

Article

Unveiling Energy Finance Market: A Bibliometric and Content Analysis

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Abstract

This paper unveils the nexus of the energy finance market and its significant dynamics. The results exhibit potential research areas, dominating research patterns and interlinkages among them. Our sample consists of 927 articles selected from the Scopus database for the sample period of 1972–2024. We present the quantitative performance of top articles, journals, authors, countries, and institutions. The result includes keyword co-occurrence analysis and co-authorship analysis for authors and countries. We include a literature review of the top 20 cited articles and the most followed methodologies. We found five themes, four clusters, and thirty-four future research questions, showing potential areas of research in the energy finance market. Additionally, based on our results, we proposed a theoretical framework of five major independent factors impacting the energy finance market. This novel study provides a comprehensive picture of the energy finance market, covering a vast period using Scopus as a database, underscoring the prevalent research patterns and serving financial practitioners, researchers, and policymakers.

Keywords: energy; financial market; bibliometric; literature review; renewable energy; greenwashing risks; energy transition; energy price; volatility; content; sustainability; SDG

JEL Classification: Q40; Q41; Q42; C80



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1. Introduction

Current global dynamics, such as climate change (IEA, 2021), renewable energy, carbon mitigation (IPCC, 2022), global energy transition (IRENA, 2021), long-term sustainability (United Nations, 2022), energy price volatility (World Bank, 2022), energy infrastructure in developing countries (IEA, 2022), and mitigating greenwashing risks (IRENA, 2020), urgently require researchers to study energy finance. The growing literature in the energy finance area reveals that countries are striving to achieve their climate targets and low-carbon economies (Robiou du Pont & Meinshausen, 2018; Zhang et al., 2019; Ma et al., 2019; Elie et al., 2021). Zhang and Ji (2019) acknowledges that today's energy market is volatile and challenging because of the various financial transitions and reforms. In 2019, a global investment of \$1.83 trillion in the energy market recognized a sudden rise in demand for solar energy, renewable energy, wind power, and electric-based projects (Megginson et al., 2022). Subsequently, the role of finance in the energy market has gained importance. The emergence of new features such as green finance, sustainable finance, climate finance,

renewable energy, and energy pricing has made the energy market an inevitable area of research and exploration of its interlinkages.

With this, we initiated the research by firstly finding an appropriate methodology to explore the potential areas in the energy market, which can guide the various stakeholders. The adoption of any research methodology may introduce biases in the sample selection and lead to survival biases. However, existing studies by [Baker et al. \(2019\)](#) and [Baker et al. \(2020b\)](#) find that bibliometric analysis is capable of handling and reducing these biases. [Ozturk et al. \(2024\)](#) and [Passas \(2024\)](#) emphasize that since bibliometric analysis follows several rigorous steps in quantifying results, and it is the most appropriate method for investigating a future research agenda. By the above discussion, our study aims to explore existing research patterns in the energy finance market and identify potential future research areas. Against this background, this study facilitates financial practitioners, policymakers, researchers, regulatory bodies, and investors in identifying knowledge gaps in the energy finance market and designing country-specific regulatory policies to address environmental concerns.

While recent studies ([Kou et al., 2024](#); [Elie et al., 2021](#); [Xu et al., 2024](#)) identify five main themes¹ and eight clusters in the area of energy finance market, which are based on the Web of Science (WOS) database covering a recent period of time. [Kou et al. \(2024\)](#) selected the WOS database while covering the period from 1900 to 2022 and analyzed 10,961 articles using bibliometric analysis. The authors obtained four themes: “energy and financial market”, “pricing mechanisms of energy”, “energy derivative markets”, and “green finance”. Also, the study further proposed six research topics in “stock markets and energy prices”, “exchange rate and energy market systemic risk modeling”, “financial policies related to sustainability and low carbon”, “climate and the state of the carbon emissions trading market”, “crude oil price forecasting and future market”, and “energy infrastructure investment and financing”. The study is limited to the WOS database covering the recent period, and it is based on the following two keywords, energy and finance. Hence, there is still a need to explore the inter-dynamics of energy, finance, and the market, as finance is narrow in scope, while the market is broader and comprises different participants. Similarly, a study by [Elie et al. \(2021\)](#) reveals the growing importance of funding in the field of renewable energy based on the period from 1992 to 2018, taking the database WOS. The study obtains a specific research area for different periods encompassing investors’ involvement in the policy framework around 2000. An upward trend in the number of articles published after 2008 is observed, with a prominence of homogeneity in funding of renewable energy sectors. However, the recent period shows that private players in the market are actively investing in the field, reflecting their support and interest in renewable energy projects. The study extends the scope of the energy market by including various dimensions of the renewable energy area. Another study by [Xu et al. \(2024\)](#) based on the WOS database for the period till 2023, proposes four clusters focusing on sustainable finance, climate finance, environmental sustainability, and green finance. However, the study mentions limitations in the choice of period, selection of the database, and subjectivity in the interpretation of results, hence calls for further exploration in the field. Therefore, these recent studies are confined to energy finance, and the market dynamics of energy finance are still unexplored, capturing its sub-areas such as volatility, market players, market regulators, the role of government, and recent trends in the energy market. Hence, our novel study attempts to uncover the current and potential research areas in the energy finance market.

The previous study by [V. K. Singh et al. \(2021\)](#) shows that Web of Science is the most selective database, while Scopus covers a larger number of journals, hence reducing the overlap of journals. Similarly, [Mongeon and Paul-Hus \(2015\)](#) mention that one should

be careful in selecting the database, else it may lead to differences in results, and hence generalizing the results may be uncertain. Moreover, few existing studies focus on the different dimensions of energy finance, primarily on green finance, covering the latest period (M. Wang et al., 2021; Muhmad et al., 2024; Naeem et al., 2023; Maria et al., 2023; Mentel et al., 2023). Therefore, this study contributes to the literature by exploring the nexus of the energy finance market. In view of this, our novel study is exclusive in presenting the results derived from the energy finance market articles only, with different time frames and data.

Therefore, this paper unveils the nexus of the energy finance market using bibliometric analysis, content analysis, and manual review of the literature, based on the Scopus database. Our results are based on 927 articles for the study period of 1972–2024. We present the quantitative performance of top articles, journals, authors, countries, and institutions. The result includes keyword co-occurrence analysis and co-authorship analysis for authors and countries. We included a literature review of the top 20 cited articles and the most followed methodologies. Five themes, four clusters, and thirty-four future research questions were identified, which showed the potential areas of research and pave the way for future research in the energy finance market. Additionally, we proposed a theoretical framework covering five major independent factors influencing the energy finance market.

Section 2 discusses the material and methods used in the study. Section 3 presents the results and their discussion, and Section 4 offers the concluding remarks and the future research area.

2. Materials and Methods

Unprecedented challenges arising from climate change, geopolitical risk, and AI-based technological revolution have necessitated further exploration of the energy market. The interdependency of the energy market with the financial market of any economy makes the energy financial market a crucial factor in finding research gaps available in this emerging area. With the intent of exploring both the qualitative and quantitative performance of intellectual research structure in the study area, we apply a bibliometric analysis (Verma & Gustafsson, 2020; M. A. Khan et al., 2021). Bibliometric analysis is a systematic process of following various steps that include defining the scope of the study, framing the research questions, period, selecting of database, article type, collecting the data, cleaning the data, choosing the correct techniques, performing the analysis, reporting the findings, and lastly presenting the discussion (Donthu et al., 2021; A. Khan et al., 2022; B. Singh, 2021; Chen et al., 2023). Subsequently, to answer the research question of what the available research patterns and potential research structures are in the field of energy finance, we prefer to select the Scopus database over the Web of Science. Over the years, Scopus has gained popularity over the WOS, owing to its reliability, large compilation of article types since 1900. Hence, we choose Scopus for data collection as it also outperforms WOS in assessing the impact of research predominantly in the social sciences (Norris & Oppenheim, 2007).

To achieve the broader scope of the study, we did not restrict the article coverage to any time frame. Hence, we delimit the range of the article selection, and only those articles are taken whose abstract, title, and keywords follow the search protocol. Next, we build the relevant keywords to fetch the data and thereafter obtain 2924 articles.

To obtain research intellectual structure covering past, present, and future time frames, we perform two techniques under bibliometric analysis: first, performance analysis, and second, science mapping. Performance analysis is a cross-temporal quantitative performance metric that provides the productivity and impact of the research carried out. On the other hand, science mapping exhibits the linkages and networks of the various intellectual structures. Additionally, we do content analysis using Excel by manually identifying the

popular methodologies adopted in our sample studies. Following this, we explain the finalization of our extracted sample articles.

Bibliometric analysis is performed in both quantitative and qualitative form (Baker et al., 2020a; Donthu et al., 2021; A. Khan et al., 2022; Shakil, 2024). The beauty of bibliometric analysis lies in its capacity to capture large, global datasets. It consists of performance analysis and network mapping. Performance analysis is a quantitative measurement of the number of times any item appears in the document. This can be performed in Excel as well using the Bibliometrix package 5.1.0. Once the final data is collected in Excel, the sort and filter functions are applied to obtain the performance metrics for an individual item. Alternatively, the Bibliometrix package 5.1.0 is a user-friendly software that is performed in R Studio, making the analysis more convenient. Hence, we conduct performance analysis using the Biblioshiny dashboard provided in the Bibliometrix package 5.1.0.

In the subsequent step, we perform network mapping for deeper insights into the relation between various research units, which results in the formation of a visualization network and maps. We perform this analysis using the VOSviewer 1.6.20 software. We refer to the manual of Van Eck and Waltman (2010). The software forms the visualized network map by creating a matrix for research units (authors, keywords, and countries), showing the number of joint links between two or more (authors, keywords, and countries). Wherein, the research unit represents the circle, and the size of the circle represents the productivity of the research unit. The large size of the circle shows the higher productivity of the research item and vice versa. The lines connecting the circles are known as the links; the thickness of the links determines the strength of the joint relationship between the circles. The color of each circle remains the same for each group, defined as a cluster. Each cluster shows the frequency of joint occurrence of any research item. The compilation of all clusters in one map is called a collaborative network, depicting the frequency of joint research activity performed by a unit.

An effective search query depends on the proper selection of operators and wildcard functions. To examine the trends in the “energy finance market”, we propose the search query as: “energy”, “finance”, “market”. Hence, we limit the operators and wildcards to these three words in selecting the articles. After the appropriate refinement steps, as shown in Table 1, our final sample consists of 927 articles out of 2924 articles. The sample was taken at 8:53 p.m. on 3 September 2024. The first qualifying paper, “Technology in Europe’s Future” (Pavitt, 1972), was published in 1972 and cited 20 times.

Table 1. Details of query criteria.

Steps	Query Criteria	Description	Sample	First Qualifying Paper Year	Range
1	Keyword	“energy”, “finance”, “market”	2924	1972	No range
2	Not limited by period range	No range (Automated)	2924	1972	
3	Limited by Subject area	ECON, BUSI, SCOI	1291	1972	
4	Limited by document type	Article and Review	959	1972	
5	Limited by source type	Journal and trade Journal	953	1972	

Note: Computed by authors.

We use bibliometric analysis using the Bibliometrix package in R Studio to obtain performance metrics for journals, articles, authors, and citations (Aria & Cuccurullo, 2017). Collaborative networks of keywords, authors, and countries are built using VOSviewer software 1.6.20 (Waltman et al., 2010). We manually review the literature of the top 20 most cited articles. We also search the most popular methods in Excel (Welbers et al., 2017).

3. Results and Discussion

3.1. Performance Metrics Review

For our sample articles 927, we presented the quantitative performance of top articles, journals, authors, countries, and institutions in this section.

3.1.1. Articles and Citation Growth

We discovered a consistent growth of articles over 36 years (1972 to 2008); however, from 2010 onwards, the number of articles continued to increase. This trend indicates a growing interest and engagement with the topic among researchers. Table 2 highlights major events that relate to the fluctuations in the number of articles published. Figure 1 shows the number of articles published and cited for the period 1972–2024, giving a true metric of research conducted for that specific period. The number of articles published is shown on the vertical axis, and the publication years are shown on the horizontal axis of the figure. The orange color of the figure shows the number of published articles, whereas the blue line shows the average number of times the article is cited. In 2000, we witnessed more spikes than publications, indicating substantial work carried out in the previous years. Furthermore, we found a decreasing trend in the citations in recent years, indicating that the recent publications required more time to obtain recognition and citations.

Table 2. Major events in the energy finance market.

Event	Year	References
The first oil crisis was announced by the Organization of Arab Exporting Countries (OAPEC)	1973	(Odell, 1975)
Formation of the International Energy Agency	1974	History-About (IEA, n.d.-a)
Second Oil Crisis	1979	Lomax, D.F., 1986 (Lomax, 1986)
Establishment of the New York Mercantile Exchange	1982	Futures and Options Trading for Risk Management (CME Group, n.d.)
Financialization and development Energy market	1986	Fleming and Ostdiek (1999)
Amendments to the Clean Air Act	1990	(US EPA, 2024)
UNFCCC and the Rio Earth Summit	1992	(United Nations, 1992)
Kyoto Protocol	1997	(UNTC, n.d.)
Trading Scheme under the European Emissions	2002	Demailly and Quirion (2007)
Energy Policy Act	2005	(United States Congress, 2005)
Global Great Recession	2008	Dullien (2010)
Nationally Determined Contributions	2015	Mulatu et al. (2023)
Task Force on Climate Financial Disclosures	2017	Task Force on Climate-Related Financial Disclosures TCFD), 2023 (TCFD, 2023)
Net Zero Commitments	2020	Net Zero by 2050—Analysis (IEA, 2021)
Heavy Investments in Clean Energy	2024	Overview and Key Findings—World Energy Investment 2024—Analysis (IEA, n.d.-b)

Note: Computed by authors.

3.1.2. Top Journal Performance (Article-Based)

We observed 11 leading journals with at least ten articles in the last 52 years (1972–2024), as shown in Figure 2. Next, for these leading journals, we presented the number of articles with their impact factor in Table 3. The impact factor of a journal measures the mean citations received for the published articles for that respective journal in

the last two years. The impact factor for the journal is calculated every year in June by the Clarivate Analytics institute. For our study, we reported the impact factor for the year 2025 before June 2025.

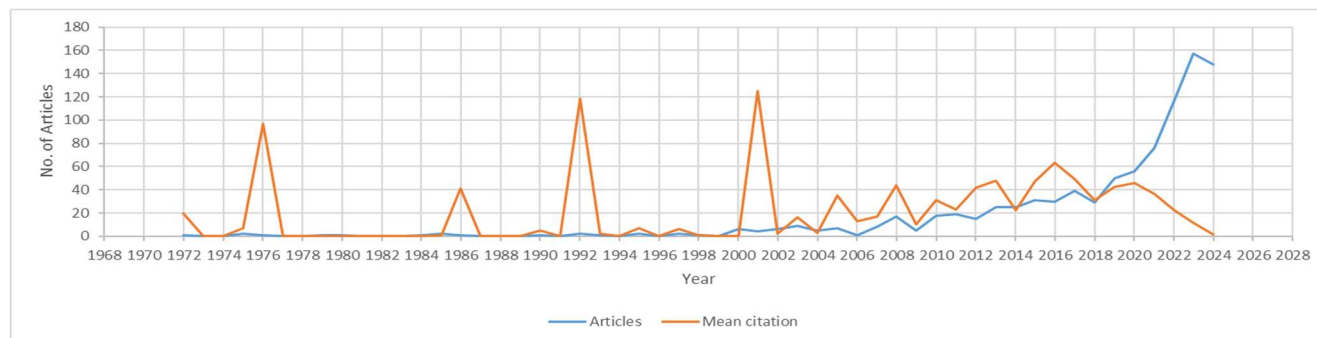


Figure 1. Articles and Citation Growth.

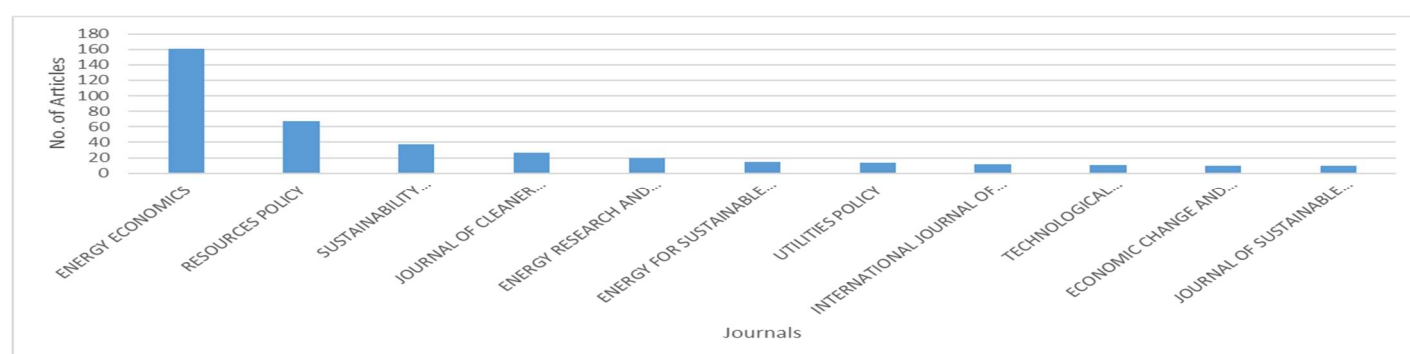


Figure 2. Top Journal performance (article based).

Table 3. Top 11 leading journals with their impact factor.

Name of the Journal	Total Number of Articles	Impact Factor
Energy Economics	161	13.6
Resources Policy	67	13.4
Sustainability (Switzerland)	37	3.3
Journal of Cleaner Production	27	9.8
Energy Research and Social Science	20	6.9
Energy for Sustainable Development	15	4.4
Utilities Policy	14	3.8
International Journal of Energy Sector Management	12	2.5
Technological Forecasting and Social Change	11	12.9
Economic Change and Restructuring	10	4
Journal of Sustainable Finance and Investment	10	3.8

Note: Computed by authors.

It was explained with the formula as shown below:

$$\text{Impact factor for the current year} = \frac{\sum \text{Published articles in the last two years}}{\sum \text{Current year's citations to the published articles in the last two years}}$$

Table 3 presents that “Energy Economics” (161 articles) with a 13.6 impact factor leads to “Resources Policy” (67 articles) with a 13.4 impact factor, considering high-quality and

influential research outputs. “Technological Forecasting and Social Change” is distinct as a highly cited journal. “Sustainability”, “Journal of Cleaner Production”, and “Energy Research & Social Science” make a moderate research contribution in sustainable and clean energy.

3.1.3. Top Journal Performance (Biennial)

We present the growth of the articles every two years in Figure 3. The selection of the top five journals was based on the previous bibliometric review by [Shakil \(2024\)](#). The growth of articles reflects the absolute number of articles published every year in the journal. This is represented by the five colored line chart, wherein the light blue color line represents “Energy Economics”, the orange color line for “Resources Policy”, the grey color line for “Sustainability”, the yellow color line for “Journal of Cleaner Production”, and the dark blue color line for “Energy Research and Social Sciences”. The upsurge in the number of publications for the top five journals “Energy Economics”, “Resources Policy”, “Sustainability”, “Journal of Cleaner Production”, and “Energy Research and Social Sciences” is seen in the latest years.

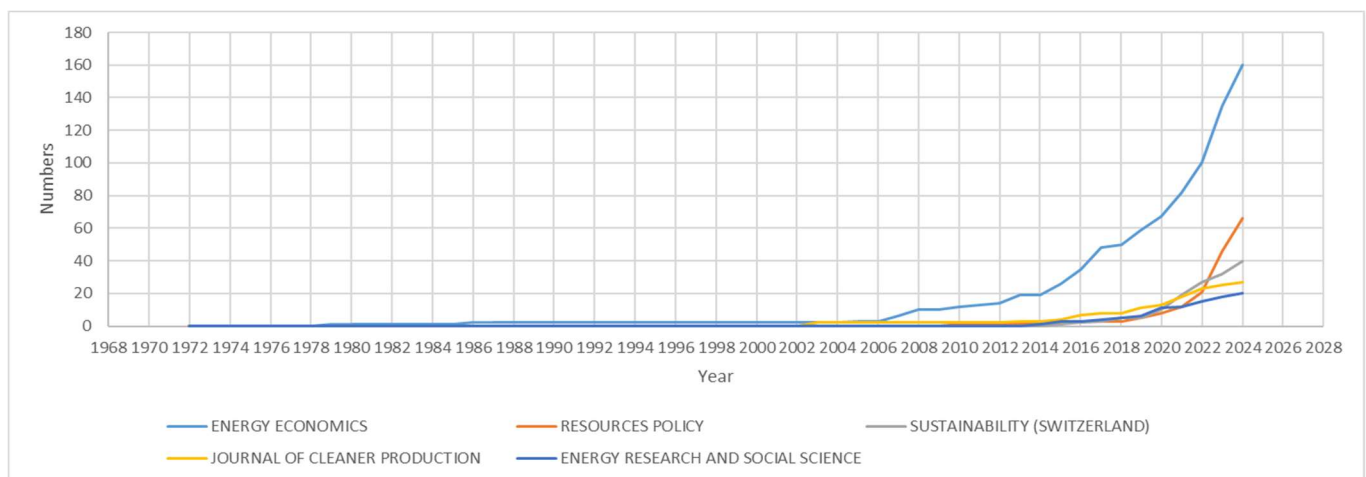


Figure 3. Top Journal Performance (Biennial).

3.1.4. Review of Literature of Top 20 Articles

We reviewed the literature of 20 articles with the highest citations, reported in Table 4. The selection of the top 20 literature reviews was based on the prior bibliometric review study by [B. Singh \(2021\)](#). Author name Jensen, M.’s paper published in “European Financial Management” (ABDC A) has received the highest citations (497) ([Jensen, 2001](#)). Afterwards, [Cao et al. \(2021\)](#) published their work in “Journal of Cleaner Production” (ABDC A), receiving 415 citations (104 citations per year). Furthermore, about the adoption of methodologies, machine learning (ML) ([Ghoddusi et al., 2019](#)), a GMM panel VAR ([Y. Ouyang & Li, 2018](#)), and DCC-GARCH ([Creti et al., 2013](#)) suggest a transition from traditional methods to advanced econometric and statistical tools. Furthermore, green finance ([Ren et al., 2020](#); [Gianfrate & Peri, 2019](#)) and energy-economy nexus ([Acheampong, 2019](#); [Çoban & Topcu, 2013](#)) have surfaced as key areas of interest.

Table 4. Literature review of top 20 cited articles.

Sr. No.	Title of the Paper	Authors	Year	Journal	Citations	TC/Year	Publisher	First 10 Keywords	ABDC Ranking	University/Institutions	Country	Key Findings
1	Value maximization, stakeholder theory, and the corporate objective function	Jensen M. (Jensen, 2001)	2001	European Financial Management	497	21	John Wiley & Sons Ltd.	Balanced scorecard; Corporate governance; Corporate objective function; Corporate purpose; Multiple objectives; Social responsibility; Social welfare; Special interest groups; Stakeholder theory	ABDC A	Monitor Group, Harvard Business School	United States	This article summarizes enlightened value maximization that combines stakeholder theory's framework with long-term value maximization as the corporate objective.
2	Digital finance, green technological innovation, and energy-environmental performance: Evidence from China's regional economies	Cao S.; Nie L.; Sun H.; Sun W.; Taghizadeh-Hesary F. (Cao et al., 2021)	2021	Journal of Cleaner Production	415	104	Elsevier Ltd.	China; Difference-in-difference model; Digital finance; Energy-environmental performance; Green technological innovation	ABDC A	College of Management and Economics, Tianjin University; College of Management and Economics, Ma Yinchu School of Economics, Tianjin University; School of Finance and Economics, Jiangsu University; Institute for China Common Prosperity Research, Jiaxing University; Department of Economics and Management, Yuncheng University; Social Science Research Institute, Tokai University	China and Japan	While digital finance affects technical efficiency only, it does not affect scale efficiency and poses a stronger stimulating effect in regions with underdeveloped credit and capital markets. China should digitize its financial markets and promote energy saving and emission reduction.
3	The nexus between financial development and energy consumption in the EU: A dynamic panel data analysis	Çoban S.; Topcu M. (Çoban & Topcu, 2013)	2013	Energy Economics	415	35	Elsevier Ltd.	Energy consumption; EU; Financial development; System-GMM	ABDC A*	Nevşehir University, Department of Economics	Türkiye	The purpose of this article is to assess the connection between financial development and energy use, using the system-GMM model in the EU over the period from 1990–2011. There are no significant impacts on the overall energy use of EU27 countries; however, stronger financial development in the older EU member states was associated with more energy use, independent of banking or stock market proxy.
4	On the links between stock and commodity markets' volatility	Creti A.; Joëts M.; Mignon V. (Creti et al., 2013)	2013	Energy Economics	401	33	Elsevier Ltd.	Commodities; Correlations; DCC-GARCH; Financial crisis; Stock market; Volatility	ABDC A*	EconomiX-CNRS, University of Paris Ouest; Ecole Polytechnique; CEPii	France	The paper investigates the relationship between price returns for 25 commodities and stocks for the period 2001–2011, for energy raw materials. It shows that volatility of correlations is very high, especially after the 2007–2008 financial crisis, and notes the financialization of commodity markets.
5	Modelling for insight: Does financial development improve environmental quality?	Acheampong A.O. (Acheampong, 2019)	2019	Energy Economics	398	66	Elsevier B.V.	CO2 emissions; Economic growth; Energy intensity; Financial development	ABDC A*	Newcastle Business School, University of Newcastle	Australia	The study finds that domestic credit to private sector, and banks all positively contributed to increase in carbon emissions; however, FDI, liquid liabilities and domestic credit to private sector had no impact on carbon emissions are found in the study.
6	Nexus between green finance, non-fossil energy use, and carbon intensity: Empirical evidence from China based on a vector error correction model	Ren X.; Shao Q.; Zhong R. (Ren et al., 2020)	2020	Journal of Cleaner Production	312	62	Elsevier Ltd.	Carbon intensity; Emission reduction; Green finance development index; Non-fossil energy use; Vector error correction model	ABDC A	School of Economics, Shanxi University of Finance and Economics; China Center for Special Economic Zone Research, Shenzhen University	China	The study demonstrated that increasing carbon intensity reduced non-fossil fuel consumption and flow into investments in the green finance sector of China. In conclusion, the study offers the means to improve the implementation of their green finance policies, expand the use of non-fossil energy consumption, and develop the carbon trading market.
7	The effect of foreign direct investment and stock market growth on clean energy use across a panel of emerging market economies	Paramati S.R.; Ummalla M.; Apergis N. (Paramati et al., 2016)	2016	Energy Economics	310	34	Elsevier B.V.	Clean energy consumption; Emerging market economies; FDI inflows; Stock market growth	ABDC A*	International Institute for Financial Studies, Jiangxi University of Finance and Economics; School of Economics, University of Hyderabad; Department of Banking and Financial Management, University of Piraeus	China, India, and Greece	The research investigates the effects of foreign direct investment (FDI) inflows and stock market growth on the consumption of clean energy in 20 developing market economies for 1991–2012. The findings of this research point to a positive relationship between economic output (FDI) inflows and stock market growth with the consumption of clean energy.

Table 4. Cont.

Sr. No.	Title of the Paper	Authors	Year	Journal	Citations	TC/Year	Publisher	First 10 Keywords	ABDC Ranking	University/Institutions	Country	Key Findings
8	The green advantage: Exploring the convenience of issuing green bonds	Gianfrate G.; Peri M. (Gianfrate & Peri, 2019)	2019	Journal of Cleaner Production	294	49	Elsevier Ltd.	Climate change; Fixed income; Green bonds; Propensity score; Responsible investment; Sustainability	ABDC A	EDHEC Business School; Bocconi University	Italy	Green bonds are coming up as a potential mechanism to direct finance to clean investments. A study of 121 green bonds in Europe issued between 2013 and 2017 concludes that green bonds are cheaper than non-green bonds for corporate issuers, and that green bonds continue in a secondary market.
9	The effects of stock market growth and renewable energy use on CO2 emissions: Evidence from G20 countries	Paramati S.R.; Mo D.; Gupta R. (Paramati et al., 2017)	2017	Energy Economics	284	36	Elsevier B.V.	CO2 emissions; FDI inflows; G20 nations; Renewable energy; Stock market growth	ABDC A*	International Institute for Financial Studies, Jiangxi University of Finance and Economics; Department of Accounting, Finance and Economics, Griffith University	Australia	The purpose of this research is to analyze how responses to stock market growth, Foreign Direct Investment (FDI) inflows, and the consumption of renewable energy fluctuate CO ₂ emissions and economic output in the G20 member countries. In the long run, stock market growth may benefit CO ₂ emissions in developing economies, FDI flows may enhance economic output, and renewable energy consumption may produce the same effects.
10	Strategic assessment of building adaptive reuse opportunities in Hong Kong	Langston C.; Wong F.K.W.; Hui E.C.M.; Shen L.-Y. (Langston et al., 2007)	2008	Building and Environment	280	16	Elsevier B.V.	Adaptive reuse; Building age; Obsolescence; Refurbishment potential; Sustainability; Useful life	NA	Department of Building and Real Estate, The Hong Kong Polytechnic University	Hong Kong	This article examines the relationships of financial, environmental, and social factors in real estate portfolio decisions. The model intends to identify buildings with the highest potential to reuse Hong Kong's energy and natural resources. It results in a real case study that demonstrates how existing resources can be used more efficiently.
11	The role of globalization on the recent evolution of energy demand in India: Implications for sustainable development	Shahbaz M.; Mallick H.; Mahalik M.K.; Sadorsky P. (Shahbaz et al., 2016)	2016	Energy Economics	266	30	Elsevier B.V.	Energy demand; F62; Financial development; Globalization; India; Q43	ABDC A*	Energy Research Center, Department of Management Sciences, COMSATS Institute of Information Technology; Montpellier Business School; IPAG Business School; Centre for Development Studies (CDS); Department of Humanities and Social Sciences (DHSS), National Institute of Technology (NIT); Schulich School of Business, York University	Pakistan, France, India, and Canada	It finds that globalization promotes economic growth, financial development, and urbanization, and the long-term effect is usually a reduction in energy consumption
12	Machine learning in energy economics and finance: A review	Ghoddusi H.; Creamer G.G.; Rafizadeh N. (Ghoddusi et al., 2019)	2019	Energy Economics	257	43	Elsevier B.V.	Artificial Neural Network; Crude oil; Electricity price; Energy finance; Energy markets; Forecasting; Machine learning; Support Vector Machine	ABDC A*	School of Business, Stevens Institute of Technology; Independent Researcher of Sharif University of Technology	Iran	The field of energy economics and finance is undergoing a revolution with the use of machine learning (ML) for price predictions, demand forecasting, risk assessment, trading strategies, data management, and macro trend analysis. Existing research has reported success, challenges, and research gaps while offering guidance for future research.
13	Financial development and deployment of renewable energy technologies	Kim J.; Park K. (Kim & Park, 2016)	2016	Energy Economics	250	28	Elsevier B.V.	Deployment of renewable energy technologies; External financing; Financial development	ABDC A*	Korea Advanced Institute of Science and Technology (KAIST)	South Korea	The research's findings suggest that developed countries experience a faster transformation in the renewable energy space, where debt and equity financing are favored compared to those countries with developing financial markets, which enables them to achieve lower CO ₂ emissions.
14	On the nexus of financial development, economic growth, and energy consumption in China: New perspective from a GMM panel VAR approach	Ouyang Y.; Li P. (Y. Ouyang & Li, 2018)	2018	Energy Economics	249	36	Elsevier B.V.	Economic growth; Energy consumption; Financial development; GMM panel VAR; PCA	ABDC A*	University of International Business and Economics, School of International Trade and Economics	China	The study examines the relationship between financial development, energy consumption, and economic growth amongst 30 provinces in China over the period of 1996Q1 to 2015Q4. Findings suggest that financial development negatively affects economic growth; however, energy consumption is positive for economic growth across all regions.

Table 4. Cont.

Sr. No.	Title of the Paper	Authors	Year	Journal	Citations	TC/Year	Publisher	First 10 Keywords	ABDC Ranking	University/Institutions	Country	Key Findings
15	Bootstrap finance: the art of start-ups	Bhide A. (Bhide, 1992)	1992	Harvard business review	237	7	Harvard Business Publishing	Capital Financing; Commerce; Data Collection; Decision Making; Organizational; Entrepreneurship; Evaluation Studies; Financing; Personal; Investments;		Harvard Business School, United States	United States	Governments and policymakers recognize the use of start-ups in job creation and economic development and often pursue some variant of the “big money” model. As a result, books and courses on new venture creation make elements of fundraising highly prominent.
16	Measuring contagion between energy market and stock market during financial crisis: A copula approach	Wen X.; Wei Y.; Huang D. (Wen et al., 2012)	2012	Energy Economics	217	17	Elsevier Ltd.	Contagion; Energy market; Stock market; Time-varying copula	ABDC A*	School of Economics and Management, Southwest Jiao Tong University	China	In this research, time-varying copulas are employed in order to investigate the contagion effect between energy markets and stock markets during the episode of financial crisis. The results indicate an increasing dependence between the Islamic financial crises and stock markets, regardless of economic conditions.
17	Analyzing volatility spillovers and hedging between oil and stock markets: Evidence from wavelet analysis	(Khalfaoui et al., 2015); Boutahar M.; Boubaker H.	2015	Energy Economics	216	22	Elsevier	BEKK-GARCH; Crude oil prices; Discrete wavelet analysis; Hedge ratio; Stock prices; Volatility spillovers; Wavelet coherence	ABDC A*	IMM; IPAG LAB-IPAG Business School	France	The study investigates the relationship between the crude oil market (WTI) and stock markets in the G-7 countries by employing the “wavelet-based MGARCH” technique. The analysis shows that these markets experience a considerable number of volatility spillovers, where WTI leads volatility spillovers in most of the markets.
18	Financial inclusion and energy poverty: Empirical evidence from Ghana	Koomson I.; Danquah M. (Koomson & Danquah, 2020)	2021	Energy Economics	208	52	Elsevier B.V.	Consumption poverty; Education; Energy poverty; Financial inclusion; Household income	ABDC A*	UNE Business School, Faculty of Science, Agriculture, Business and Law, University of New England; Network for Socioeconomic Research and Advancement (NESRA)	Ghana	The evidence shows that greater financial inclusion results in lower energy poverty, and despite the variation in households, this was consistent for rural households as well as male-headed households. In terms of differential benefits for employees, they received the greatest gain from increased financial inclusion.
19	Measuring resource efficiency and circular economy: A market value approach	Di Maio F.; Rem P.C.; Baldé K.; Polder M. (Di Maio et al., 2017)	2017	Resources, Conservation and Recycling	203	25	Elsevier B.V.	Agriculture; Energy; Manufacturing; Mining; Services	NA	Delft University of Technology; Statistics Netherlands (CBS)	Netherland	This paper presents a new value-based indicator for determining the performance of supply chain actors in resource efficiency and the circular economy. The assessment focuses on the resources and resource efficiency performance indicators measured in terms of the market value of valued ‘stressed’ resources—that is, regarded in the sense of scarcity versus competition; including the market indicators of taxes representing social and environmental externalities.
20	Financial implications of fourth industrial revolution: Can bitcoin improve prospects of energy investment?	Su C.-W.; Qin M.; Tao R.; Umar M. (Su et al., 2020)	2020	Technological Forecasting and Social Change	184	37	Elsevier Inc.	Bitcoin price; Granger causal relationship; Oil price; Rolling-window	ABDC A	School of Economics, Qingdao University; Graduate Academy, Party School of the Central Committee of the Communist Party of China (National Academy of Governance); Qingdao Municipal Center for Disease Control and Prevention; School of Business, Qingdao University	China	This study finds that Bitcoin is viewed as an asset that can provide insulation from high oil prices, while the adverse effects of high oil prices typically show weak hedging abilities of the Bitcoin bubble. By anticipating oil price volatility and providing regulation toward Bitcoin bubble formation, governments can help facilitate and protect the proper development of both the Bitcoin market and the energy market.

Note: Computed by authors. The abbreviated form of Sr. No. is the serial number. The abbreviated form of TC is total citations per year. ABDC denotes the Australian Business Deans Council, which ranks the journals based on their quality and impact factor. Keywords are the short phrases that define the content of the article.

3.1.5. 15 Leading Authors, Institutions, and Countries

We presented the 15 leading authors, institutions, and countries based on the number of articles published and cited countries in Table 5. We selected the top 15 authors based on their published productivity. We included the active author with the highest number of articles published and excluded the less active authors with long tails of a similar number of articles. Hence, we set a natural cut-off of 15 authors.

Table 5. A total of 15 Leading authors, institutions, and countries.

Sr. No.	Leading Authors	TA	Institutions	TA	Countries	TA	Cited Countries	TA
1	TAGHIZADEH-HESARY F	14	CHINA UNIVERSITY OF GEOSCIENCES	21	CHINA	165	CHINA	4961
2	LIU Y	9	UNIVERSITY OF INTERNATIONAL BUSINESS AND ECONOMICS	16	USA	86	USA	2287
3	LI X	7	QINGDAO UNIVERSITY	15	UNITED KINGDOM	54	AUSTRALIA	1596
4	WANG J	7	UNIVERSITY OF SUSSEX	14	GERMANY	30	FRANCE	1403
5	WANG Y	7	CHINA UNIVERSITY OF MINING AND TECHNOLOGY	13	INDIA	30	UNITED KINGDOM	1261
6	CHEN Y	6	GRIFFITH UNIVERSITY	12	FRANCE	29	NETHERLANDS	750
7	MIRZA N	6	SCHOOL OF BUSINESS	11	AUSTRALIA	28	TÜRKIYE	743
8	SUN Y	6	TOKAI UNIVERSITY	11	ITALY	28	JAPAN	593
9	WANG X	6	XI'AN JIAOTONG UNIVERSITY	11	NETHERLANDS	18	ITALY	563
10	ZHANG Y	6	ANHUI UNIVERSITY OF FINANCE AND ECONOMICS	10	CANADA	17	PAKISTAN	534
11	DONG X	5	SAPIENZA UNIVERSITY OF ROME	10	JAPAN	17	GERMANY	521
12	LEE C-C	5	TECHNICAL UNIVERSITY OF DENMARK	10	SPAIN	11	INDIA	502
13	SIMSHAUSER P	5	SOUTHWESTERN UNIVERSITY OF FINANCE AND ECONOMICS	9	SWITZERLAND	11	CANADA	439
14	ZHAO J	5	UNIVERSITY OF EDINBURGH	9	TÜRKIYE	11	NORWAY	424
15	Ghosh B.	4	NANJING UNIVERSITY OF INFORMATION SCIENCE AND TECHNOLOGY	8	KOREA	10	KOREA	394

Note: Computed by authors. The abbreviated form of Sr. No. is the serial number. The abbreviated form of TA is the total articles published by per author. ABDC denotes the Australian Business Deans Council, which ranks the journals based on their quality and impact factor. Keywords are the short phrases that define the content of the article.

An Associate Professor, Taghizadeh-Hesary F., from Tokai University, Japan, stands out as the leading contributor in climate and green finance, energy transition, and economics. Most of his works were published in ABDC A journals, four of which were published in FRL. Subsequently, a lot of prolific authors included Liu Y. (nine articles), Li X., Wang J., and Wang Y. (seven articles each), all come from China.

The significant influence on the research area goes to “China University of Geosciences” (21 articles). Accompanied by the “University of International Business and Economics” (16 articles) and “Qingdao University” (15 articles), all from China. Other influential position is held by “University of Sussex” (14 articles) from the UK, “China University of

Mining and Technology” (13 articles), “Griffith University” (12 articles) from Australia, and “Tokai University” (11 articles) from Japan.

Globally, China is a strong global influencer in research articles and citations. 32% of the total articles include 165 articles, and 27% of the total citations include 4961 citations. Followed by the USA (86 articles, 2287 citations), the UK (54 articles), and Australia (1596 citations). India, Germany, France, Italy, and Australia have 28–30 articles each. However, India, Germany, and Italy receive few citations, indicating a lower global impact, suggesting opportunities for international collaborations. Remarkably, Pakistan and Türkiye are traditionally less present in research, but both countries show notable citations, indicating an increase in interest and influence in this area.

3.2. Graphical Representation of Collaborative Networks (Authors, Keywords, and Countries)

In this section, we introduce a network analysis of the co-occurrence of keywords, the co-authorship, the highly cited authors (first five), and the co-authorship by countries and authors.

3.2.1. Keyword Co-Occurrence Analysis

Keyword co-occurrence analysis links items that occur and results in knowledge graphs (Emich et al., 2020). The determination of the threshold is a significant part of this since it offers clarity and accuracy in the network graph (Van Eck & Waltman, 2010; Donthu et al., 2021; Zupic & Cater, 2014). In keyword co-occurrence analysis, the threshold value limits the frequency with which a pair of keywords appears together in a document. It aims to understand the strength of the keyword linkages. A lower threshold value results in a high keyword co-occurrence frequency, while a high threshold value results in a lower keyword co-occurrence frequency. The selection of the threshold value provides and improves the visualization of keyword linkages. However, there exists no standard for choosing the threshold anyway; its finalization lies in the scope, size, and objectives of the study. A threshold of 1–3 occurrences is required for documents less than 1000, while a threshold of 5–10 occurrences is required for documents greater than 1000. The interpretability is improved, and the clutter is reduced as a result. We refer to the previous study (Narong & Hallinger, 2023; Van Eck & Waltman, 2014) while selecting the threshold for our study. Additionally, we follow the bibliometric review study by B. Singh (2021), which suggests checking the network map formed by incrementing the threshold by one. Fixing the lower threshold value leads to overlapping in keywords and dense images, resulting in unclear images and biased results. The formation of a messy network with insignificant repetition of words is called word clutter, which does not generate the formation of clear clusters. Hence, we start with the threshold of five and finally fix it at 15.

Keeping a minimum keyword occurrence of five for 5274 keywords, we created seven clusters that include 381 keywords. To enhance the clarity in the network map, we increased the keywords to ten occurrences, which produced five clusters having 167 keywords, 6725 links, and 20,851 total links. Lastly, the final network displays four clusters consisting of 108 keywords and 3798 links, reaching a total link strength of 15,538 by using an occurrence threshold of 15.

The findings of the keyword co-occurrence are depicted in the network map, presented in Figure 4. Subsequently, we obtained four clusters for keyword co-occurrence analysis. We obtained the clusters by implementing the Louvain method, which is a modularity-based algorithm used in VOSviewer. Hence, these clusters are the outcomes of the network analysis briefly mentioned in the methodology section. The most recurring words are “finance” (283 times), “energy market” (183 times), and “commerce” (156 times). Additionally, we performed the keyword co-occurrence analysis year-wise, shown in Figure 5. It shows the change in color of keywords over the period. Former research (2017–2019) is more attentive to classical

finance, which includes the stock market, crude oil pricing, oil supply, and price fluctuations. While recent studies (2020–2022) show a shift toward climate investments, green finance, renewable energy, the energy market, and sustainable finance, COVID-19 is causing market disruptions. Former research (2017–2019) is more attentive to classical finance, which includes the stock market, crude oil pricing, oil supply, and price fluctuations. While recent studies (2020–2022) show a shift toward climate investments, green finance, renewable energy, the energy market, and sustainable finance, COVID-19 is causing market disruptions. Now, we present the four clusters with their thematic names and references in Table 6. Our results of keyword co-occurrence are consistent with Kou et al. (2024), focusing on the keywords “Energy, stock market, energy pricing, and volatility”. Accordingly, we propose the research questions, which are the main contribution of our study.

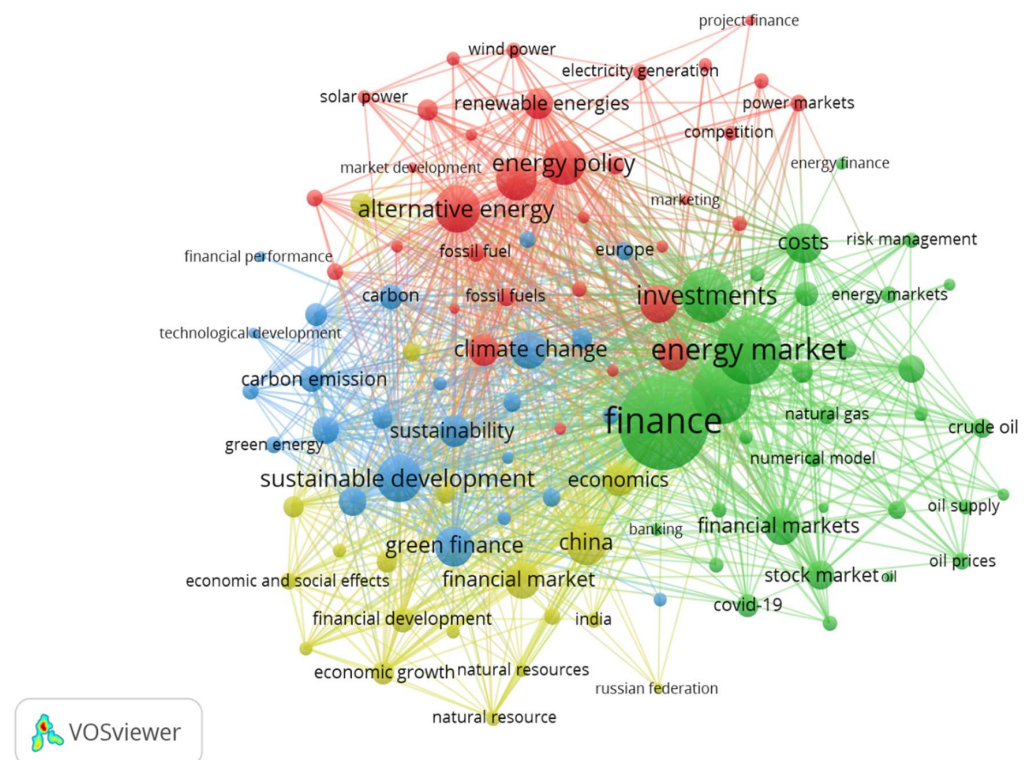


Figure 4. Keyword Co-occurrence Network.

Cluster 1 (Red zone, 33 items): Energy policy and transition strategies.

“Alternative energy” (108 times) and “energy policy” (96 times), along with “renewable energies” (91 times), appear in cluster 1, which focuses on climate change matters and energy source transitions for sustainable initiatives.

Cluster 2 (Green zone, 32 items): Energy Finance, market volatility, and risk assessment.

“Finance” (283 times), “energy market” (183 times), and “commerce” (156 times) appear in cluster 2, which focuses on the commercialization of energy markets and the development of investment plans in international banking, trade, and the energy industry.

Cluster 3 (Blue zone, 24 items): Sustainable finance, green economy, and climate policy for carbon reduction.

“Sustainable finance” (105 times), “green finance” (84 times), and “climate change” (81 times) appear in cluster 3, which focuses on climate finance, green bonds, and sustainable finance in fostering sustainability efforts while encouraging financial support for eco-friendly projects.

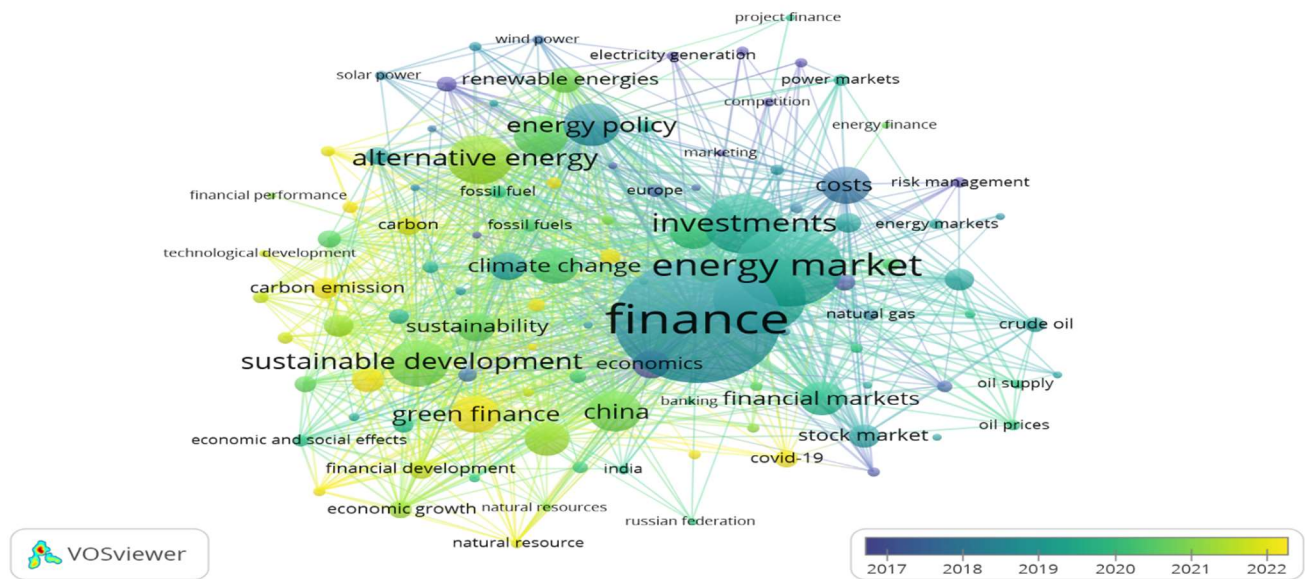


Figure 5. Year-wise keyword co-occurrence network.

Table 6. Clusters of keywords.

Cluster	Keywords	Top Three Keywords	References
Cluster 1 (red zone, 33 items)	Africa, alternative energy, competition, decision making, developing countries, electricity, electricity generation, electricity supply, energy, energy efficiency, energy management, energy policy, energy transition, environmental impact, fossil fuel, governance approach, housing, infrastructure, investment, market development, marketing, power generation, power markets, project finance, renewable energies, renewable energies, renewable resource, solar energy, solar power, sub-Saharan Africa, wind power	Alternative energy (108 times) Energy policy (96 times) Renewable energies (91 times)	(Pangalos, 2023; Hammoudeh & McAleer, 2015; Zhai et al., 2024; Belachew, 2023)
Cluster 2 (green zone, 32 items)	Banking, commerce, commodity price, costs, COVID-19, crude oil, empirical analysis, energy finance, energy market, energy markets, exchange rate, finance, financial crisis, financial markets, financialization, forecasting, investments, market conditions, natural gas, numerical model, oil, oil prices, price dynamics, profitability, regression analysis, risk assessment, spillover effect, stock market, uncertainty analysis, United States	Finance (283 times) Energy market (183 times) Commerce (156 times)	(Yousfi & Bouzgarrou, 2024; Patel, 2025; Sun et al., 2023)
Cluster 3 (blue zone, 24 items)	Carbon, Carbon dioxide, Carbon emission, clean energy, climate change, climate finance, emission control, environmental economies, environmental policy, Europe, European union, financial performance, financial system, green bonds, green economy, green energy, green finance, innovation, panel data, sustainability, sustainable development, sustainable developments, sustainable finance, technological development	Sustainable development (105 times) Green finance (84 times) Climate change (81 times)	(J. Wang et al., 2023a; K. Wang et al., 2023b; Meng et al., 2023)
Cluster 4 (yellow zone, 19 items)	China, economic analysis, economic and social effects, economic development, economic growth, economic growths, economics, energy resource, energy use, energy utilization, environmental protection, financial development, financial market, India, natural resource, natural resources, public policy, renewable energy resources, Russian Federation	China (91 times) Economics (62 times) Financial market (75)	(Y. Liu et al., 2023; Zakeri et al., 2022; Fasanya et al., 2022)

Note: Computed by authors.

Cluster 4 (Yellow zone, 19 items): Economic progress and environmental sustainability in international markets.

“China” (91 times), “economics” (62 times), and “financial market” (75 times) appear in cluster 4, which focuses on global (mainly China, India, and Russia) contributions in bridging the gap between environmental sustainability and energy resources while focusing on economic growth.

3.2.2. Co-Authorship Analysis

A total of 2282 authors contributed to this study; 145 satisfied the requirements for two documents with two citations, resulting in nine clusters with 38 items. This is shown in Figure 6, the detailed description of which is presented in Table 7. We obtain the clusters by implementing the Louvain method, which is a modularity-based algorithm used in VOSviewer. Hence, these clusters are the outcomes of the network analysis briefly mentioned in the methodology section. The research indicates that Professor Taghizadeh-Hesary F. stands as the most prolific author who has published 14 articles with 21 total links (Figure 6). We have already provided the essentials of this prolific author in Section 3.1.5. Thereafter, Professor Kangyin Dong and Professor Sitara Karim, along with the other authors, have published four articles with nine total links. Professor Kangyin Dong is an Associate Professor at the University of International Business and Economics, China, and Professor Sitara Karim is a Professor at ILMA University, Pakistan. Referring to Figure 6, the largest network among authors is shown in a red cluster with its seven-member links that signify joint research.

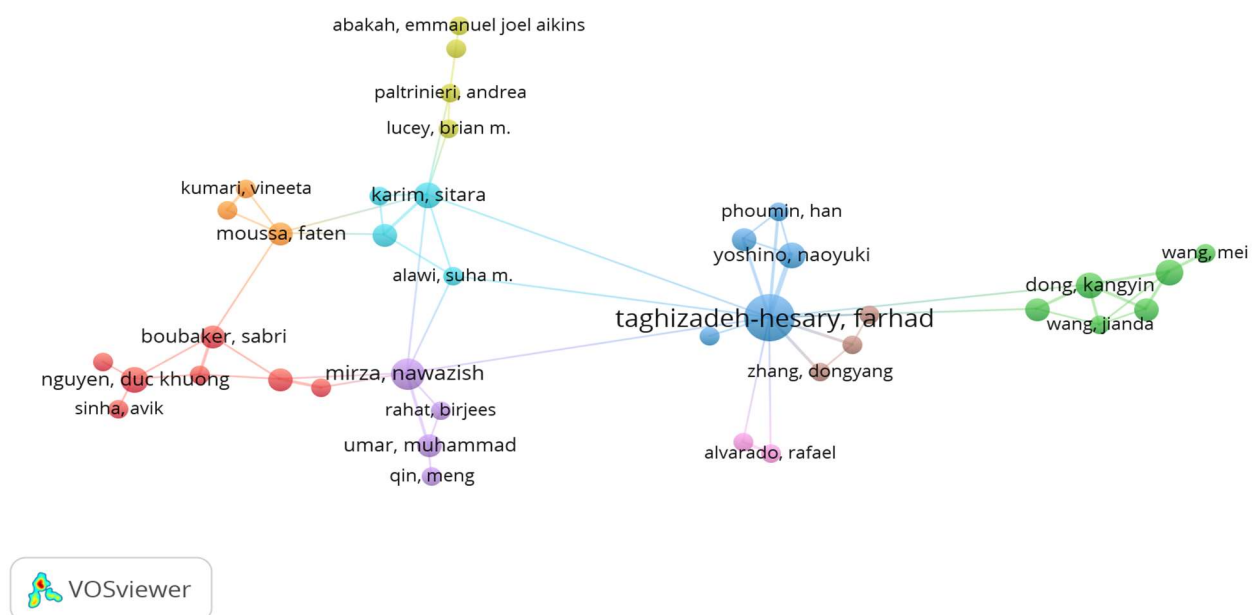


Figure 6. Co-authorship Network.

3.2.3. Highest Citation Authors (First Five)

In the process of co-authorship analysis, we displayed the first five best-cited researchers among 145, as shown in Table 8. Professor Taghizadeh-Hesary F. has the highest citations (953) in energy finance and markets, with his total citations on Google Scholar being 20,000. Subsequently, Professor Sudharshan Reddy from the American University of the Middle East, Kuwait, has 757 citations and a combined 9246 citations in international finance, energy finance, carbon finance, and sustainable economic development as per Google Scholar. Similarly, both Professor Nicholas Apergis from the University of Piraeus,

Greece, and Professor Mallesh Ummalla from the Central University of Karnataka, India have 473 citations. Lastly, Professor Nawazish Mirza from Excelia Business School, France, has 435 citations.

Table 7. Co-authorship details.

Author	Total Link Strength	Document
Cluster 1, Red zone, 7 items		
Rizvi, Syed Kumail Abbas	5	3
Boubaker, Sabri	5	3
Cluster 2, Green color, 6 items		
Dong, Kangyin	9	4
Liu, Yang	7	4
Cluster 3, Blue color, 5 items		
Taghizadeh-Hesary, Farhad	21	14
Yoshino, Naoyuki	6	4
Cluster 4, Yellow color, 4 items		
Paltrinieri, Andrea	3	2
Cluster 5, Purple color, 4 items		
Mirza, Nawazish	8	6
Umar, Muhammad	4	3
Cluster 6, Light blue color, 4 items		
Karim, Sitara	9	4
Naeem, Muhammad Abubakr	5	3
Cluster 7, Orange color, 3 items		
Moussa, Faten	5	3
Cluster 8, Brown color, 3 items		
Mohsin, Muhammad	4	2
Cluster 9, Light pink, 2 items		
Alvarado, Rafael	2	3

Note: Computed by authors.

Table 8. Highest citation authors (First Five).

Author	Articles	Citations	Total Link Strength
Taghizadeh-Hesary, Farhad	14	953	21
Paramati, Sudharshan Reddy (Paramati et al., 2016)	3	757	4
Apergis, Nicholas	2	473	4
Ummalla, Mallesh	2	473	4
Mirza, Nawazish	6	435	8

Note: Computed by authors.

3.2.4. Co-Authorship by Countries

Figure 7 presents the visual networking of the countries' co-authorship. The detailed description of which is shown in Table 9. Out of 97 countries, 64 countries met the threshold of documents and citations of two, forming nine clusters. Both the red and the green clusters

exhibit a group of ten countries (ten items) that research together. China stands out in research work linkages (155) with other countries. Followed by the United Kingdom with 118 total link strength, the United States (117), France (102), and Australia (73). Pakistan and India are potential countries in terms of research work. The lines connecting the circles are known as the links; the thickness of the links determines the strength of the joint relationship between the circles. The higher strength implies a substantial number of articles written together by the countries. It indicates the degree of associated research work conducted together by countries.

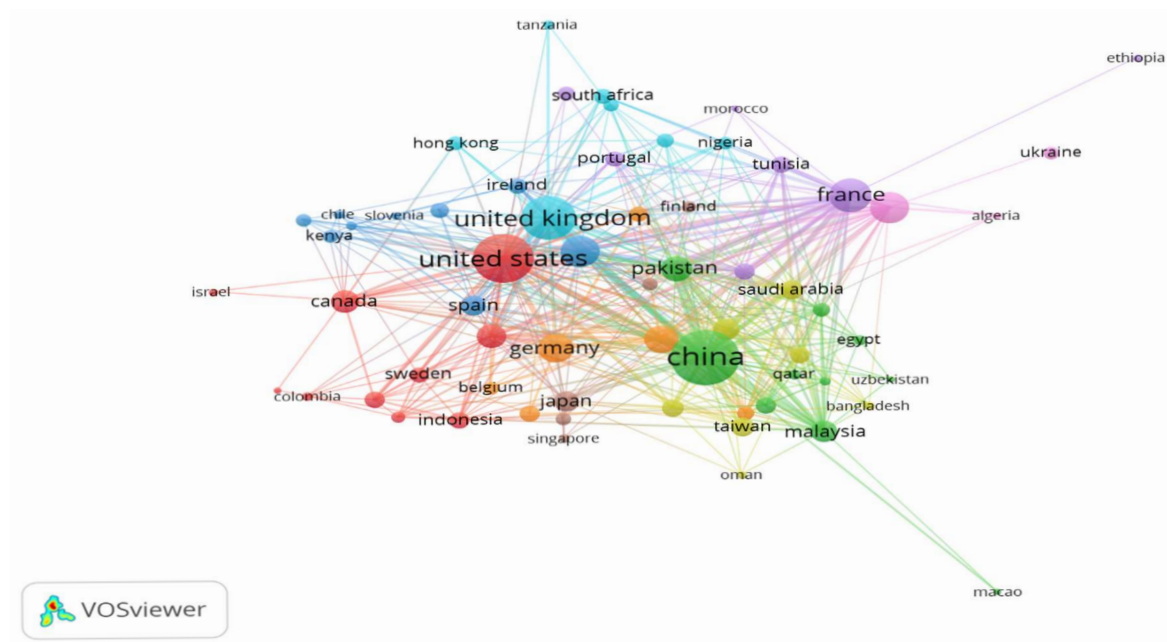


Figure 7. Countries' Co-authorship Network.

Table 9. Co-authorship by countries.

Country	Articles	Citations	Total Link Strength	Country	Articles	Citations	Total Link Strength
China	204	6609	155	Kenya	8	260	13
United States	156	4274	117	South Africa	12	234	15
France	68	3125	102	Nigeria	8	234	13
United Kingdom	119	2554	118	Sweden	12	233	17
Australia	60	2497	73	Poland	11	232	22
Pakistan	36	1571	87	New Zealand	9	215	9
India	58	1516	56	Switzerland	14	208	20
Japan	24	1195	30	Thailand	7	195	15
Türkiye	25	1151	54	Czech Republic	4	183	13
Italy	44	1070	48	Lebanon	10	160	30
Germany	52	1055	43	Slovenia	3	150	9
Netherlands	33	1004	45	Singapore	4	149	5

Table 9. Cont.

Country	Articles	Citations	Total Link Strength	Country	Articles	Citations	Total Link Strength
Canada	31	880	35	Ecuador	4	113	15
Spain	24	740	26	Chile	4	105	10
Vietnam	15	682	47	Brazil	10	94	3
Saudi Arabia	20	669	55	Russian Federation	14	80	15
South Korea	18	653	32	Romania	8	69	9
Greece	11	574	17	Egypt	6	61	14
Ireland	12	542	23	Macao	2	61	3
Taiwan	19	514	28	Tanzania	4	60	5
Norway	14	513	5	Qatar	6	50	7
United Arab Emirates	15	449	40	Bangladesh	4	43	11
Denmark	12	424	9	Belgium	8	42	7
Hong Kong	10	390	10	Colombia	4	32	8
Iran	9	373	7	Oman	3	28	6
Malaysia	26	368	60	Argentina	2	26	2
Tunisia	14	361	27	Israel	3	23	2
Finland	7	314	8	Algeria	2	19	5
Ghana	8	307	14	Ukraine	8	12	1
Indonesia	15	305	21	Uzbekistan	2	9	5
Portugal	12	295	19	Ethiopia	3	7	1
Austria	12	277	19	Morocco	2	3	4

Note: Computed by authors.

3.3. Methodological Trends

Finally, we presented the most popular research methods in the field: “survey” (29 times) and “case study” (27 times) in Table 10. Additionally, we conducted a content analysis using Excel by manually identifying the popular methodologies adopted in all 927 articles. Finally, we displayed the most popular research methods in the field through “survey” (29 times) and “case study” (27 times) in Table 10. The use of “GARCH” (Generalized Autoregressive Conditional Heteroskedasticity) models and “simulation methods” emerges within modelling-based research various times. A growing number of researchers now use both “DID” (Difference-In-Difference) alongside “GMM” (Generalized Method of Moments), and “Monte Carlo Simulation.” “Bibliometric analysis” has occurred only eight times. Overall, we found that traditional and advanced research methods exist in energy finance and the market, while the predictive analysis and empirical support remain primary research priorities.

Table 10. Popular methods.

Method	Frequency	Method	Frequency	Method	Frequency
Survey	29	GMM	13	Deep Learning	4
Case Study	27	Monte Carlo Simulation	12	Machine Learning	4
GARCH	26	Event Study	10	Random Effect	3
Forecasting	23	Bibliometric	8	Panel Regression	3
Time Series	18	Fixed Effect	6	Multiple Regression	3
Simulation	18	Vector Autoregressive	6	Meta-literature	1
Optimization	15	GMM	13		
DID	13	Content Analysis	4		

Note: Computed by authors.

4. Conclusions and Future Research

This study suggests that the energy market is changing rapidly, from conventional financial strategies to new policies to fulfill SDG and Net Zero commitments (Mbarki et al., 2023; Y. Wang et al., 2024; Sinha et al., 2023; Y. Liu et al., 2023). In this section, we contribute to the academic and research fraternity by proposing the research areas in the field of energy finance markets. These areas will direct the research topics for further investigation and subsequently provide a guiding framework to the government, policy makers, and regulators. These research questions will guide in selection of a suitable methodology, enhancing the clarity in the analysis. The results derived from the quantitative analysis and network mapping, such as the proposed theme from the keyword co-occurrence analysis, enabled us to design a research question. Accordingly, we read the limitations of the influential study conducted in that respective area by analyzing the abstract and suggest potential research questions. Nevertheless, we find a research gap in exploring the relationship between energy and its pricing, stock markets, financial dynamics, government, and machine learning algorithms (Gatfaoui, 2015; Ghoddusi et al., 2019; Z. Liu et al., 2024; Cheng et al., 2023). Building upon this, we recommend 34 future research questions to serve as possible themes for a call for proposals for research papers on energy finance markets, as shown in Table 11.

Table 11. Future research questions.

Authors	Future Research Questions
1. Reviewing energy prices for firm, sector, and stock market performance	
(Gatfaoui, 2015)	1. What are the endogenous and exogenous commodity prices that affect the energy sector?
(Gatfaoui, 2015)	2. How much do energy prices affect firm performance and the economy?
(Gatfaoui, 2015)	3. Is there a relationship between energy prices and the stock market regime?
Z. Liu et al. (2024)	4. Are there any time-lag effects of coal prices, investor sentiment, and the stock market?
(Gatfaoui, 2015)	5. Do stock market, monetary policy, and macro-economic variables depend on the price of energy?

Table 11. Cont.

Authors	Future Research Questions
2. Exploring the role of machine learning (ML) algorithms in energy markets	
Ghoddusi et al. (2019)	1. Can we use ML techniques to predict the energy market stock prices?
Ghoddusi et al. (2019)	2. Can we use ML to predict optimal bidding strategies in the energy market?
Ghoddusi et al. (2019)	3. Can we use machine learning (ML) algorithms to predict energy market risk and volatility?
Frecautan (2022)	4. Assess the role of Fintech in the energy finance markets.
Yang et al. (2023)	5. Can we use artificial intelligence to predict the oil price shocks?
Gorkhali and Chowdhury (2022)	6. What role does blockchain technology play in the energy finance market to protect the privacy and security of investors' data?
(Ghoddusi et al., 2019)	7. Do the textual and spatial data predict the amount of electricity consumed?
3. Unravelling the link between energy and the stock market	
Frecautan (2022)	1. What impact does investor sentiment have on the stock performance of energy firms?
Z. Liu et al. (2024)	2. Do fossil fuel and renewable energy stocks perform differently?
Z. Liu et al. (2024)	3. Do energy and non-energy stocks perform differently?
M. Ouyang and Xiao (2024)	4. How do macro-economic variables impact tail risk spillovers in different energy stocks?
Frecautan (2022)	5. What is the role of financial and non-financial factors in energy markets' performance?
Ghoddusi et al. (2019)	6. Is the internet mood forecast the volatility of the energy price?
Z. Liu et al. (2024)	7. Can the economic policy uncertainty index measure the energy stock volatility?
Rodrigues et al. (2024)	8. Do industry-specific factors cause volatility in energy stocks: a comparative analysis of the normal and distress period.
Zhu et al. (2023)	9. Do ESG factors maximize portfolio returns for the energy stock market?
4. Investigating the relationship between energy and financial dynamics	
Mbarki et al. (2023)	1. Are fossil fuels, renewable energy, and financial assets interconnected in any way?
Z. Liu et al. (2024)	2. Examine how financially viable fossil fuel and renewable energy projects are.
Z. Liu et al. (2024)	3. What are the different financial products that promote the energy market?
Z. Liu et al. (2024)	4. Can we investigate the relationship between the energy-based commodities and the financial market using a copula model, time frequency, wavelet, or TVP-VAR models?
Authors' suggestion	5. Comparison between the financial performance of projects based on renewable energy and fossil fuels.
Yang et al. (2023)	6. Can mixed-method approaches explain interconnectedness among oil price shocks, CO ₂ emissions, and financial market dynamics?
Authors' suggestion	7. What role do insurance companies play in promoting renewable energy projects?
Zadeh and Romagnoli (2024)	8. What are the different financing mechanisms other than debt and equity for financing sustainable energy transition?
Authors' suggestion	9. What is the role of corporate governance in the financial performance of energy firms?

Table 11. Cont.

Authors	Future Research Questions
5. Analyzing the role of government in the energy market	
Ghoddusi et al. (2019)	1. Is there a causal relationship between energy consumption and economic progress, using cross-sectional and panel data?
Frecautan (2022)	2. Can the renewable energy market in developed and emerging markets be compared?
Cheng et al. (2023)	3. How are supply chain logistics impacted by the geopolitical crisis in the energy sector?
Authors' suggestion	4. What role does government play in promoting green investment: a comparative analysis of developed and developing economies?

Note: Computed by authors.

Our study on bibliometric and content analysis in the energy market will help researchers shape the future energy research agenda. This study is the first in the area of energy finance market and underpins the methodological review of recent developments, serving academicians, various regulators, and policymakers. Furthermore, we propose a theoretical framework consisting of five major independent factors (Energy Prices, Machine Learning Techniques, Investor and Market Sentiment, Financial Products, and Government Roles) influencing the energy finance market, as shown in Figure 8. The proposed framework can be implemented by applying different methods to measure stock market performance, market forecasting and risk management, energy stock performance and volatility, financial viability and return on investment (ROI), sustainable energy transition and economic growth.

Hence, our study finds five main themes for discussion and 34 future research questions. We propose our identified themes to be considered by journals. Nonetheless, our research work offers valuable insights into the energy finance market; it can be extended by incorporating multiple databases such as Web of Science, Google Scholar, and Dimensions. Additionally, the search query of our study includes “energy”, “finance”, “market”, which can be further extended by including their subfields to explore the dynamics in the recent period. Lastly, we find only eight bibliometric articles on the energy finance market, suggesting a need for more bibliometric papers with different databases, periods, methods, and other dynamics.

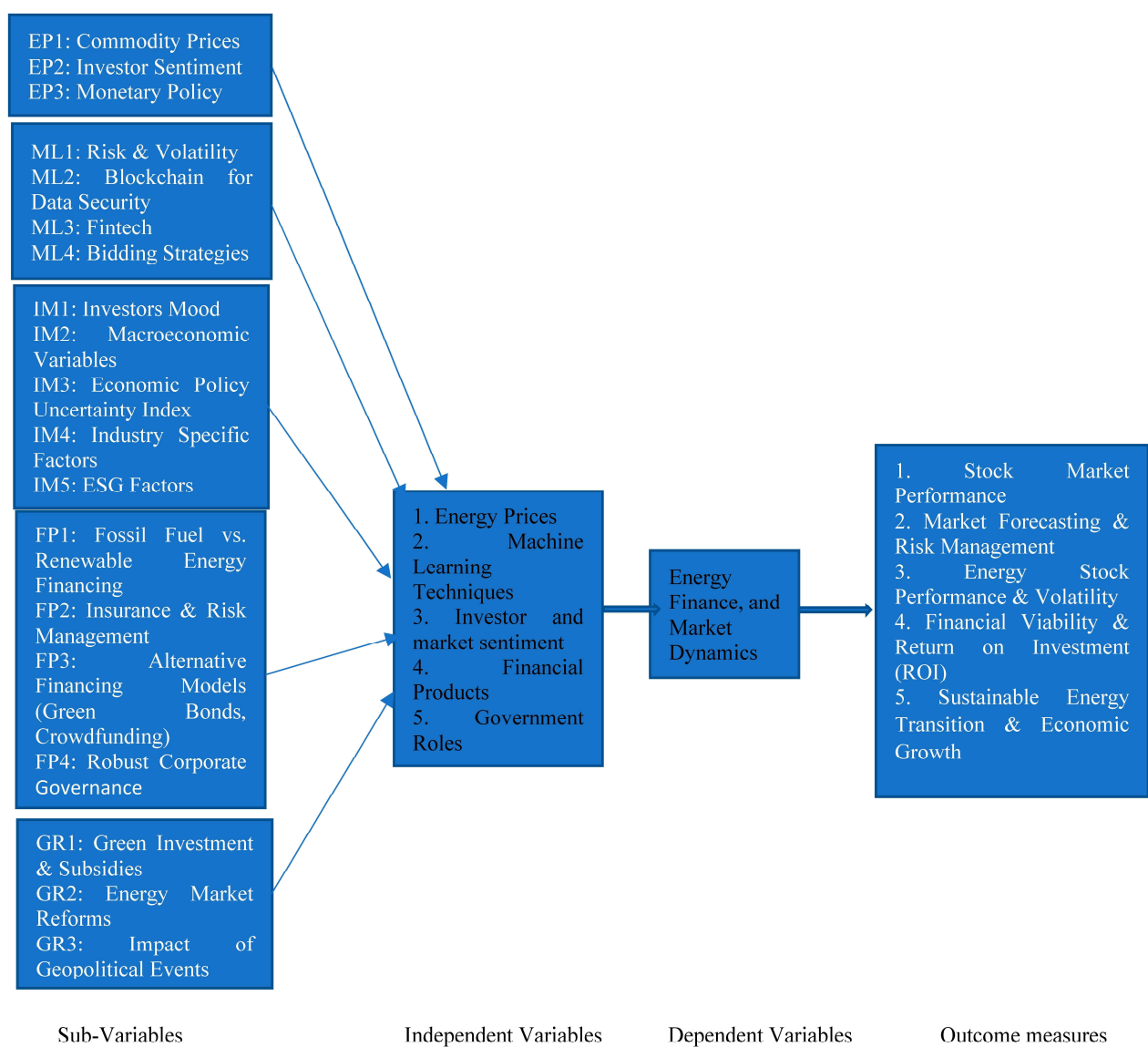


Figure 8. Proposed research framework.

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Note

¹ Energy and financial markets, pricing mechanisms, derivative markets, green finance, and energy infrastructure investment.

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