

Book: Climate Change and Finance: Navigating the Challenges and Opportunities in Capital Markets*

Chapter

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Investor Attitudes and Preferences Toward Climate Change and Sustainable Investments: a bibliometric analysis*

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Abstract

This chapter explores the evolving academic perspective on the nexus between climate change, finance, and responsible investment. Within the global academic landscape, there's an intensified emphasis on the intricate relationship between business practices and the urgent issue of climate change. Specifically, the finance domain is at the forefront, delving into the financial implications of environmentally conscious decisions and how they shape the modern investment arena. As the discourse progresses, studies have underscored the growing significance of climate-related risks for institutional investors, suggesting that contemporary financial strategies are increasingly attuned to climate considerations. There's also a marked rise in publications illustrating the link between climate concerns and investment behaviors, emphasizing the synthesis of ethical considerations with financial strategies. Echoing broader societal shifts, the academic sphere presents climate change as an immediate concern, necessitating a proactive response from the influential investment community. This chapter employs bibliometric techniques to methodically examine the research literature evolution. It identifies the most relevant authors, the theoretical framework they built to support their contributions, and the various themes they developed around the topic. This way, we provide objective grounds for further studies and also identify potential gaps that could be addressed.

Keywords: Climate change, Sustainability, Investors Preferences, Investor Attitudes, ESG criteria, Bibliometric analysis, Bibliometric analysis.

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Introduction

The global academic landscape has seen a dramatic shift in recent years, emphasizing the critical nature of climate change and its intertwining relationship with business practices. Within the broad spectrum of research, there's a burgeoning interest in the crossroads of finance, investment, and socially responsible behaviors, particularly as they relate to climate change.

Leading the charge in this dialogue is the field of finance, where researchers are increasingly examining the financial implications of ethical and environmentally conscious decisions. Renneboog et al. (2008) stands as a testament to this, offering an in-depth exploration into the performance of socially responsible mutual funds. Their findings suggest that environmental considerations, among other ethical concerns, play a pivotal role in shaping the modern investment landscape.

Another pivotal piece comes from Krueger et al (2020). In their seminal study, they underscored the growing importance of climate-related risks for institutional investors. Their findings reflect a paradigm shift, suggesting that contemporary financial strategies are more than ever attuned to the potential risks and rewards associated with climate-conscious decisions.

Further underpinning the importance of this discourse is the surge in publications addressing the intricate link between climate considerations and investment behaviors. Hartzmark & Sussman (2019) research provides a compelling perspective on this, elucidating how investor reactions to sustainability rankings translate into tangible shifts in fund flows. Their work, among others, serves as evidence of the increasing confluence between sound financial management and a proactive approach to climate change.

The findings from a bibliometric review of recent literature are revealing. We can observe a notable increase in publications in this field. Moreover, the evolving themes suggest a comprehensive and integrated strategy towards addressing climate change in investment. Ethical considerations, which were once regarded as less important, are now at the forefront, driven by both moral responsibility and today's financial demands.

It is evident that the academic sphere is echoing the broader societal shifts. Climate change is no longer a distant concern but a pressing reality that demands a response. The investment community, with its substantial influence, is increasingly playing a proactive role, underpinned by a synthesis of ethics and strategy. This blend of social responsibility and financial acumen is likely to shape the future trajectory of both academia and the global economy. Then, it is convenient to delve into this topic based on the study of the scientific production already in place, setting an objective ground on the relevance of the authors, topics, and the extant intellectual framework. This, in turn, will enlighten potential gaps for future research. To accomplish this aim, we utilize bibliometric techniques (Groos & Pritchard, 1969; McCain, 1990) and the following sections of this chapter address the methodology, the results, discussion of the obtained results, and, finally, the conclusions and a prospect of avenues for future research.

Methodology

Bibliometric techniques utilize mathematical and statistical tools (McCain, 1990) to analyze data from published works. These methods conform an objective base to study the structure of the research literature, allowing to establish relevant grounds to justify and drive a proper discussion on current and new approaches (Durisin & Puzone, 2009). Several disciplines and research fields have been analyzed using them. It is the case of management (Tahai & Meyer, 1999), finance (Alexander & Mabry, 1994; Merigó et al., 2015), strategic management (Nerur et al., 2008; Ramos-Rodríguez & Ruíz-Navarro, 2004), operations management (Pilkington & Liston-Heyes, 1999; Pilkington & Meredith, 2009), organizational behavior (Culnan et al., 1990), human resources management (Fernandez-Alles & Ramos-Rodríguez, 2009) or innovation (Fagerberg et al., 2012). Besides, they are also employed in the analysis of topics such as family business (Casillas & Acedo, 2007), entrepreneurship (Etemad & Lee, 2003; Landström et al., 2012; Schildt et al., 2006), human resources training (Danvila-del-Valle et al., 2019) or diversity (Estevez-Mendoza, 2022). Related fields like corporate social responsibility (De Bakker et al., 2005) and socially responsible investments have been addressed (Estevez-Mendoza, 2023).

In this chapter, we will utilize impact indicators and co-occurrence analysis for the case of the documents, authors, references, and the topics they refer. Thus, relevant contributions, similarities among topics, and intellectual frameworks are more easily identified (Culnan, 1987; Pilkington & Liston-Heyes, 1999; Ramos-Rodríguez & Ruíz-Navarro, 2004). We use the visualization of mapped networks with bibliometrix R package and VOSviewer to help understanding and interpreting the results of the analysis (Aria & Cuccurullo, 2017; van Eck et al., 2010).

Methodology steps

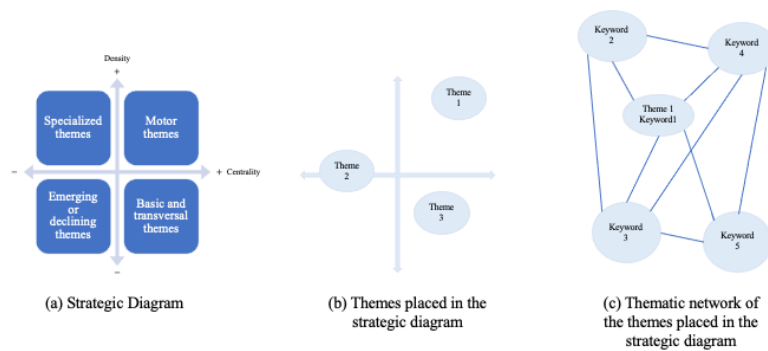
Bibliometric analyses require to follow procedural steps that include data retrieving and cleaning, descriptive and relational analysis, and visualization (Zupic & Cater, 2015). Relevant databases and appropriated search terms are key for data retrieval. Since inconsistencies and wrong documents may appear, cleaning follows to secure the contributions which are adequate for the study.

In the phase of analysis, descriptive and relational bibliometric indicators are established. Thus, the frequency of publications helps to understand the evolution of the research and to set different stages if that is the case. Main authors are defined on the number citations and impact indicators and depict those topics the Academia is giving more importance. The study of the keywords utilized for the categorization of the documents identifies related topics and, consequently, gaps for future research.

To identify their evolution and behavior, we created co-occurrence networks and applied clustering algorithms (Cobo et al., 2011, 2012), helped by two analytical elements: the strategic diagram and the thematic network (Bailón-Moreno et al., 2005; Callon et al., 1991; Cobo et al., 2011; López-Herrera et al., 2009). Using density and centrality measures, they allow to classify into motor, basic, highly developed/isolated, and emerging/declining themes. Each theme has an

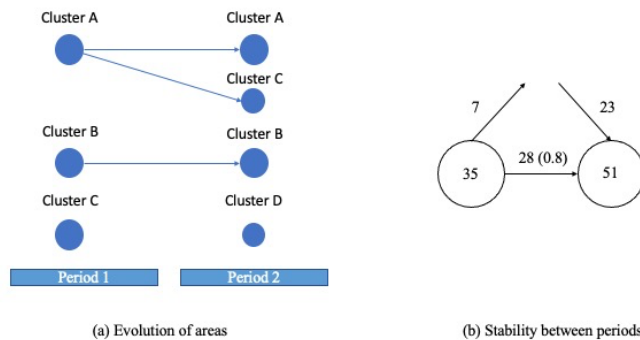
associated network of related keywords (See Fig. 1). Since we split the analysis in two stages, the evolution of topics is visualized, and the process is also summarized computing the stability between periods (See Fig. 2).

Fig 1. Strategic diagram and thematic networks layouts examples.



Source: adapted from (Cobo et al. 2012)

Fig 2. Evolution of areas and stability between periods. Examples.



Source: Adapted from Cobo et al. 2012

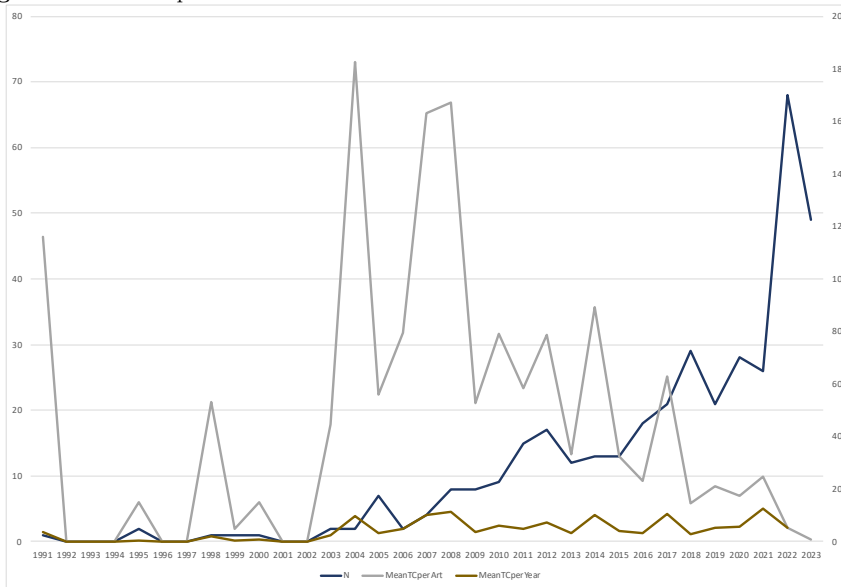
We analyze these themes alongside the works of pertinent authors and their references. These references provide the foundational intellectual context for the research. Co-occurrence maps can assist in identifying and examining them.

The sample of documents was obtained from the Web of Science Main Collection Database. The applied criteria of selection and the cleaning steps brought 378 documents from 146 different journals. There were 956 authors and they accounted for 18,943 references in their documents.

Evolution of research works

Research evolves over the 30-year period and shows a growing pattern, especially noticeable in the last decade (Figure 3). There is seeding stage which is characterized by a low number of highly cited publications. Then, it appears a sharp increase in the last seven years, yielding two identifiable stages that might be used in further steps of the analysis.

Fig 3. Evolution of published works



Impact and relevance of journals

We ranked the journals behind the documents of our sample according to h-index and the total number of citations (Table 1). A journal devoted to ethics, the *Journal of Business Ethics*, heads both classifications and shows the increasing interest inside this discipline towards the topic of analysis. Journals in the field of finance such as the *Journal of Banking and Finance*, the *Journal of Financial Economics*, or the *Journal of Finance* also have an important role. But the contributions are also boosted by journals in the field of management (*Academy Of Management Review*, *Strategic Management Journal*) and other that are more explicitly devoted to sustainability (*Business Strategy And The Environment*, *Technological Forecasting And Social Change*, *Corporate Social Responsibility And Environmental Management*, *Environmental & Resource Economics*, *Ecological Economics*). The recent surge in publications over the past decade can be largely attributed to this development, laying the groundwork for an expansion in research endeavors. This evolution not only underscores the value of specialized resources, but also highlights the potential they have for fostering cross-disciplinary impacts.

Table 1. Impact and relevance of journals by indices and citations

Journal	H-In- dex	G-In- dex	M-Index	Journal	TC	NP
Journal Of Business Ethics	19	32	0,90	Journal Of Business Ethics	1997	32
Energy Policy	18	27	0,62	Energy Policy	1332	27
Ecological Economics	11	21	0,38	Journal Of Banking & Finance	847	7
Business Strategy And The Environment	8	16	0,62	Ecological Economics	749	21
Journal Of Banking & Finance	7	7	0,37	Journal Of Economic Perspectives	708	1
Energy Economics	6	6	0,50	Academy Of Management Review	567	1
European Journal Of Operational Research	6	6	0,50	Journal Of Financial Economics	412	3
Technological Forecasting And Social Change	6	10	0,40	Journal Of Risk And Uncertainty	317	2
Business Ethics-A European Review	5	5	0,33	Journal Of Finance	278	1
Corporate Social Responsibility And Environmental Management	5	5	0,33	Business Strategy And The Environment	273	16
Environmental & Resource Economics	5	6	0,26	Accounting Auditing & Accountability Journal	254	3
Business & Society	4	4	0,44	Strategic Management Journal	254	1
Journal Of Economic Behavior & Organization	4	6	0,44	Resource And Energy Economics	252	4
Resource And Energy Economics	4	4	0,21	Business Ethics-A European Review	212	5
Sustainability Accounting Management And Policy Journal	4	5	0,44	European Journal Of Operational Research	186	6
Transportation Research Part B-Methodological	4	4	0,67	World Development	182	4
Accounting Auditing & Accountability Journal	3	3	0,30	Technological Forecasting And Social Change	169	10
Australian Journal Of Management	3	3	0,25	Energy Economics	166	6
Economic Analysis And Policy	3	3	0,75	American Economic Review	153	1
Economics Letters	3	3	0,60	Environmental & Resource Economics	151	6
Energy Journal	3	4	0,23	Organization Studies	148	1

Journal Of Behavioral And Experimental Finance	3	3	0,75	Australian Journal Of Management	144	3
Journal Of Environmental Economics And Management	3	5	0,25	European Journal Of Finance	144	1
Journal Of Financial Economics	3	3	0,50	Journal Of Environmental Economics And Management	126	5
World Development	3	4	0,27	Transportation Research Part A-Policy And Practice	122	2
Business Ethics Quarterly	2	2	0,11	Review Of Financial Studies	120	2
California Management Review	2	2	0,08	Energy Journal	116	4
Corporate Governance-An International Review	2	4	0,12	Journal Of Consumer Affairs	116	1
Economic Systems Research	2	2	0,29	Journal Of Economic Behavior & Organization	96	6
Emerging Markets Review	2	2	0,40	Tourism Management	92	2
Finance Research Letters	2	3	0,67	Omega-International Journal Of Management Science	89	1
International Review Of Economics & Finance	2	3	0,20	Transportation Research Part B-Methodological	88	4
Journal Of Corporate Finance	2	2	0,40	Corporate Social Responsibility And Environmental Management	84	5

Relevant authors and their topics

After computing the h-index and the total citations received by authors in the field we ranked them and show a summary in Table 2.

Table 2. Relevant authors by indices and citations

Author	h-index	g-index	m-index	TC	Author	TC	NP	Year
Arenas-Parra M	5	5	0,46	161	Bloom N	708	1	2014
Bilbao-Terol A	5	5	0,46	161	Renneboog L	707	1	2008
Canal-Fernandez V	5	5	0,46	160	Ter Horst J	707	1	2008

Busch T	3	3	0,30	88	Zhang Cd	707	1	2008
Di Falco S	3	3	0,27	98	Mackey A	573	2	2007
Gutsche G	3	4	0,60	56	Mackey Tb	573	2	2007
Smeets P	3	3	0,33	370	Barney Jb	567	1	2007
Adamson D	2	2	0,50	14	Ben-Amar W	379	1	2017
Bauer R	2	2	0,22	92	Chang M	379	1	2017
Belghitar Y	2	2	0,20	63	Mcilkenny P	379	1	2017
Bilbao-Terol C	2	2	0,18	43	Smeets P	370	3	2015
Boiral O	2	3	0,29	192	Millington A	295	2	2004
Botzen Wjw	2	2	0,13	259	Dasgupta P	289	1	2008
Brimble M	2	2	0,12	53	Riedl A	278	1	2017
Brotherton Mc	2	2	0,40	18	Menichetti E	261	1	2012
Brzeszczyński J	2	2	0,40	19	Wustenhagen R	261	1	2012
Chamorro-Mera A	2	2	0,40	8	Botzen Wjw	259	2	2009
Clark E	2	2	0,20	63	Delmas Ma	254	1	2010
Daigneault Aj	2	2	0,33	76	Montes-Sancho Mj	254	1	2010
Dam L	2	2	0,15	68	Aerts Jcjh	242	1	2009
Deshmukh N	2	2	0,20	63	Van Den Bergh Jcjm	242	1	2009
Diouf D	2	2	0,25	199	Flammer C	240	1	2021
Doskeland T	2	2	0,25	44	Brammer S	231	1	2004
Edenhofer O	2	2	0,29	15	Cox P	231	1	2004
Fankhauser S	2	2	0,11	203	Fankhauser S	203	2	2005
Fu Xw	2	2	0,50	17	Diouf D	199	2	2016
Gond Jp	2	2	0,17	159	Boiral O	192	3	2017
Hackel B	2	2	0,29	40	Hoepner Agf	169	2	2011
Hassan Mk	2	2	0,33	20	Tol Rsj	166	1	2005
Hepburn C	2	2	0,11	113	Pastor L	164	1	2021
Hoepner Agf	2	2	0,15	169	Stambaugh Rf	164	1	2021
Howarth Rb	2	2	0,10	71	Taylor La	164	1	2021
Hudson R	2	2	0,11	51	Arenas-Parra M	161	5	2013
Komendantova N	2	2	0,17	136	Bilbao-Terol A	161	5	2013
Mackey A	2	2	0,12	573	Canal-Fernandez V	160	5	2013
Mackey Tb	2	2	0,12	573	Gond Jp	159	2	2012
Mattauch L	2	2	0,33	9	Slager R	158	2	2012
Mendez-Rodriguez P	2	2	0,20	40	Nilsson J	157	2	2008
Millington A	2	2	0,10	295	Deschenes O	153	1	2017
Nilsson J	2	2	0,13	157	Greenstone M	153	1	2017
Paetzold F	2	2	0,20	46	Shapiro Js	153	1	2017

Palacios-Gonzalez Mm	2	2	0,40	8	Moon J	148	1	2012
Patt A	2	2	0,17	136	Hochstadter Ak	146	1	2015
Pedersen Ljt	2	2	0,25	44	Scheck B	146	1	2015
Perez-Gladish B	2	2	0,17	79	Rammal Hg	144	1	2011
Scholtens B	2	2	0,22	65	Rezec M	144	1	2011

The most relevant authors inside the research community address different elements. We summarize first those among the top-ranked authors according to the Hirsch index and then we complete the landscape with those receiving more citations. Bauer et al (2021) emphasize the significance of social preferences in sustainable investing, where investors are willing to sacrifice financial returns for sustainability. The study also explores how pension funds should address their clients' social preferences but notes that investment managers often find it challenging and costly to elicit such preferences, resulting in their neglect within pension funds' decision-making processes. On the other hand, Bauer & Smeets (2015) focus on the investment decisions of clients at socially responsible banks, revealing that social identification predominantly influences their allocations.

Other investigations have contributed to portfolio selection and sustainable investment. Bilbao-Terol et al. (2013) present a portfolio selection approach that incorporates socially responsible financial assets, multi-objective programming, and a new SR measure. The empirical results indicate that socially responsible investments have a relatively small financial sacrifice for "cautious" investors, encouraging SR adoption without significantly impacting financial returns. In their subsequent work, Bilbao-Terol et al (2014) introduce a methodology for evaluating the non-financial performance of government bond funds, with a focus on sustainability. The assessment process utilizes the multi-criteria TOPSIS methodology and an innovative additive version to model relative criteria importance. The resulting scores enable the incorporation of sustainability as an objective in multi-objective portfolio optimization. Besides, Bilbao-Terol et al. (2016) present a tool for sustainable and responsible investors using goal programming with fuzzy hierarchies (GPFH) modeling. GPFH addresses conflicting objectives by utilizing fuzzy relations to model relative importance among criteria. An application to UK-SR mutual funds is showcased.

Examining public attitudes towards sustainable initiatives, Dumbrell et al. (2022) surveyed residents from South Australia and Victoria to assess their preferences for a hydrogen industry. The study found that safety was rated as the most important characteristic, followed by climate change mitigation and affordability, influencing public support for the industry's development in Australia. Socio-demographic and attitudinal factors were found to significantly impact individuals' importance ratings. In the other hand, high-net-worth individuals prioritize real-world impact over value-aligned investments or sustainability for financial risk purposes (Paetzold et al., 2022). They primarily invest in securities aligned with Sustainable Development Goals (SDGs) to mobilize capital for sustainable development, but their strong preference for high financial returns may lead to underfunding of less attractive SDGs. Paetzold & Busch (2014) identify barriers to sustainable investing among private investors. Finally, Riedl & Smeets (2017) investigate investors' motivations for choosing socially responsible mutual funds. They found that investors choose these funds due to social preferences and signaling rather than purely financial motives. The study

reveals that investors expect lower returns and higher management fees, reflecting their willingness to prioritize social values over financial performance.

Research groups headed by Gutsche (Gutsche et al., 2021, 2023; Gutsche & Ziegler, 2019) reviewed individual sustainable investment behavior. Positive correlations were found between socially responsible investments (SRIs) and warm glow feelings, social norms in environmental organizations, and peer behaviors. In terms of countries, Japan's sustainable investment was in its early stage with information deficits, while in Germany, strong preferences for sustainable funds were driven by pecuniary and non-pecuniary factors, particularly warm glow feelings. These findings carry significant implications for promoting sustainable development through individual investors.

Scholarly explorations into climate change adaptation, juxtaposed with agricultural investment decisions, have been undertaken by a cadre of distinguished researchers. In their seminal work, Di Falco & Bulte (2013) elucidate that within the confines of rural Ethiopia, mandatory risk-sharing notably diminishes the impetus for weather shock self-shielding. Further, Di Falco & Sharma (2018) unveil that profound pro-environmental convictions directly augment adaptive propensities, with environmentally-conscious incentives amplifying adaptive investments in the picturesque Fiji Islands. Complementing this, Di Falco et al. (2019) manifest how income fluctuations, steered by rainfall discrepancies, modulate farmers' subjective discount rates, subsequently influencing agricultural forays in rural Ethiopia. Collectively, these erudite studies proffer salient insights into the intricacies of climate change adaptation interwoven with agricultural decision-making paradigms. In a parallel vein, Rodriguez Lopez et al. (2017) determine that regulation-induced ambivalence molds corporate endeavors towards reducing environmental impact, even though generic regulatory uncertainties yield no palpable consequence. Mallawaarachchi et al. (2020), on the other hand, delve into the byzantine pro-farmer water stratagems of Australia's Murray-Darling Basin, advocating fervently for the imperative of water commerce and reformative strategies that champion efficacious adaptation through synergistic collaboration.

In the discussion of corporate sustainability and ethical investment, various scholars contribute multidimensional perspectives. One line of research, including work by Ben-Amar et al. (2017) and Cox et al. (2004), suggests that board gender diversity and long-term institutional investment are influential factors in Corporate Social Performance and sustainability disclosure. This reflects the broader themes of stakeholder management and governance structure.

Another aspect worth noting is the role of uncertainty. Bloom (2014) and Botzen et al (2009) both address this, albeit from different angles. The former examines economic uncertainty across business cycles, while the latter considers how homeowners deal with climate-related uncertainties through insurance.

Policy considerations also come into play, with contributions from Dasgupta (2008) and Fankhauser (2017). While Dasgupta challenges the conventional approaches to social discount rates by incorporating ethical considerations, Fankhauser delves into the economic challenges of climate adaptation. Both suggest that policy plays a key role, but they approach the issue from unique methodological standpoints.

On the investment side, Flammer (2021) examines the impact of corporate green bonds on investor perception, a theme echoed in the work of Hoepner & Schopohl (2018), who explore ethical dimensions of various investment styles, including sector-based exclusions and Islamic mutual funds.

The intricate economic reverberations of climate change have been astutely dissected by pioneering intellects such as Fankhauser & Tol (2005). They eloquently delineate the multifaceted ramifications of climate-induced variations upon capital proliferation and savings inclinations, extending the scholarly discourse from immediate societal well-being to protracted economic horizons. In sum, such perspicacious inquiries cumulatively posit that governance structures, nuanced investor predispositions, policy contemplations, and the multifarious economic elements are paramount in decoding corporate oscillations towards sustainability and the looming climate conundrum.

Venturing into the sophisticated domain of Corporate Social Responsibility (CSR), a myriad of scholarly endeavors adopts variegated methodologies to fathom investor behaviors and their expansive ramifications. The erudition of Mackey et al. (2022) invokes the mathematical elegance of game theory to decipher the modalities by which investors can galvanize socially responsible comportment within corporate entities. This investigative thrust finds harmonious resonance with the earlier musings of Fankhauser and Tol (2005), who elucidated the kinetic interplay of investor behavior vis-à-vis climate-centric perils. Mackey and his consortium's keen insights into the dialectics of reward versus retribution as fulcrums for CSR stand as a noteworthy scholarly beacon.

Pursuing this intellectual trajectory, an incisive exploration by Mackey et al. (2007) grapples with the nebulous intersections of market valuations and CSR. Their scholarship finds a kindred spirit in the investigations of Wüstenhagen & Menichetti (2012), who illuminate the strategic topographies of renewable energy capital commitments. Such oeuvres accentuate the convoluted lattice of investment deliberations, tethered invariably to policy frameworks, market voracities, and the moral compass of social accountability. Mol et al. (2020), adopting a tangential perspective, delve into the psychological substrates motivating self-insurance against nature's caprices. Their discernments embellish our comprehension of fiscal stratagems amidst climatic vicissitudes, augmenting the dialogue initiated by Fankhauser and Tol (2005). Along analogous lines, Pástor et al. (2021) embark on an odyssey into the equilibria of sustainable investing, elucidating that verdant asset, albeit perhaps offering modest returns, serve as bulwarks against climate adversities. This thematic confluence resonates harmoniously with the critical appraisals of Renneboog et al., (2008a) and is subsequently echoed in the reflections of Riedl & Smeets (2017)—all collectively interrogating the delicate equipoise between pecuniary augmentation and the loftier aspirations of societal beneficence in investment decision-making.

Finally, research by Delmas & Montes-Sancho (2010) scrutinizes the effectiveness of voluntary environmental agreements, raising important questions about the real impact of corporate commitments to sustainability. Wong & Millington (2014) then bring these discussions full circle, examining corporate social disclosures from a stakeholder viewpoint. Their findings shed light on both corporate transparency and the behavior of socially responsible investors.

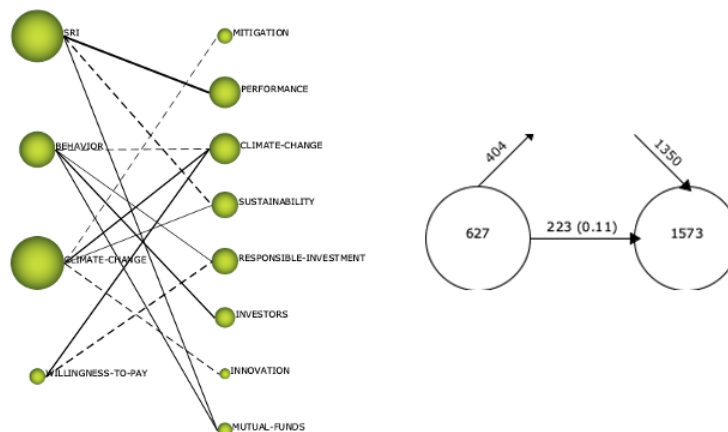
Most of the mentioned authors made their contributions through quantitative methods, although there are also theoretical proposals (Bloom, 2014; Dasgupta, 2008; A. Mackey et al., 2007; Pástor et al., 2021) and reviews (Fankhauser, 2017; Renneboog et al., 2008). Among the different techniques, the use of surveys is very common (Bauer et al., 2021; Bauer & Smeets, 2015; Ben-Amar et al., 2017; Botzen et al., 2009; Di Falco & Sharma, 2018; Gutsche et al., 2021; Riedl & Smeets, 2017; Rodriguez Lopez et al., 2017; Wong & Millington, 2014), which might be easily understood since they address perceptions and responses. Regression models widely serve to test hypotheses (Bauer & Smeets, 2015; Cox et al., 2004; Di Falco et al., 2019; Gutsche et al., 2021, 2023; Riedl

& Smeets, 2017) and probit models (Ben-Amar et al., 2017; Di Falco & Bulte, 2013; Fankhauser, 2017; Gutsche et al., 2019, 2021; Riedl & Smeets, 2017; Rodriguez Lopez et al., 2017) and logit models (Bauer et al., 2021; Gutsche et al., 2021; Gutsche & Ziegler, 2019; Wong & Millington, 2014) often appear among them. The need of testing models and finding causal relationships lead also to the use of framed experiments and path analyses (Di Falco & Sharma, 2018; Riedl & Smeets, 2017), difference-in-difference techniques (Flammer, 2021), or EVE-CVaR (Bilbao-Terol et al., 2013). Structured interviews are employed in qualitative studies (Paetzold & Busch, 2014) and even new methods are proposed (Bilbao-Terol et al., 2014).

Relevant topics and intellectual framework

Regarding publications covered, we may observe significant changes between the periods of observation. The number of themes doubles and, consequently, it opens more nuances to the study of the topic. This situation correlates with the increase in the number of keywords. It is also noticeable that a small percentage of keywords remains in the second period, implying not only a growth in contributions and related topics, but also a relatively significant change of the focus of research in the second one (See Figure 4).

Fig 4. Evolution of themes and stability between periods



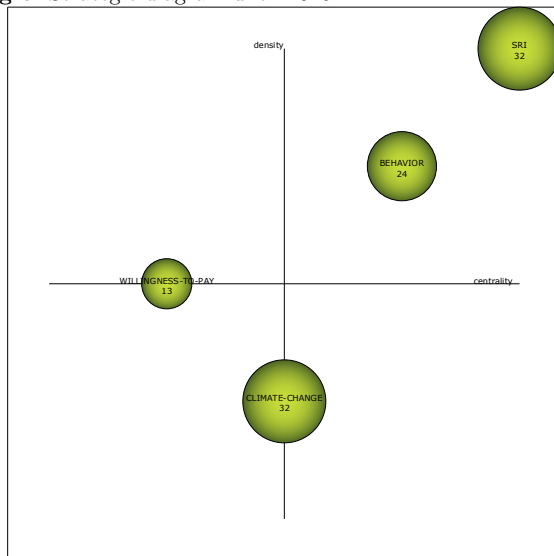
Source: own elaboration with SCImat. Left picture shows the evolution of themes over periods. Right picture shows the number of keywords consider in each period, the number of them that remain in both periods and the news ones.

As we mentioned, after realizing the differences between the two periods, we split the analysis of the topics and their intellectual framework in two different periods. The first covers publications until 2015 and the second is centered in those elaborated afterwards.

Until 2015

In this period there just four themes in contributions. SRI and behavior are the motor themes, whereas those on climate-change and WTP seem to progress towards being basic and niche themes, respectively (See figure 5 Strategic diagram until 2015.).

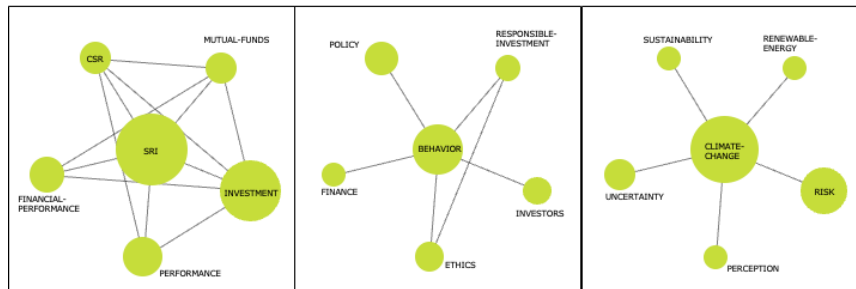
Fig 5. Strategic diagram until 2015.



Source: own elaboration with SCImat. Theme nodes are placed according to their co-occurrence’s centrality and density. Size of the nodes signifies the relative importance according to the h-index of each one.

Analyzing the thematic networks, SRI theme is associated with the investments, their performance, and CSR, and linked to mutual funds. This gives importance to the firm’s conduct and the financial vehicles in performing these kinds of investments. Behavior theme is associated with the investors’ ethics and responsibility, which is clearly linked to the topic of this article. And climate change is associated to its perception, the uncertainty and its risk, and renewable energy (See Figure 6).

Fig 6. Thematic networks until 2015.



Source: own elaboration

with SCImat.

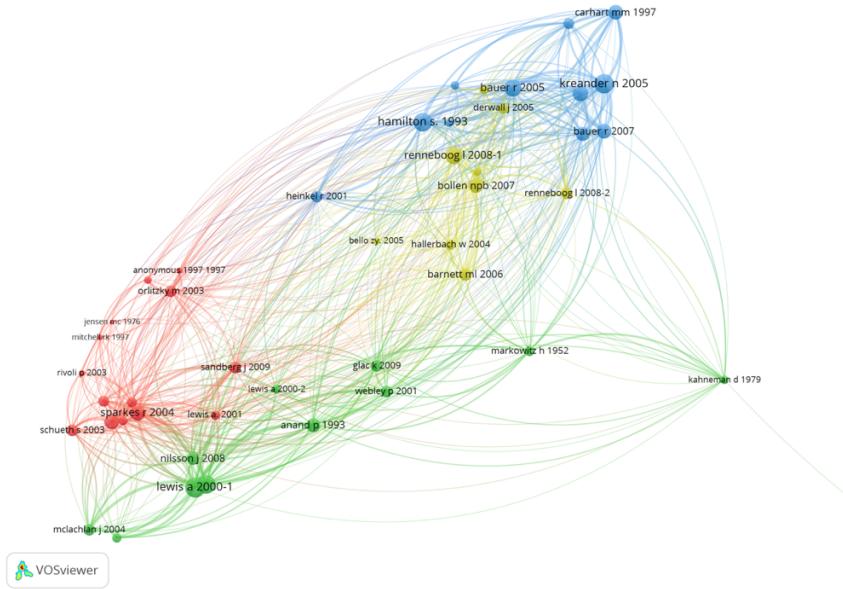
Looking into the intellectual framework of the period, there are four main pillars based of the main co-occurrences of references (Figure 7). First, the body of work on Socially Responsible Investing (SRI) covers diverse aspects, from its potential mainstream acceptance (Dunfee, 2003) to the psychological factors influencing investor choices (Glac, 2009; Kahneman & Tversky, 1979). Studies also examine the motivations and characteristics of ethical versus ordinary investors

(Lewis, 2001; Rosen et al., 1991), as well as the complexity and diversity within the SRI landscape (Sandberg et al., 2009). Other research discusses the ethical foundations of SRI and its evolving relationship with corporate social responsibility (Sparkes, 2001; Sparkes & Cowton, 2004). Finally, Markowitz (1952) utility function theory and Webley et al. (2001) experimental approach contributes to understanding the risk and commitment aspects of SRI. Together, these studies underscore SRI's growing importance and complexity.

The scholarly landscape on ethical funds and business ecosystems is both nuanced and interconnected. Barnett et al. (2006) sets the stage by examining the concept of corporate reputation the role of "keystone" companies within business ecosystems, a consideration that becomes particularly pertinent when applied to ethical investing. Performance-wise, studies by Bauer et al., (2005, 2007), Kreander et al. (2005), and Mallin et al. (1995) corroborate the idea that ethical and traditional funds show comparable returns, a notion further reinforced by Bollen (2007) and Carhart (1997), who emphasize the stability and persistence of ethical funds. However, Hamilton et al. (1993) and Renneboog et al. (2008b) offer a more complex picture, indicating mixed performance outcomes that warrant further analysis. Beyond performance metrics, Hallerbach et al. (2004) contribute by offering a framework for managing ethical portfolios, while Heinkel et al. (2001) posit that ethical investing itself can influence corporate behavior. These discussions should also be contextualized within Merton's (1987) insights into market anomalies due to informational inefficiencies, which could impact ethical funds.

In examining corporate social responsibility and stakeholder management, Margolis & Wals (2003) scrutinize the tension between economic objectives and broader societal roles for businesses, suggesting that embracing this tension could offer new avenues for research. Mitchell et al. (1997) contribute to stakeholder theory by creating a typology based on the attributes of power, legitimacy, and urgency, aimed at helping managers identify key stakeholders. In the other hand, Orlitzky et al. (2003) provide a meta-analysis affirming that corporate social and environmental performance positively correlates with financial performance, challenging the notion that these elements are too fractured for general conclusions. Together, these studies explore the intricate relationships between corporations, stakeholders, and society, while questioning traditional economic paradigms.

Fig 7. Intellectual framework until 2015. Co-citation map.

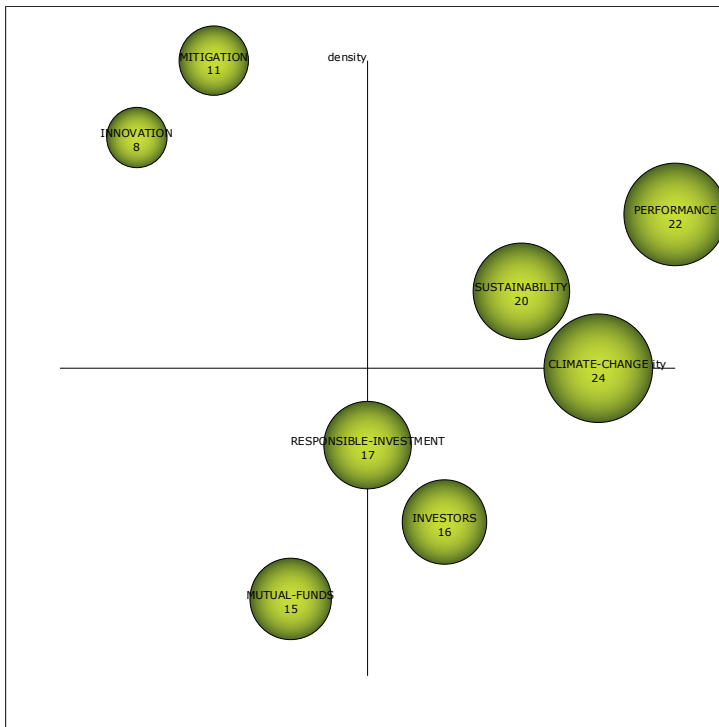


Source: own elaboration with bibliometrix and VOSviewer.

Since 2016

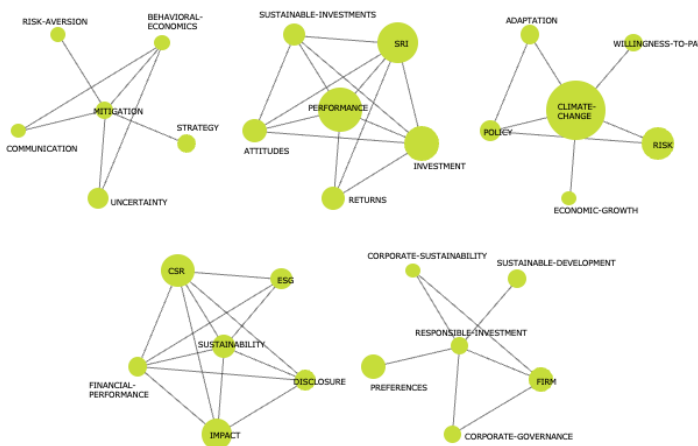
Contributions of the sample provide new themes evolving to new related topics and detailing previously defined ones (Figure 8). Thus, we found eight fundamental themes. Performance, sustainability, and climate change are motor themes in this period. In turn, responsible investment and investors themselves are a basic theme. Innovation and mitigation appear as niche themes and mutual funds is a declining theme (Figure 9).

Fig 8. Strategic diagram 2016 – 2022.



Source: own elaboration with SCImat. Theme nodes are placed according to their co-occurrence's centrality and density. Size of the nodes signifies the relative importance according to the h-index of each one.

Fig 9. Thematic networks 2016 – 2022.



Source: own elaboration with SCImat.

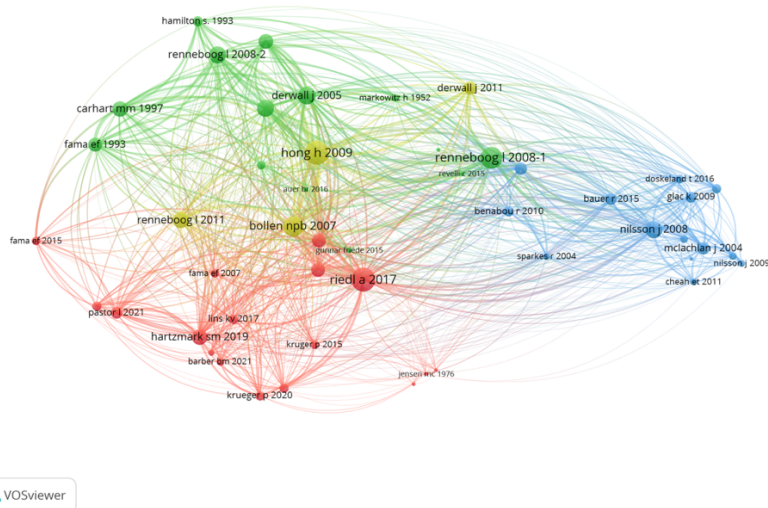
The topics of the period are grounded in three identified pillars that conform the intellectual framework (Figure 10). On one hand, Bollen (2007b) study on the lower volatility of cash flows in socially responsible funds laid the groundwork for understanding investor loyalty, which complements the findings of Dyck et al. (2019) and Hartzmark & Sussman (2019), who respectively linked institutional ownership to better environmental and social firm performance and revealed

how sustainability categorization steers fund flows. Meanwhile, Edmans (2011) research disrupted traditional asset valuation by demonstrating that firms with happy employees have higher stock returns, a sentiment echoed by Krueger et al. (2020) who noted the growing priority institutional investors place on climate risks. Fama & French (2007 & 2015) in their seminal work expanded asset pricing models to encompass not just financial metrics but also investor tastes and a broader range of factors, dovetailing with Pástor et al. (2021) model that shows how ESG investing alters asset prices and corporate behavior. Heinkel et al. (2001) and Hong & Kacperczyk (2009) offered contrasting viewpoints; the former established that ethical investing can punish polluters by elevating their cost of capital, whereas the latter highlighted the high returns of 'sin stocks' often avoided for ethical reasons. Lins et al. (2017) emphasized the protective role of social capital in times of crisis, which parallels the conclusions of Kulich et al. (2011) and Riedl & Smeets (2017) that non-financial attributes like ethics and social preferences are potent drivers in socially responsible investments.

In the second pillar of this period, the literature on SRI is combined with multiple facets, from investor behavior to institutional dynamics. Barreda-Tarrazona et al. (2011) and Bauer & Smeets (2015) focus on the role of social preferences and identification in SRI decisions. Demographics play a significant role in SRI attitudes as per Cheah et al. (2011), while Derwall et al. (2011) explore the divide between values-driven and profit-seeking investors. Benabou & Tirole (2010) provide a broader context of societal demands for social responsibility. Glac (2009) and Nilsson (2008) delve into the cognitive aspects and trade-offs involved in SRI. Hong & Kostovetsky (2012) highlight political leanings as an influencing factor. McLachlan & Gardner (2004), Renneboog et al. (2008), and (Sparkes & Cowton, 2004) examine investor behavior, performance, and the maturation of SRI. Taken together, these studies suggest that SRI is a multifaceted field influenced by individual, demographic, and societal factors.

The performance of SRI and ethical mutual funds is a debated topic, and it constitutes another pillar of the framework. Bauer et al. (2005) and Carhart (1997) find no significant difference in risk-adjusted returns compared to conventional funds. Contradictorily, Kempf & Osthoff (2007) report that SRI can yield abnormal returns. Derwall et al (2005) assert that eco-efficient portfolios outperform, while Hamilton et al (1993) find SRI funds' performance comparable to conventional ones. Nofsinger & Varma (2014) note SRI funds excel during crises but lag otherwise. Renneboog et al. (2008) find underperformance in SRI funds globally. These varying findings, rooted in Markowitz's (1952) utility theory, indicate that ethical investing outcomes are nuanced and context dependent.

Fig 10. Intellectual framework since 2016. Co-citation map.



Source: own elaboration with bibliometrix and VOSviewer.

As result, empirical evidence shown in the contributions suggests that investor demand for socially responsible investment options is prompting corporations to adopt more sustainable environmental practices. Specifically, recent studies show that firms with better environmental records attract more investment from funds with a stated preference for 'green' investments. This has led to a virtuous cycle where companies not only seek to improve their environmental impact to comply with regulatory standards but also to appeal to a growing segment of the investment community that prioritizes sustainability. Furthermore, exploring the role of environmental, social, and governance (ESG) metrics as a common language, align investor preferences with corporate behavior. These metrics provide a framework through which investors can assess corporate responses to climate change, leading to more informed investment decisions that, in turn, incentivize companies to innovate and implement environmentally friendly policies. Those mechanisms, supported by both quantitative data and qualitative analysis, provides a comprehensive understanding of how social investment preferences are currently shaping corporate strategies in the realm of climate change.

Conclusions

The research contributions on investor attitudes and preferences toward climate change and sustainable investments experienced a sharp increase over the last decades and built a significant knowledge corpus. We identified two periods in which seminal works preceded others devoted the related themes. This growth was significantly helped by specialized journals and the cross-impact with journal on finance, economics, and management. We think that they play a key role that it

would be necessary to achieve a maturation stage, which usually follows this pattern of development.

The main themes behind climate change perception evolved over the above-mentioned periods. In the first one, SRI and behavior have a main role, whereas in the second, sustainability and performance become motor themes, and the role of investors and responsible investment developed as basic themes. Mitigation of risk in a context of uncertainty is link to the strategy, and sustainability is usually linked to its disclosure and to CSR. Responsible investment ties preferences to institutionalized concepts like sustainable development, corporate governance, and corporate sustainability.

Since the climate change perception is initially based on SRI, the most relevant authors contributed to the topic addressing a variety of themes often related to the disciplines of corporate governance, management, and finance. They include the role of board diversity and long-term investment in corporate social performance, the impact of economic and climate-related uncertainties, and the importance of policy in shaping sustainable practices. Additionally, various investment styles are explored, ranging from green bonds to ethical and sector-based choices. Studies also investigate how investor behavior can incentivize corporate social responsibility and delve into the complex factors affecting investment decisions, such as policy and market demand. Behavioral motivations for self-insurance and the balance between financial gains and social benefits in sustainable investing are also discussed. In sum, they highlight how governance, investor behavior, policy, and economic factors are crucial in understanding corporate financial sustainability and the perception and preferences towards climate change related issues.

Regarding the intellectual framework behind the contributions on the topic, the body of research is diverse, nuanced, and centered on Socially Responsible Investing (SRI). It covers different grounding pillars, from investor behavior and motivations to performance metrics and corporate influence. References indicate that SRI is gaining mainstream acceptance and is influenced by a range of psychological and demographic factors. On the performance side, the consensus is less clear. While some of the provided research documents suggest that ethical funds perform comparably to traditional funds in terms of returns, others point to mixed or even underperforming results. Importantly, these outcomes are influenced by various market conditions and investor characteristics. Ethical investing not only has the potential to shape corporate behavior but also responds to broader societal demands for social responsibility. Additionally, research in stakeholder management and corporate social responsibility expands the understanding of SRI by questioning traditional economic paradigms and emphasizing the correlation between social/environmental and financial performance. The field is also impacted by evolving asset pricing models that consider not just financial metrics but investor preferences and ethical considerations. In summary, SRI is configured as a multifaceted and complex field that is shaped by individual, institutional, and societal factors, with ongoing debates about its financial viability and broader impact.

The existing literature on investor attitudes and preferences toward climate change and sustainable investments reflects a dynamic evolution of themes and methodologies, as well as a growing sophistication in how these topics are explored and understood. However, a critical gap remains in the integration and application of these insights to actual investment practices and policymaking. There is a need for translational research that bridges the divide between academic findings and practical implementation. Current contributions often stop at the theoretical level or in controlled empirical settings, which may not fully capture the complexities of real-world markets and

investor behaviors. The challenge lies in translating the nuanced understanding of investor psychology and market dynamics into actionable strategies that can be adopted by practitioners and policymakers. This translation requires interdisciplinary approaches that blend finance, economics, psychology, and sustainability studies to create robust frameworks that can withstand the test of practical application. Furthermore, it necessitates the development of new tools and metrics that can effectively measure the impact of SRI and climate change considerations on investment returns and risk profiles in a way that resonates with a broad range of investors, from individuals to large institutions. Only through such efforts can the field move beyond the maturation stage and make a tangible impact on fostering sustainable investment practices that align with the urgent needs of addressing climate change.

Lines of future research

In the evolving landscape of sustainable investment, new research should redefine the interplay between finance and climate change. The development of standardized metrics for impact measurement is pivotal, enabling investors to truly understand the real-world effects of their capital allocations. This pursuit is complemented by an exploration of the psychological underpinnings of investor behavior, where the focus is on aligning communications and policies with investors' intrinsic motivations and biases. Moreover, the integration of emerging technologies such as AI and blockchain is viewed as a game-changer, offering transparency and revolutionizing environmental impact analysis and investment resilience in the face of climate-related risks. An in-depth understanding of the financial implications of extreme climate events is also critical, as it can reveal how market behaviors, asset valuations, and investor sentiment respond to such phenomena. By synthesizing these elements—technological advancements, behavioral insights, climate change realities, and policy synergy—researchers can provide the investment community with sophisticated strategies that balance economic soundness with environmental sensitivity, paving the way for a regenerative economy and the next era of responsible investing.

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