk management, as well as the related impacts of the COVID-19 pandemic; the number of publications rose rapidly, and interdisciplinary approaches became increasingly common (*Benedek 2021; Bozsik et al. 2024; Sárvári 2021; Zöldy et al. 2022*).

Since 2021, mature research into sustainable finance has been closely linked to the issue of financial stability, as well as to the central bank and the prudential regulatory discourse (*Bethlendi – Holczinger 2026; Gafoor et al. 2025*). The measurability of climate risks, their stress testing and their integration into capital requirements have become central themes. Key considerations now include the adaptability of the financial intermediary system and the financing of the green transition. Bibliometric patterns indicate that the themes of publications have become more focused (e.g. analysis of product markets, the validity of ESG methodologies, climate risk stress tests and reporting standards, as well as the risk of greenwashing), whilst the methodology and empirical grounding have become more sophisticated (*Szendrey – Dombi 2024*). Meanwhile, earlier, primarily climate-

² EIB CAB: European Investment Bank Climate Awareness Bond.

³ COP26 was the 26th United Nations Climate Change Conference.

⁴ Corporate Social Responsibility (CSR).

centred interpretations are complemented by a new approach that focuses on the living world as a whole (Bhatnagar – Sharma 2022; Carè – Weber 2023; Kiss et al. 2025; Muchiri et al. 2022; Putzer – Posza 2026; Zhang et al. 2019).

5. Summary and directions for future research

Following a detailed conceptual presentation and a bibliometric comparative analysis, we have described the conceptual development as a gradual expansion of content leading from carbon finance to sustainable finance. Within this, carbon finance represents the narrowest category, as it focuses primarily on the mitigation of greenhouse gas emissions. The concept of climate finance is broader: it also encompasses the financing of climate change adaptation. Green finance integrates further environmental objectives into the financial system, such as the prevention of pollution and the conservation of biodiversity. Environmental finance represents an even broader ecological perspective and places greater emphasis on challenging the primacy of economic growth. Sustainable finance brings all these elements together and extends them to social and governance aspects, as well as to all sustainable development goals.

This periodisation highlights how research into sustainable finance was initially marginal, then rapidly expanded, and eventually became an established academic discipline. The development of research into this subject area has not been linear, but rather a process closely intertwined with global economic, political and environmental changes. Clarifying conceptual frameworks and distinguishing between different periods helps to make the field's findings comparable and more easily interpreted. The widespread adoption of comparable, auditable indicators and open, documented methodologies is a prerequisite for direct use in policy-making and supervision. A key challenge is the under-representation of developing countries in the sustainable finance discourse (across market, policy and academic spheres), which may distort the picture of global impacts. The prudential management of climate risks is of paramount importance for future research, as are the real-economy impacts of sustainable financial instruments and the role of central banks in supporting the green transition.

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Author contributions

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Data Availability

Data sharing is not applicable to this article as no new datasets were generated or analysed during the current study.

Ethical Approval

Not applicable. This study did not involve human participants or sensitive personal data requiring institutional ethical approval.

Use of AI Tools

The authors did not use any generative AI tools in the creation of this manuscript.

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Appendix

Overview of bibliometric background

Authors	Year	Corpus (number of studies)	Data source	Time frame of the corpus	Areas of focus, results
<i>Akomea-Frimpong et al.</i>	2022	46	Scopus	1990–2019	Applies content analysis to evaluate key journals, authors, countries and institutions, examine research methods, identify relevant topics, and highlight research gaps and future directions.
<i>Bhatnagar – Sharma</i>	2022	666	Scopus	1997–2021	Describes publication trends and sources, authors' data and subject areas, conducts a thematic analysis, and presents co-citations and bibliographic links.
<i>Cai – Guo</i>	2021	172	Scopus	2005–2020	Provides a comprehensive overview of publications, the most productive regions and countries, the universities and institutes with the most publications, as well as the most prestigious journals, the most prolific authors, the most frequently cited publications, the co-occurrence of authors' keywords, and also includes a thematic map.
<i>Carè – Weber</i>	2023	315	Scopus	2001–2021	Describes and analyses the most important areas and development trends in climate finance research (with a performance analysis and a scientific map), and identifies research gaps in the climate finance literature.
<i>Cunha et al.</i>	2021	166	Web of Science, Scopus	1952–2020	Identifies the terms most frequently used in each period and the concepts associated with them. Summarises the main actors, their characteristics and motivations, as well as the key research questions, and describes the methodological features.
<i>Debrah et al.</i>	2022	995	Web of Science, Scopus, ScienceDirect, Google Scholar	1989–2021	Their findings reveal six main areas of research focus and, based on research gaps, propose 29 future research directions. They also provide an insight into the most important applications.

Authors	Year	Corpus (number of studies)	Data source	Time frame of the corpus	Areas of focus, results
<i>Desalegn – Tangl</i>	2022	146	Web of Science, Scopus	2015–2022	Analyses green finance instruments and metrics, highlights general research trends and presents the most influential authors, countries, publishers and journals. Critically analyses the corpus and highlights regulatory issues.
<i>Kashi – Shah</i>	2023	723	Scopus	2001–2021	Conducts a bibliometric performance analysis and applies content analysis. Describes trends in the literature on sustainable finance and possible directions for future research. Identifies the most important research topics and conducts a bibliometric network analysis.
<i>Khan et al.</i>	2024	507	Scopus	2013–2023	Presents a critical review, describing the current state of research, the key contributors, the topics and possible future research.
<i>Kouwenberg – Zheng</i>	2023	1,347	Scopus	1991–2021	Lists the most influential publications, authors and journals in the field, presents the geographical distribution of published studies, conducts a co-citation analysis, and summarises the topics and methods of the most frequently cited articles. Also identifies influential authors and sub-fields within climate finance literature.
<i>Kumar et al.</i>	2022	936	Scopus	1986–2020	Lists the most impactful studies, as well as the most significant journals, authors, institutions and countries. Also summarises the methodologies used in sustainable finance research and outlines the context of such research. Sets out a number of recommendations for the future.
<i>Linnenluecke et al.</i>	2020	1,338	Scopus, journal websites	2015–2022	Lists the most cited studies and models the main research directions, whilst providing citation statistics. Also identifies emerging research trends and topics.
<i>Luo et al.</i>	2022	3,786	Web of Science	2000–2021	Summarises the co-occurrence of scientific fields, publication characteristics, collaborations, influences, co-occurrence of keywords, shared citations and structural variation.

Authors	Year	Corpus (number of studies)	Data source	Time frame of the corpus	Areas of focus, results
<i>Muchiri et al.</i>	2022	321	Web of Science	2015–2022	Provides an overview of green finance following the Paris Agreement, highlights annual research outputs and presents a variety of analyses (3-field diagram, co-citation, co-occurrence).
<i>Naeem et al.</i>	2023	1,413	Scopus	1990–2021	Presents research findings, identifies the most prolific authors, the most influential documents and sources, the most significant institutional affiliations and countries, provides a co-citation analysis and identifies trends within sustainable finance.
<i>Sárvári et al.</i>	2026	4,436	Web of Science, Scopus	2001–2024	Provides an integrated overview of the development of sustainable finance research, identifies its key historical phases and outlines possible future directions. The study combines an analysis of publication trends, shared citation networks, keyword mapping and geographical distribution to capture the structure of the literature. Systematises the development of the field, highlights influential authors and journals, and identifies emerging and under-explored areas of research.
<i>Singhania et al.</i>	2024	1,269	Web of Science, Scopus	1984–2021	Summarises publication trends, presents co-authorship networks, leading research topics, the most significant journals, countries and institutions, and also includes keyword and cluster analysis. Furthermore, the study outlines key themes and indicates future research directions.
<i>Tao et al.</i>	2022	892	Web of Science	1971–2020	Identifies the main research directions and presents the most popular research topics. Also outlines areas of research, presents a review of the literature and highlights emerging research topics.
<i>Yu et al.</i>	2021	888	Web of Science	1989–2020	Describes the historical development of green finance and the classification of research focal points based on the distribution of countries, authors and institutions, as well as the distribution of journals and co-citation analysis.
<i>Zhang et al.</i>	2019	381	Web of Science	2001–2018	Presents the main journals, authors' countries of origin, an analysis of keywords and citations.