“The Russia–Ukraine war and energy-market transformation: Bibliometric mapping of macroeconomic stability, risk, investment, and policy”

AUTHORS	Tetiana Vasylieva Martina Mateášová Karina Taraniuk Andreas Horsch

ARTICLE INFO	Tetiana Vasylieva, Martina Mateášová, Karina Taraniuk and Andreas Horsch (2026). The Russia–Ukraine war and energy-market transformation: Bibliometric mapping of macroeconomic stability, risk, investment, and policy. *Problems and Perspectives in Management*, *24*(3), 858–883. doi:10.21511/ppm.24(3).2026.52
DOI	http://dx.doi.org/10.21511/ppm.24(3).2026.52
RELEASED ON	Tuesday, 29 September 2026
RECEIVED ON	Wednesday, 15 July 2026
ACCEPTED ON	Tuesday, 15 September 2026

JOURNAL	"Problems and Perspectives in Management"
ISSN PRINT	1727-7051
ISSN ONLINE	1810-5467
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
71	8	8

BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine

www.businessperspectives.org

Tetiana Vasylieva (Germany, Ukraine), **Martina Mateášová** (Slovak Republic), **Karina Taraniuk** (Ukraine, Lithuania), **Andreas Horsch** (Germany)

THE RUSSIA–UKRAINE WAR AND ENERGY-MARKET TRANSFORMATION: BIBLIOMETRIC MAPPING OF MACROECONOMIC STABILITY, RISK, INVESTMENT, AND POLICY

Abstract

The Russia–Ukraine war has fundamentally reshaped global and European energy markets, intensifying concerns over energy security, macroeconomic stability, financial risk, investment priorities, and the coordination of public policy. This study maps the development, performance, and intellectual structure of management- and governance-oriented research on energy-market transformation under the conditions created by the war. The analysis covers 417 Scopus-indexed publications issued between 2014 and the first half of 2026 and applies descriptive bibliometric indicators using Biblioshiny. The related literature expanded rapidly, recording an annual growth rate of 44.22%. In contrast, 403 publications, or 96.64% of the corpus, appeared between 2022 and the first half of 2026, showing a pronounced increase in scholarly output following the full-scale invasion. The 2023 publication cohort achieved the strongest citation performance, averaging 40.20 citations per document and 10.05 citations per document per citable year, while the most cited paper accumulated 363 citations. China was the leading first-author country, with 86 publications (20.62% of the corpus), while international co-authorship accounted for 37.41% of all documents, indicating substantial cross-border scientific collaboration. The thematic results show a transition from an earlier focus on investment, geopolitics, and energy security toward a broader agenda encompassing Ukraine, energy policy, renewable energy, inflation, natural gas, volatility, and market spillovers. Multiple correspondence analysis, using an eight-cluster solution, revealed two dominant knowledge domains: the first two dimensions accounted for 67.76% of total inertia and centered on geopolitical energy-market disruption and energy policy, transition, and sustainable development.

Keywords Russia–Ukraine war, energy transformation, macroeconomic stability, geopolitical risk, energy investment, energy policy, bibliometric analysis

JEL Classification F51, Q43, Q48, G32

Type of the article: Research Article

Received on: 15th of July, 2026
Accepted on: 15th of September, 2026
Published on: 29th of September, 2026

Tetiana Vasylieva, Dr., Professor, Research Associate, Faculty of Business Administration, Chair of Investment and Finance, TU Bergakademie Freiberg, Germany; Department of Financial Technologies and Entrepreneurship, Sumy State University, Ukraine. (Corresponding author)

Martina Mateášová, Ph.D. Ing., Assistant Professor, Accounting and Auditing Department, Bratislava University of Economics and Business, Slovak Republic.

Karina Taraniuk, Ph.D., Associate Professor, Oleg Balatsky Department of Management, Sumy State University, Ukraine; Bioeconomy Research Institute, Agriculture Academy Vytautas Magnus University, Lithuania.

Andreas Horsch, Dr., Professor, Faculty of Business Administration, Chair of Investment and Finance, TU Bergakademie Freiberg, Germany.

Conflict of interest statement:
Author(s) reported no conflict of interest

INTRODUCTION

The Russia–Ukraine war has transformed energy security from a sector-specific concern into a central challenge of economic governance, strategic management, and international policy coordination. The International Energy Agency characterizes the invasion as a major supply crisis that drove energy prices to record levels and placed energy security at the center of European political and managerial agendas (IEA, 2025). The sharp contraction in Russian energy supplies placed exceptional pressure on European energy markets, exposed the vulnerability created by concentrated import dependence, and accelerated efforts to diversify suppliers, reduce demand, and expand renewable-energy capacity. According to the European Commission (n.d.), the share of Russian pipeline gas and liquefied natural gas in EU gas

http://dx.doi.org/10.21511/ppm.24(3).2026.52

imports declined from 45% in 2021 to 12% in 2025, while import volumes fell from 152 to 36 billion cubic meters and Russian coal was removed from the EU energy mix. Nevertheless, continued imports of Russian gas, oil, and nuclear fuel indicate that the restructuring of Europe's energy relations remains incomplete.

The consequences of the war extend well beyond energy supply, encompassing inflationary pressures, fiscal strain, financial risks, infrastructure destruction, and substantial investment needs. IMF analyses show that disruptions to European gas supplies associated with the war contributed to exceptionally large energy price shocks, and that the pass-through of energy prices to headline inflation intensifies as shocks become larger, with production networks and sectoral interdependencies shaping the transmission process (Alvarez & Kroen, 2025). In Ukraine, the latest joint assessment led by the World Bank estimates direct damage to the energy sector at USD 24.8 billion, associated economic losses at USD 88.2 billion, and recovery and reconstruction needs at USD 90.6 billion. Approximately 70% of the direct damage occurred in the power subsector. The required response includes decentralized generation, renewable energy deployment, flexible capacity, protection of critical assets, regulatory reform, and stronger mechanisms for private-sector participation (World Bank et al., 2026). At the EU level, the crisis has also accelerated the reorientation of investment: renewable sources supplied 50% of EU electricity in 2024, investment in renewable generation exceeded investment in unabated fossil-fuel power by a ratio of 35:1, and annual grid investment was expected to surpass USD 70 billion in 2025 (IEA, 2025).

These developments make a systematic assessment of the scientific literature particularly timely. The interaction between geopolitical conflict, energy-market restructuring, macroeconomic stability, financial contagion, investment priorities, and policy responses has produced a rapidly expanding yet conceptually fragmented body of research spanning energy economics, finance, public policy, risk management, and sustainable development. Institutional evidence suggests that energy-market transformation cannot be understood solely through changes in fuel prices or import volumes, as it also involves managerial decisions concerning infrastructure resilience, capital allocation, crisis preparedness, affordability, decarbonization, and cross-border coordination (IEA, 2025; European Commission, n.d.; World Bank et al., 2026). Bibliometric and science-mapping analyses are therefore required to trace the evolution of this research field since 2014, identify its most influential contributions and collaboration patterns, and assess how effectively the literature integrates energy security with macroeconomic, financial, investment, and governance perspectives. Such an analysis can clarify the existing knowledge structure and contribute to a more coherent research and policy agenda for managing energy systems amid prolonged geopolitical instability. Accordingly, the study considers not only publications that explicitly refer to the Russia–Ukraine war, but also research that captures its broader geopolitical and energy-market consequences through concepts such as geopolitical risk, sanctions, supply disruption, energy dependence, and market instability.

1. LITERATURE REVIEW

The Russia–Ukraine war has repositioned energy security as a core component of macroeconomic governance, international relations, and strategic management. The weaponization of energy supplies and the reconfiguration of European energy dependence have demonstrated that energy markets can transmit geopolitical pressure through prices, trade flows, inflation, and investment expectations (Cosmulese, 2026; Pan et al., 2023). Comparable evidence from other conflict-prone regions confirms that disruptions to energy markets can generate broader systemic instability through migration, fiscal pressure, and weakened economic security (Kafoe & Foh, 2026; Khan et al., 2023). In Europe, the war accelerated the transition from dependence on fossil fuels (especially Russian) toward supply diversification and the deployment of renewables. However, the scale and effectiveness of this adjustment vary across countries according to their initial import exposure and institutional capacity (Vasylieva et al., 2025a). The resulting transformation also affected trans-

port behavior, as changes in fuel prices altered the relative attractiveness of public transport across EU member states (Alves & Marques da Costa, 2024). In parallel, trade disruption at "chokepoints" (maritime) such as the Black Sea region intensified geoeconomic vulnerability and revealed the close connection between energy security, logistics, and international commerce (Verschuur et al., 2025; Nate et al., 2024).

A major strand of the literature examines how geopolitical shocks propagate through commodity, financial, and foreign-exchange markets. War-related increases in energy prices generated significant spillovers across sectors and countries, affecting production costs, trade balances, and macroeconomic stability (Cevik & Zhao, 2026; Yagi & Managi, 2022). Commodity markets also became an important channel for systemic risk, with the war increasing connectedness among oil, gas, metals, and other asset classes (Wang et al., 2022; Gong et al., 2023; Abid et al., 2024). Intraday evidence further shows that oil and European equity markets reacted differently during the COVID-19 and Russia–Ukraine crises, indicating that the direction and intensity of spillovers depend on prevailing market conditions (Alshater et al., 2024). Broader studies of financial-market turbulence likewise demonstrate that energy shocks intensify the transmission of extreme volatility and weaken diversification benefits during crisis periods (Boubaker et al., 2023). In BRICS economies, oil-price shocks are closely associated with exchange-rate and stock-market dynamics, while market efficiency and volatility responses differ across countries and institutional structures (Ahmed et al., 2025; Marathe et al., 2025). These findings are complemented by evidence that geopolitical risk produces nonlinear spillovers across sectors such as sustainable finance, energy assets, precious metals, and FinTech, making risk management in these sectors seminal (Cevik & Zhao, 2026; Hakmi et al., 2026).

The financial consequences of energy-market transformation extend beyond traditional fossil-fuel assets, such as oil and gas company equities, energy-sector corporate bonds, and fossil-fuel commodity futures, to sustainability-linked assets, including green bonds, clean-energy equities, and sustainable investment portfolios. Strong connectedness has also been identified among climate-risk indices, green financial assets, and renewable-energy markets, suggesting that sustainability-oriented portfolios remain exposed to systemic transmission channels (Lorente et al., 2023). Green finance and traditional energy markets exhibit asymmetric dependencies amid changing market conditions, and geopolitical risk can influence both the direction and effectiveness of green capital allocation (Wu et al., 2024; Zhang et al., 2023). A broader review of green-bond research similarly shows that global policy uncertainty affects returns through risk repricing, liquidity conditions, and investor expectations (Belghouthi & Boubaker, 2026; Gyamerah & Asare, 2024). These studies demonstrate that energy-market transformation is inseparable from financial resilience, portfolio management, and the institutional architecture of risk sharing.

Another group of studies focuses on the structural transition of energy systems and the managerial challenges associated with decentralization, renewability, and grid resilience. The broader energy-transition literature emphasizes that decarbonization involves complex interactions among technological change, economic growth, investment, labor markets, and public policy (Genc & Kosempel, 2023; D'Arcangelo et al., 2022). In Europe, the deployment of renewables has increasingly been interpreted not only as a climate instrument but also as a means of reducing geopolitical vulnerability and strengthening energy security (Vasylieva et al., 2025a; Marhold, 2023). Bibliometric evidence confirms that decentralization and renewability are becoming increasingly interconnected research themes, particularly in relation to resilience, local generation, and institutional transformation (Belgibayeva et al., 2025; Purwanto et al., 2025). Ukraine provides an especially important case because the rapid growth of renewable electricity must be reconciled with grid reliability across pre-full-scale-invasion, wartime, and post-war conditions (Balahurovska et al., 2025; Kurbatova et al., 2024). The crisis has also intensified attention to energy efficiency and household-level management technologies, including home energy management systems that support demand flexibility and consumer participation (Jaeger-Erben et al., 2025; Gajdzik et al., 2024; Gualandri & Kuzior, 2023). However, the expan-

http://dx.doi.org/10.21511/ppm.24(3).2026.52

sion of renewable generation and decentralized systems requires coordinated investment in networks, balancing capacity, digital infrastructure, and regulatory reform rather than isolated technological deployment.

At the organizational and policy levels, energy shocks shape corporate strategy, innovation, operational continuity, and investment decisions. Firms with high energy dependence are particularly vulnerable to geopolitical risk, although green total factor productivity and decentralized top-management networks can strengthen adaptive capacity (Gao et al., 2025). Modern industrial technologies can also contribute to the security of socioeconomic systems during war by improving efficiency, autonomy, and continuity of critical production processes (Melnyk et al., 2025). Energy-price dynamics may even affect the adoption of advanced technologies that contribute to energy efficiency (Popp, 2002; Linn, 2008), as illustrated today by artificial intelligence, by altering operating costs, investment incentives, and expected returns (Škare et al., 2025). At the societal level, wartime resilience is supported by solidarity-based economic arrangements, local cooperation, and inclusive resource mobilization (Kuzior et al., 2023). Macroeconomic recovery, however, remains sensitive to inflation, fiscal constraints, and external shocks, making coordinated governance essential for stabilization and reconstruction (Becker et al., 2025; Kuzior et al., 2024). Recent evidence on electricity price shocks confirms that the inflationary response varies across European energy and renewable regimes and that this heterogeneity has direct implications for public governance (Coutinho & Licchetta, 2025; Vasylieva et al., 2025b; Vasylieva et al., 2025c).

The literature also highlights the institutional and knowledge-governance dimensions of war-related transformation. Modern Government Technology (GovTech) can support transparent, secure, and accountable public administration during wartime and reconstruction, while bibliometric approaches help identify the institutional capabilities required for digital governance under crisis conditions (Lyeonov et al., 2026; Nose, 2023). Previous research has shown the value of bibliometric analysis for structuring fragmented policy fields, particularly in energy economics (Anas et al., 2025), and similar approaches have been applied to leadership, human capital, and financial performance (Viet & Thanh, 2024).

Despite these advances, existing research remains dispersed across energy economics, finance, management, public policy, security studies, and sustainable development. The literature therefore lacks an integrated mapping of how the Russia–Ukraine war has reshaped the research agenda linking energy-market transformation with macroeconomic stability, financial risk, investment, and policy. Consequently, a bibliometric and science-mapping analysis is paramount for identifying the field's growth dynamics, influential contributions, collaboration structure, thematic evolution, and conceptual foundations.

This study aims to systematize and map the development and intellectual structure of research on energy-market transformation associated with the Russia–Ukraine war and its wider geopolitical consequences, with particular attention to macroeconomic stability, financial risk, investment and policy responses, from 2014 to the first half of 2026.

2. METHOD

2.1. Data source and search strategy

The bibliometric dataset was retrieved from Scopus using a structured TITLE-ABS-KEY search combining five conceptual blocks: (i) the Russia–Ukraine war and related geopolitical disruptions; (ii) energy markets and energy security; (iii) market transformation, policy responses, and transmission mechanisms; (iv) macroeconomic, financial, regulatory, and investment consequences; and (v) the geographical context of Ukraine, Russia, and Europe. The complete query is provided in Appendix A. Broad expressions such as "Ukrainian crisis", "geopolitical risk", "armed conflict", "military conflict", sanctions and embargoes were retained to maximize retrieval sensitivity, because relevant studies may describe the consequences of the Russia–Ukraine war without naming it explicitly. Their inclusion was constrained by the remaining conceptual and geographical blocks of the query and subsequently checked through substantive relevance screening.

The initial search returned 447 records. Restricting the period to 2014–2026 reduced the sample to 443, while limiting document types to articles, book chapters, conference papers, and books resulted in 417 records: 371 articles, 24 book chapters, 19 conference papers, and 3 books. The 2026 records covered only the first half of the year and were treated as an incomplete annual cohort. The selected period captured the development of the literature from the beginning of the Russia–Ukraine war in 2014 through the major geopolitical and energy-market disruptions following Russia's full-scale invasion of Ukraine in February 2022.

The retained records were additionally screened for substantive relevance using titles, abstracts, and author keywords. Explicit use of the terms Russia–Ukraine war, invasion, or conflict was not required; relevance was determined by a substantive connection to geopolitical or energy-market developments involving Russia, Ukraine, or Europe and at least one focal dimension of the study. Peripheral or purely technical publications without a meaningful market, economic, financial, investment, or policy component were excluded. The validated corpus remained at 417 publications. The records were exported with full bibliographic metadata and cited references and subsequently analyzed in Biblioshiny.

2.2. Software environment and bibliometric workflow

Bibliometric analyses were conducted in R version 4.4.0, released on April 24, 2024, under the name "Puppy Cup", on the x86_64-w64-mingw32/x64 platform. The Bibliometrix package was applied through its Biblioshiny web interface. The analytical workflow followed the comprehensive bibliometric and science-mapping framework developed by Aria and Cuccurullo (2017) and the practical Biblioshiny procedures described by Aria and Cuccurullo (2026) and Aria et al. (2026). The exact Bibliometrix package version should be reported separately as 5.4.1, because R 4.4.0 denotes the statistical-computing environment rather than the package version.

The analysis combined descriptive performance indicators with science-mapping techniques. This integrated approach reflects the methodological principle that research performance analysis and the mapping of the intellectual structure should be considered jointly when examining the development of a scientific field (Noyons et al., 1999).

2.3. Keyword preprocessing and data cleaning

Authors' keywords (DE) and Scopus Index Keywords (stored by Bibliometrix in the ID field and labeled "Keywords Plus" in Biblioshiny) were merged into the All Keywords field used for all thematic analyses. A custom exclusion list removed generic methodological and statistical terms, including regression analysis, vector autoregression, machine learning, panel data, and related expressions.

A custom thesaurus harmonized spelling variants, singular/plural forms, and conceptually equivalent terms. For example, variants of the Russian Federation, the energy market, renewable energy, geopolitical risk, investment, and the financial market were consolidated, while different expressions referring to the Russia–Ukraine war were standardized as a single concept. Additional harmonization covered terms such as exchange rate, oil price, energy transition, GDP, carbon emissions, decarbonization, spillover effects, and energy poverty. Stemming was not applied, and indexed multi-word expressions remained intact.

For reproducibility, the complete custom exclusion list and keyword thesaurus are provided in Appendix A (Tables A1–A2). The merged All Keywords field was applied consistently in the thematic map, thematic-evolution, and MCA analyses to ensure comparability of results.

2.4. Descriptive bibliometric and citation analysis

The descriptive analysis covered publication output, document types, sources, annual growth, authorship, collaboration, and citation performance using standard Bibliometrix procedures (Aria & Cuccurullo, 2017, 2026). Because the Biblioshiny annual growth rate includes the incomplete 2026 cohort, an additional compound annual growth rate was calculated for 2014–2025. Publication dynamics were also described using a second-order polynomial fitted to 2021–2025; this model was used only as a descriptive indicator and not for forecasting or saturation assessment.

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Citation performance was assessed using mean total citations, citations per citable year, global and local citations, and year-normalized indicators. Author impact was evaluated using the h-, g-, and m-indices, total citations, and publication counts, with all measures interpreted as corpus-specific rather than career-level indicators. Country output was assigned using the first/corresponding author affiliation, while single- and multiple-country publications were distinguished according to the presence of international co-authorship.

2.5. Trend-topic analysis

Trend-topic analysis was conducted using the merged All Keywords field. Terms occurring at least four times in the full corpus were eligible for inclusion, and up to three of the most frequent terms were displayed for each median year. For each term, Biblioshiny summarizes the temporal distribution of its occurrences using the first quartile (Q1), the median year, and the third quartile (Q3). The bubble is positioned at the median publication year, the horizontal line represents the interquartile range (Q1–Q3), and the bubble size is proportional to the term's overall frequency in the corpus. Accordingly, the analysis identifies the temporal concentration of keyword use rather than a statistical association between a term and a specific year.

Because the 2026 records covered only the first half of the year, terms located in 2026 were interpreted as being most strongly associated with the latest observation period rather than as evidence of confirmed long-term emergence. The analysis, therefore, identified changes in recent thematic prominence without making deterministic claims about their persistence.

2.6. Thematic mapping

The overall thematic map was generated from a keyword co-occurrence network based on the merged All Keywords field. Up to 250 terms occurring at least twice were retained. The analysis used unigrams, no stemming, and the Louvain community detection algorithm. The graphical settings included a node-size scaling factor of 0.3, a maximum of five labels per cluster, and a community-repulsion value of 0.5.

The methodological design and interpretation of the strategic diagram followed the approach of Cobo et al. (2011). Themes were positioned according to Callon centrality and Callon density (Callon et al., 1991). Centrality measured the strength of a thematic cluster's relationships with other clusters in the network, whereas density represented its internal development and cohesion. On this basis, themes were classified as motor, basic, niche, or emerging or declining. Because the lower-left quadrant cannot, by itself, determine whether a theme is emerging or losing importance, these clusters were interpreted jointly with the thematic-evolution analysis.

2.7. Thematic-evolution analysis

Thematic evolution was examined across three event-based periods: 2014–2021, 2022–2025, and the first half of 2026. These intervals were selected to distinguish the pre-full-scale-invasion literature from the field's subsequent expansion and its latest configuration. Because the periods differ substantially in both duration and corpus size, particularly the 2014–2021 period, which contains only 14 publications, the resulting thematic maps are not interpreted as directly comparable measures of thematic diversity, cluster size, or maturity. The pre-2022 map is therefore treated as a descriptive baseline indicating the limited thematic configuration visible in the small early corpus, rather than as a stable representation of the field's intellectual structure.

For each strategic map, the analysis used the merged All Keywords field, retained up to 250 terms, and applied an n-gram setting of one. Stemming was not used, and thematic clusters were identified through the Louvain algorithm. The node-size scaling factor was set to 0.3, the maximum number of labels per cluster to five, and community repulsion to 0.5.

The thematic-evolution procedure was based on the approach developed by Cobo et al. (2011), in which links between clusters in consecutive periods represent thematic continuity through shared keywords. The wider integration of thematic evolution with performance and science-mapping indicators followed the framework discussed by Noyons et al. (1999). Because the three time slices

differed substantially in duration and the number of publications, changes in cluster number, size, and apparent thematic diversity were interpreted with caution.

2.8. Conceptual-structure analysis

The conceptual structure of the literature was examined using multiple correspondence analysis (MCA) based on the merged All Keywords field. MCA was used to assess the proximity among keywords based on their co-occurrence patterns across publications. The integration of performance analysis and conceptual mapping was consistent with the science-mapping principles established by Noyons et al. (1999) and implemented within the Bibliometrix framework developed by Aria and Cuccurullo (2017, 2026).

Terms occurring fewer than 14 times were excluded, and stemming was not applied. The MCA was initially specified with eight clusters (clust = 8; k.max = 8) to provide a sufficiently differentiated representation of the conceptual structure while retaining interpretability of the resulting groups. Because the number of clusters was analytically specified rather than estimated by MCA, the robustness of the conceptual interpretation was further assessed using alternative cluster solutions and the automatic clustering option. The principal conceptual domains remained substantively stable across these specifications.

2.9. Publication-growth modeling

Annual publication dynamics were additionally evaluated through descriptive curve fitting. A second-order polynomial trend was fitted to complete annual observations for 2021–2025 to characterize the acceleration and subsequent deceleration of publication growth. The coefficient of determination, also known as *R*-squared, was used to evaluate descriptive model fit. The model was not interpreted as causal or as a precise forecast of future publication activity.

An exploratory publication life-cycle analysis was also conducted using annual and cumulative publication counts for 2014–2025. The incomplete 2026 observation was excluded from model estimation to avoid treating partial-year output as an observed annual decline. The fitted annual curve was used to identify an indicative turning point, while the cumulative curve illustrated progression toward the estimated asymptote. Because the model was based on a short time series dominated by the rapid post-2021 expansion, it was treated as an exploratory approximation rather than definitive evidence of long-term saturation.

3. RESULTS

3.1. Corpus characteristics and annual publication dynamics

The bibliometric dataset comprised 417 documents published between 2014 and the first half of 2026 across 228 sources, including journals, books and conference proceedings (Table 1). The literature showed a substantial annual growth rate of 44.22% (the full period from 2014 to 2025 yields an approximate compound annual growth rate of 52.40%), while the relatively low average document age of 1.91 years indicates that the field has expanded rapidly in recent years. The publications received an average of 15.39 citations per document and collectively cited 21,506 references. Their intellectual content was represented by 1,619 Keywords Plus and 1,343 author-defined keywords. In general, 1,188 authors contributed to the analyzed publications, of whom 63 produced single-authored documents. The average number of co-authors per document was 3.14, and international co-authorship accounted for 37.41% of the dataset, indicating a considerable level of cross-country research collaboration. Regarding publication types, journal articles predominated, accounting for 371 documents, followed by 24 book chapters, 19 conference papers, and three books.

The annual publication dynamics show a highly uneven pattern of development. Output remained very limited between 2014 and 2018, with one document per year; it increased modestly to three documents annually during 2019–2021, then rose sharply from 29 publications in 2022 to 93 in 2023, 97 in 2024, and 103 in 2025. A second-order polynomial ($y = -7.1429x^2 + 169366x - 903$) fitted to the complete 2021–2025 observations provides a strong descriptive fit ($R^2 = 0.941$). It indicates that a moderation followed the exceptionally

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Table 1. Main characteristics of the bibliometric dataset

Category	Indicator	Result
Main information about the data	Timespan	2014–first half of 2026
	Sources (journals, books, etc.)	228
	Documents	417
	Annual growth rate (%)	44.22 (52.4*)
	Average document age (years)	1.91
	Average citations per document	15.39
	References	21,506
Document contents	Keywords Plus	1,619
	Authors' keywords	1,343
Authors	Authors	1,188
	Authors of single-authored documents	63
Author collaboration	Single-authored documents	63
	Co-authors per document	3.14
	International co-authorships (%)	37.41
Document types	Articles	371
	Books	3
	Book chapters	24
	Conference papers	19

Note: Biblioshiny value includes an incomplete 2026 year. * when the 1st half of 2026 is excluded.

rapid increase in publication output after 2021, in the growth rate. This pattern should be interpreted descriptively rather than as evidence that the field is approaching saturation, particularly given the short time series and the substantial number of publications already recorded in the first half of 2026. The 81 documents published during the first half of 2026 already represent approximately 78.6% of the total output recorded in 2025; consequently, the lower 2026 value shown in Figure 1 reflects the incomplete observation period and should not be interpreted as a confirmed decline in publication activity.

3.2. Citation performance and influential publications

Citation performance differed markedly across publication cohorts, though the results for 2014–2018 should be interpreted with caution, as each annual value was based on a single document. As shown in Table 2, the highest mean total citation count was recorded in 2023, at 40.20 citations per document, followed by the 2022 cohort at 30.55 and the 2014 cohort at 24.00. After adjustment for the available citation window, the 2023 cohort also recorded the highest mean annual citation rate, at

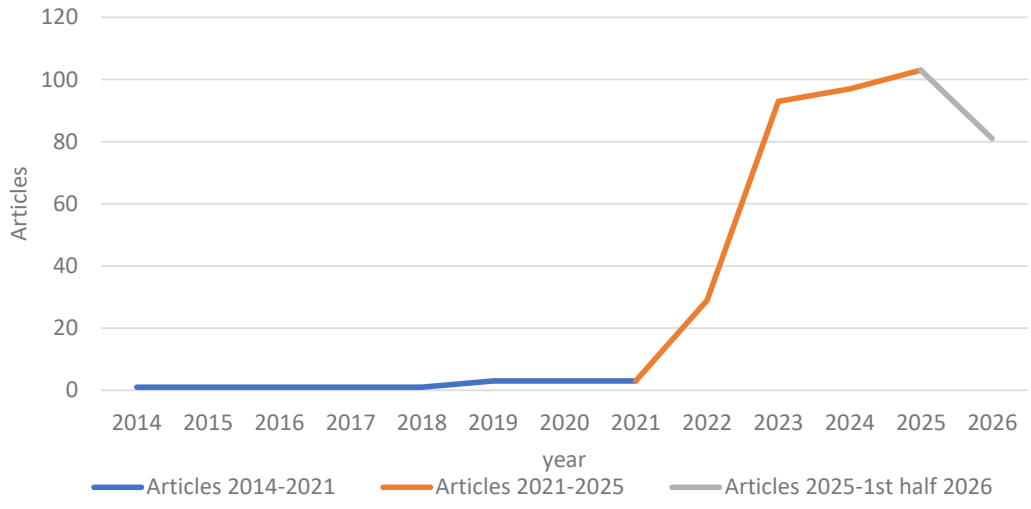


Figure 1. Annual scientific publication output, 2014–2026 (first half of 2026)

10.05 citations per document per citable year, compared with 6.11 for 2022 and 4.42 for 2024. However, these means should not be interpreted as representing the citation performance of a typical publication, because they are influenced by a relatively small number of exceptionally highly cited papers. Table B1 of Appendix B shows that the high 2023 mean was supported by eight publications with more than 100 global citations, led by Guan et al. (2023) with 363 citations and Lin et al. (2023) with 306, while the 2022 result was strongly influenced by Wang et al. (2022) with 276 citations and Fang and Shao (2022) with 236. Gajdzik et al. (2024) was the most often cited publication in the 2024 cohort, receiving 237 citations and achieving the highest normalized citation score in the dataset, at 17.86. Table B2 complements this global perspective by identifying publications with at least five local citations and therefore those most influential within the analyzed corpus. Fang and Shao (2022) ranked first with 19 local citations, whereas Van de Graaf (2014) recorded the highest local-to-global citation ratio (of 58.33%). The lower citation averages for 2025 and the first half of 2026 primarily reflect their shorter exposure periods and should not be interpreted as evidence of weaker scholarly relevance.

Because the available Biblioshiny output provided annual mean citation indicators rather than complete distributional statistics, median citations, interquartile ranges, and the proportion of uncited documents could not be reported; consequently, the annual citation results were interpreted together with the paper-level global and local citation rankings presented in Appendix B.

3.3. Author impact and international collaboration

The authors listed in Table 3 achieved the highest h-index observed in the analyzed corpus, with an h-index of 3. This means that each author had at least three publications included in the dataset that had each received at least three global citations. The indicators refer only to publications captured by the search strategy and should not be interpreted as measures of the authors' complete career impact. Citation performance nevertheless differed considerably among authors with the same h-index. Bouri recorded the highest total citation count, with 394 citations across four publications, followed by Wang Y., with 314 citations across five publications, and Cifuentes-Faura, with 309 citations across three publications. Wang Y. also achieved the highest g-index of 5, indicating a greater concentration of citations among the author's most highly cited publications. The highest m-index, at 0.75, was recorded by authors whose first publication in the analyzed corpus appeared in 2023, reflecting the relatively rapid accumula-

Table 2. Annual citation performance of the analyzed publications, 2014–2026

Year	MeanTCperArt	N	MeanTCperYear	CitableYears
2014	24.00	1	1.85	13
2015	3.00	1	0.25	12
2016	9.00	1	0.82	11
2017	5.00	1	0.50	10
2018	0.00	1	0.00	9
2019	9.33	3	1.17	8
2020	4.33	3	0.62	7
2021	3.33	3	0.56	6
2022	30.55	29	6.11	5
2023	40.20	93	10.05	4
2024	13.27	97	4.42	3
2025	3.59	103	1.79	2
2026	0.53	81	0.53	1

Note: MeanTCperArt denotes the mean cumulative number of global citations received per publication in each annual cohort; N denotes the number of publications; MeanTCperYear denotes the mean cumulative citation count per publication divided by the year-based citation window reported by Biblioshiny; and CitableYears is an integer approximation of citation exposure rather than an exact measure of elapsed time. In particular, the value assigned to the 2026 cohort for one citable year does not represent a complete 12-month period, as the dataset covers only the first half of 2026. Mean values may be influenced by a small number of exceptionally highly cited publications; the principal global and local citation leaders are therefore reported separately in Tables B1 and B2 in Appendix B. Citation counts were retrieved from Scopus on July 26, 2026, and may change over time.

http://dx.doi.org/10.21511/ppm.24(3).2026.52

Table 3. Authors with the highest citation impact in the analyzed corpus based on an h-index of 3

Author	h-index	g-index	m-index	TC	NP	PY_start
Abakah E. J. A.	3	3	0.75	93	3	2023
Bouri E.	3	4	0.60	394	4	2022
Cifuentes-Faura J.	3	3	0.75	309	3	2023
Deng J.	3	3	0.75	40	3	2023
Lee C.-C.	3	4	0.75	129	4	2023
Sokhanvar A.	3	4	0.75	187	4	2023
Wang C.	3	3	0.75	50	3	2023
Wang Y.	3	5	0.60	314	5	2022

Note: The h-index represents the number h of an author's publications included in the analyzed dataset that have each received at least h global citations. The g-index gives greater weight to an author's most highly cited publications, while the m-index adjusts the h-index for the number of years since the author's first publication in the analyzed corpus. TC denotes the cumulative global citations received by the author's publications included in the dataset; NP is the number of those publications; and PY_start is the year of the author's first publication in the dataset. These indicators are corpus-based and do not represent the authors' complete publication and citation records. Local citation influence is reported separately in Table B2.

tion of citation impact during the observed period. Overall, the results demonstrate that an identical h-index may be accompanied by substantial differences in publication volume and cumulative citation performance.

China was the leading first-author country, accounting for 86 publications (20.62% of the corpus) and substantially exceeding all other countries (Table 4). Of these publications, 59 were single-country papers and 27 involved international collaboration, producing a multi-country publications (MCP) share of 31.40%. Germany and Poland ranked jointly second, with 17 publications each, although Germany recorded a higher international co-authorship share than Poland (of 29.41% compared to 17.65%). The United States contributed 16 publications, evenly divided between single- and multiple-country papers, while India produced 15 publications, of which six involved international

Table 4. Publication output and collaboration patterns by corresponding/first-author country

Country	Articles	Articles (%)	SCP	MCP	MCP (%)
China	86	20.62	59	27	31.40
Germany	17	4.08	12	5	29.41
Poland	17	4.08	14	3	17.65
United States	16	3.84	8	8	50.00
India	15	3.60	9	6	40.00
France	13	3.12	5	8	61.54
Spain	13	3.12	7	6	46.15
Italy	12	2.88	9	3	25.00
Türkiye	12	2.88	7	5	41.67
Greece	9	2.16	4	5	55.56
Iran	9	2.16	9	0	0.00
Ukraine	9	2.16	3	6	66.67
Tunisia	8	1.92	6	2	25.00
United Kingdom	8	1.92	2	6	75.00
Romania	7	1.68	6	1	14.29
Australia	5	1.20	1	4	80.00
Japan	5	1.20	3	2	40.00
Portugal	5	1.20	2	3	60.00

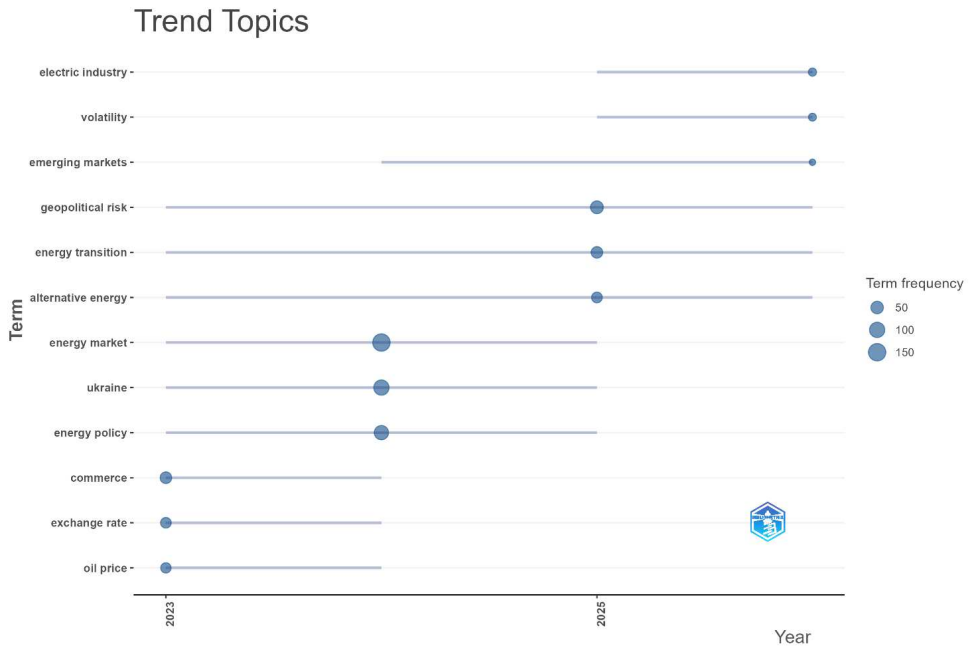
Note: Country attribution is based on the country of the first author's affiliation, as recorded in the Bibliometrix CO/AU1_CO field and presented in Biblioshiny under "Corresponding Author's Countries". Articles denotes the number of publications assigned to each first-author country, while Articles (%) represents its share of the 417-document corpus. SCP denotes single-country publications in which all listed affiliations originated from the same country. MCP denotes multiple-country publications involving at least one co-author affiliated with an institution in another country. MCP (%) is calculated as MCP divided by the total number of publications attributed to the country in question. The indicators, therefore, describe collaboration among publications assigned to each first-author country rather than the complete publication output of all countries represented among the co-authors. Only countries with at least five assigned publications are presented.

collaboration. France combined a comparatively substantial output of 13 publications with a high MCP share of 61.54%. Among countries with smaller publication counts, Australia, the United Kingdom, and Ukraine had the highest MCP shares at 80.00%, 75.00%, and 66.67%, respectively. These percentages correspond to only four of five Australian publications, six of eight United Kingdom publications, and six of nine Ukrainian publications. They should therefore be interpreted as descriptive patterns rather than as stable estimates of national propensity for collaboration. By contrast, all nine publications attributed to Iran were single-country papers. Overall, the findings indicate a strong concentration of first-author output in China, while several lower-output countries exhibited comparatively high participation in international co-authorship.

3.4. Trend topics and thematic evolution

Figure 2 shows differences in the temporal concentration of frequently occurring terms in the analyzed literature. Oil price, exchange rate, and commerce have a median publication year of 2023, indicating that the central part of their occurrence distribution is concentrated relatively early in the post-2022 literature. Energy market, Ukraine, and energy policy have a median publication year of 2024, while geopolitical risk, energy transition, and alternative energy are centered on 2025. Emerging markets, volatility, and the electric industry have the latest median publication year, 2026. These positions indicate the temporal center of each term's occurrence distribution rather than the year in which a topic emerged or the strength of its association with a particular year.

Because the 2026 dataset covers only the first half of the year, all findings referring to 2026 should be interpreted as provisional and may change when complete annual data become available. Figure 3 indicates that the field is organized around several central but unevenly developed thematic clusters. The cluster comprising Ukraine, energy policy, energy, energy crisis, and energy security is positioned within the basic-themes quadrant, demonstrating high relevance to the overall research domain but comparatively limited internal development. The second basic cluster links investment, COVID-19, spillover effects, oil, and commerce, reflecting the continuing importance of financial and market transmission mechanisms.



Note: Trend topics were generated from the All Keywords field. The minimum overall term frequency was four, and up to three terms were displayed for each median year. Bubble position represents the median publication year of a term's occurrences, the horizontal line spans the first to the third quartile (Q1–Q3) of its temporal distribution, and bubble size represents overall term frequency.

Figure 2. Evolution of trend topics in the analyzed literature, 2023–2026

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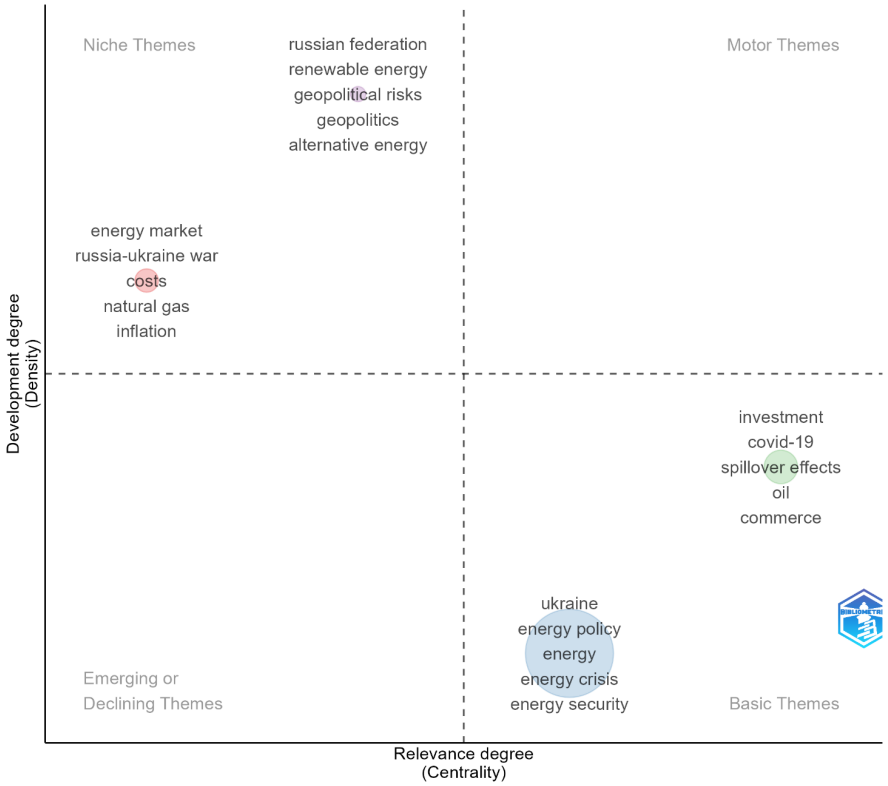
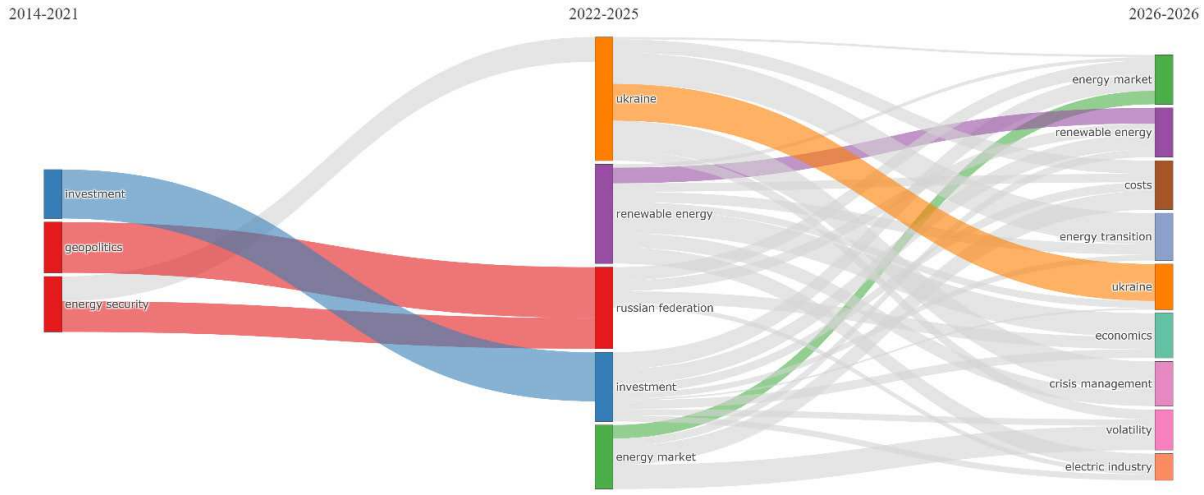
By contrast, the clusters centered on geopolitics, geopolitical risks, renewable and alternative energy, energy markets, the Russia–Ukraine war, costs, natural gas, and inflation appear as niche themes. These clusters are relatively well developed internally but remain less strongly connected to the wider conceptual structure. The absence of a clearly established motor-theme cluster suggests that the literature is still consolidating around several competing research streams rather than being driven by a single dominant, mature, and highly central theme. Clusters in the lower-left quadrant are described as emerging or declining because a cross-sectional thematic map alone cannot establish the direction of their development; their temporal trajectory must be interpreted together with Figure 4 and the period-specific maps in Appendix B.

Hereafter, Figure 4 reveals a substantial transformation of the thematic agenda over time. Within the small 2014–2021 corpus, the limited thematic structure visible in the map was organized mainly around investment, geopolitics, and energy security. This early configuration should be regarded as a descriptive baseline rather than directly compared with the much larger post-2022 corpus for thematic diversity or cluster development. Following 2022, these initial strands expanded into five major clusters centered on Ukraine, renewable energy, the Russian Federation, investment, and the energy market. By the first half of 2026, these themes had diversified further into the energy transition, costs, economics, crisis management, volatility, and the electric industry, while Ukraine, renewable energy, and the energy market retained clear thematic continuity. The period-specific maps in Appendix B further show that renewable energy, alternative energy, and sustainable development formed an important motor theme in 2022–2025. In contrast, the 2026 structure gives greater prominence to the interconnected cluster of energy markets, geopo-



Note: The thematic map was generated from a keyword co-occurrence network using the merged keyword field (All Keywords), which combines authors' keywords and Keywords Plus. The analysis retained up to 250 terms that occurred at least twice and was based solely on unigrams. Stemming was not applied. The thematic clusters were identified using the Louvain community-detection algorithm. The graphical parameters were set to a node-size scaling factor of 0.3, a maximum of five labels per cluster and a community-repulsion value of 0.5. The horizontal axis represents Callon centrality, indicating the degree of connection between a theme and the overall research field. In contrast, the vertical axis represents Callon density, reflecting the internal development and cohesion of each thematic cluster.

Figure 3. Thematic structure of the analyzed literature based on centrality and density



Note: Thematic evolution was analyzed across three time slices: 2014–2021 (*n* = 14), 2022–2025 (*n* = 322), and the first half of 2026 (*n* = 81). For each strategic map, the analysis used the merged keyword field (All Keywords), retained up to 250 terms and was based on unigrams only. Stemming was not applied, and thematic clusters were identified using the Louvain community-detection algorithm. The graphical parameters were set to a node-size scaling factor of 0.3, a maximum of five labels per cluster and a community-repulsion value of 0.5. Connections between clusters indicate thematic continuity based on shared terms across consecutive periods. Because the three time slices differ substantially in duration and document count, differences in the number, size and apparent development of thematic clusters should be interpreted with caution.

Figure 4. Thematic evolution of the research field across 2014–2021, 2022–2025, and the first half of 2026

litical risks, investment, and spillover effects. At the same time, Ukraine, energy policy, energy crisis, and energy security remain highly central but comparatively underdeveloped basic themes. As the 2026 results cover only the first half of the year, the latest thematic configuration should be treated as provisional. At the same time, Ukraine, energy policy, energy crisis, and energy security remain highly central but comparatively underdeveloped basic themes.

The period-specific thematic maps in Appendix B provide a more detailed view of how the field's intellectual structure changed over time. Figure B1 provides a descriptive view of the small 2014–2021 corpus, in which three broad thematic groupings are visible around energy security and the Russian Federation, geopolitics, and investment. Given the limited number of publications in this period, these clusters should not be interpreted as a stable or directly comparable pre-2022 thematic structure. Figure B2 demonstrates substantial diversification during 2022–2025, when renewable energy, alternative energy, fossil fuels, sustainable development, and carbon emissions became prominent motor themes, while Ukraine, energy policy, energy crisis, and energy security became highly central basic themes. At the same time, research on the energy market, the Russia–Ukraine war, natural gas, costs, and inflation occupied an intermediate position. In contrast, the cluster focused on the Russian Federation, geopolitical risks and economic consequences remained comparatively peripheral. Figure B3, covering the first half of 2026, indicates further thematic reorganization: the cluster linking energy markets, geopolitical risks, geopolitics, investment, and spillover effects moved toward the motor-themes quadrant, while costs, energy efficiency, inflation, Ukraine, and energy policy also displayed high centrality. In contrast, topics concerning renewable energy, the Russia–Ukraine war, the Russian Federation, and alternative energy shifted toward the basic-themes quadrant, while themes related to crisis management, energy prices, and electricity supply emerged as research directions or declined in prominence.

3.5. Conceptual structure of the literature

Figure 5 presents the conceptual structure of the literature derived from multiple correspondence analysis, with the first two dimensions account-

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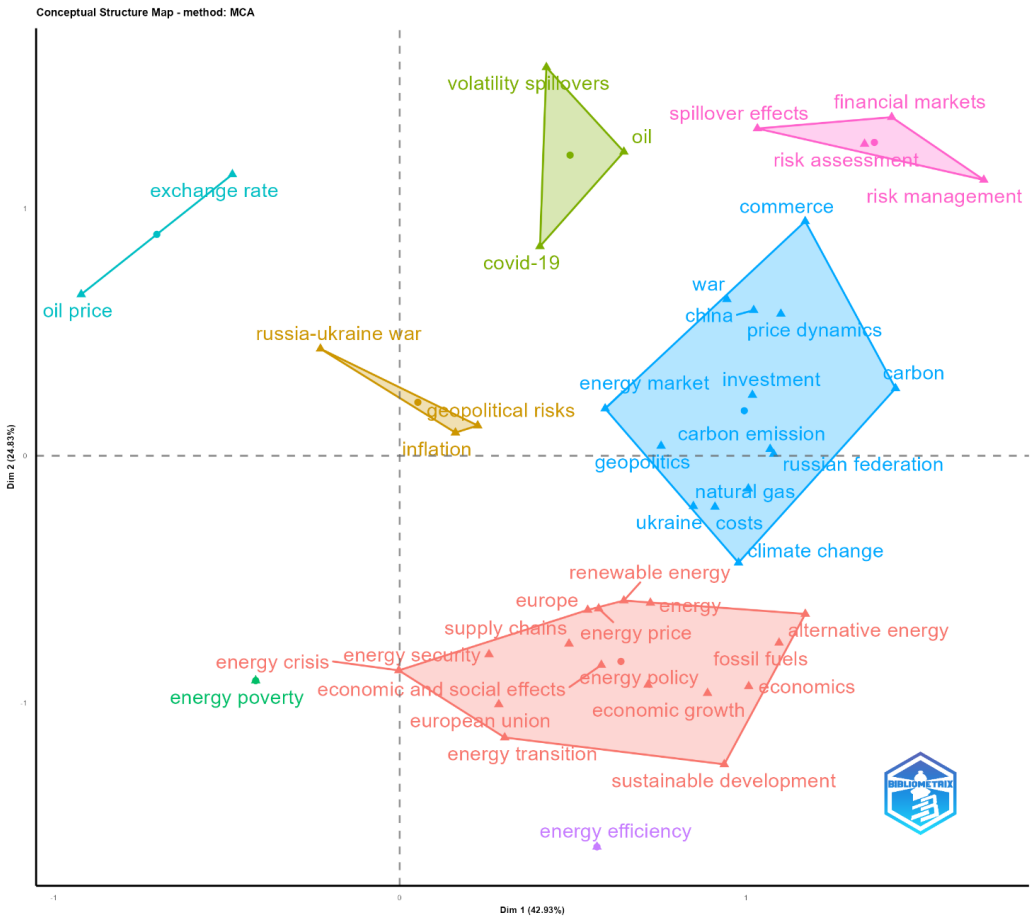
ing for 67.76% of the total inertia (Dimension 1: 42.93%; Dimension 2: 24.83%). The largest central cluster links energy markets, geopolitics, Ukraine, the Russian Federation, natural gas, costs, carbon emissions, investment, and price-related terms, indicating that geopolitical disruption and its energy-market consequences constitute the principal conceptual core of the literature. The second broad cluster combines energy policy, energy security, energy crisis, energy transition, renewable energy, alternative energy, fossil fuels, economic growth, and sustainable development, reflecting policy and sustainability responses to geopolitical and energy shocks. Smaller clusters represent more specialized research streams concerning financial-market spillovers and risk management, oil-market volatility, and COVID-19, and relationships between oil prices and exchange rates. The proximity of Russia–Ukraine war, geopolitical risks, and inflation identifies a connected strand focused on the inflationary consequences of geopolitical conflict. By contrast, the relatively isolated positions of energy poverty and energy efficiency indicate that these concepts have weaker co-occurrence relationships with the dominant thematic clusters in the analyzed corpus.

The combined performance indicators show that the literature emerged from a small, fragmented research area into a rapidly expanding international field after 2021. Only 14 of the 417 publications appeared during 2014–2021, whereas 403 documents, or 96.64% of the corpus, were published between 2022 and the first half of 2026. This



Note: The conceptual structure was examined using multiple correspondence analysis (MCA) based on the merged keyword field (All Keywords), which combines authors' keywords and Keywords Plus. Terms occurring fewer than 14 times were excluded, and stemming was not applied. The analysis specified eight conceptual clusters (clusters = 8; k.max = 8). Up to five representative documents per cluster were selected for display, and the label-size parameter was set to 5. Although the n-gram parameter was set to 1, the use of the pre-existing merged keyword field means that indexed multi-word expressions, such as "energy security", were retained as complete keyword units rather than divided into individual words. The first two MCA dimensions accounted for 67.76% of the total inertia.

Figure 5. Conceptual structure of the research field based on multiple correspondence analysis

expansion was accompanied by substantial citation visibility, particularly for the 2022 and 2023 publication cohorts, although their mean citation values were partly driven by a limited number of exceptionally influential papers. Author-level impact remained relatively dispersed, with the highest corpus-based h-index reaching only 3, while country-level production was strongly concentrated in China, which accounted for 20.62% of the corpus. At the same time, international co-authorship accounted for 37.41% of all publications, and several lower-output countries showed high proportions of multiple-country publications, indicating that the geographical concentration of research output coexisted with extensive cross-border collaboration.

The thematic and conceptual analyses identify geopolitical disruption, energy-market instability, and policy responses as the principal organizing dimensions of the field. The initial focus on investment, geopolitics, and energy security evolved after 2022 into a broader framework encompassing Ukraine, the Russia–Ukraine war, renewable energy, natural gas, inflation, energy prices, and market spillovers. By the first half of 2026, the literature showed greater differentiation into energy-market risk, investment, crisis management, volatility, energy efficiency, and electricity-sector themes, while Ukraine, energy policy, and energy security remained central connecting concepts. The MCA results support this interpretation by distinguishing a dominant geopolitical and energy-market cluster from a second, broader cluster centered on energy policy, transition, and sustainable development, alongside smaller specialized streams on financial risk, volatility spillovers, and exchange-rate transmission. Overall, the results demonstrate that the research field has expanded not only quantitatively but also conceptually, moving from a limited geopolitical-energy agenda toward a multidimensional structure integrating market, macroeconomic, financial, security, and sustainability perspectives.

4. DISCUSSION

The sharp post-2021 expansion of the literature indicates that the full-scale invasion coincided with a major reorientation of scholarly attention toward energy-market disruption and its wider economic consequences. Of the 417 publications identified, 403, or 96.64%, appeared between 2022 and the first half of 2026, while the 2023 cohort recorded the highest mean citation performance, at 40.20 citations per document and 10.05 citations per document per citable year. This temporal concentration is consistent with empirical research documenting substantial changes in energy supply relations, trade, investment, and public governance following the invasion. Studies on the weaponization of energy and European fossil-fuel dependence similarly characterize the 2022 crisis as a major geopolitical disruption rather than a temporary price disturbance (Cosmulese, 2026; Lee & Powell, 2025; Vasylieva et al., 2025a). In contrast, related research documents effects on Black Sea trade and the resilience of socioeconomic systems under conflict conditions (Nate et al., 2024; Melnyk et al., 2025). At the same time, the maximum corpus-based h-index of 3 suggests that scholarly influence remains relatively dispersed. China accounted for 20.62% of first-author publications, whereas international co-authorship represented 37.41% of the corpus, indicating that geographical concentration in research output coexists with substantial cross-border collaboration.

The thematic and conceptual results indicate that energy, financial, and macroeconomic transmission mechanisms occupy a central position in the mapped research structure. The growing visibility of energy markets, inflation, natural gas, volatility, and spillover effects is consistent with empirical studies showing that war-related energy shocks are associated with changes in commodity prices, equity markets, exchange rates, and systemic risk. In particular, the bibliometric prominence of spillovers and volatility corresponds to evidence of increased connectedness across energy and commodity markets during periods of stress (Wang et al., 2022; Gong et al., 2023; Boubaker et al., 2023). In comparison, other studies demonstrate that relationships among oil, equities, and foreign-exchange markets vary across crisis regimes and institutional settings (Cui et al., 2025; Alshater et al., 2024; Ahmed et al., 2025; Marathe et al., 2025). The MCA structure, with the first two dimensions accounting for 67.76% of total inertia, places geopolitics, Ukraine, Russia, natural gas, costs, investment, and price dynamics within a major conceptual domain. This bibliometric configura-

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tion is consistent with empirical evidence linking energy-price shocks to heterogeneous inflation responses across European countries and energy regimes (Coutinho & Licchetta, 2025; Vasylieva et al., 2025b; Vasylieva et al., 2025c). These substantive relationships derive from the cited empirical studies rather than from the bibliometric mapping itself.

The second major knowledge domain connects energy policy, renewable energy, sustainable development, and investment, showing that these issues occupy an important position in the post-2022 research agenda. The prominence of renewable energy during 2022–2025 is consistent with substantive empirical studies linking renewable deployment to lower fossil-fuel dependence and stronger energy resilience, although these effects depend on infrastructure, governance, and national socioeconomic conditions (Li et al., 2026; Vasylieva et al., 2025a). Similarly, the growing visibility of decentralization, grid reliability, and energy efficiency in the bibliometric structure corresponds to empirical research on Ukraine's electricity system, emphasizing the importance of balancing capacity, infrastructure protection, and flexible network management (Kurbatova et al., 2024; Belgibayeva et al., 2025). At the organizational level, the bibliometric prominence of investment, risk management, and crisis response is consistent with empirical evidence that corporate energy dependence, green productivity, and management structures are associated with firms' responses to geopolitical shocks (Gao et al., 2025). The comparatively isolated positions of energy poverty and energy efficiency indicate that distributional and demand-side issues remain less integrated into the dominant research structure. Their substantive importance is nevertheless demonstrated by empirical studies of household exposure to energy price shocks and affordability pressures (Guan et al., 2023; Jaeger-Erben et al., 2025).

The study is limited by its reliance on Scopus as the sole bibliographic source, selected search terms and document types for the corpus, and its use of citation indicators that are affected by publication age and by a small number of highly cited papers. The first half of 2026 constitutes an incomplete observation period; country attribution is based on the first or corresponding author's affiliation, and the thematic results may vary with keyword cleaning, frequency thresholds, and clustering parameters. Moreover, the publication life-cycle model is exploratory and should not be interpreted as a precise forecast of future research saturation. A further limitation is that the thematic analyses were based on the merged All Keywords field rather than Author Keywords alone. Within the Biblioshiny workflow used in this study, an equivalent Author-Keywords-only specification could not be implemented consistently across all thematic procedures; therefore, sensitivity to keyword-field selection could not be assessed directly. Future studies using script-based Bibliometrix workflows could examine this issue more systematically. Future studies should also update the analysis after 2026, compare Scopus with Web of Science and other databases, apply full-text topic modeling and qualitative content analysis, and examine regional or institutional differences in greater depth. Further research could also connect bibliometric patterns with empirical indicators of energy prices, investment, energy security, macroeconomic stability, and policy effectiveness to determine whether shifts in the scientific agenda correspond to measurable changes in management practice and public policy.

CONCLUSION

This study aimed to trace the development, influence, and intellectual structure of management- and governance-oriented research on energy-market transformation during the Russia–Ukraine war, with particular attention to macroeconomic stability, financial risk, investment, and policy responses. The analysis covered 417 Scopus-indexed publications published between 2014 and the first half of 2026 and applied descriptive bibliometric indicators, citation and collaboration analyses, trend-topic analyses, thematic mapping and evolution, multiple correspondence analysis, and exploratory publication-growth modeling using Bibliometrix and Biblioshiny.

The corpus of 417 publications from 228 sources recorded a Biblioshiny annual growth rate of 44.22%, while the compound annual growth rate calculated for the complete 2014–2025 period reached approximately 52.40%. Only 14 publications appeared during 2014–2021, whereas 403 documents, or 96.64% of the corpus, were published between 2022 and the first half of 2026, showing a pronounced post-2021 expansion. The 2023 cohort achieved the highest mean citation performance, with 40.20 citations per publication and 10.05 citations per publication per citable year, while the most highly cited individual paper accumulated 363 citations. China was the leading first-author country, with 86 publications (20.62% of the corpus), while international co-authorship accounted for 37.41% of all publications. Under the eight-cluster specification, the MCA distinguished eight conceptual groupings, with the first two dimensions accounting for 67.76% of the total inertia, revealing two dominant knowledge domains centered on geopolitical energy-market disruption and on energy policy, transition, and sustainable development.

The bibliometric results identify energy security, market resilience, investment, decarbonization, financial risk, and affordability as closely interconnected areas of scholarly attention. They do not, by themselves, establish the effectiveness of particular policies or corporate responses. However, when interpreted alongside the substantive empirical literature reviewed in this study, the mapped research agenda highlights the importance of coordinated approaches to energy diversification, infrastructure resilience, investment planning, risk management, and affordability. These implications should therefore be understood as literature-informed policy considerations rather than causal conclusions derived from the bibliometric analysis.

AUTHOR CONTRIBUTIONS

Conceptualization: Tetiana Vasylieva, Martina Mateášová, Karina Taraniuk, Andreas Horsch.
Data curation: Tetiana Vasylieva.
Formal analysis: Tetiana Vasylieva, Karina Taraniuk.
Funding acquisition: Tetiana Vasylieva.
Investigation: Tetiana Vasylieva.
Methodology: Tetiana Vasylieva.
Project administration: Andreas Horsch.
Resources: Tetiana Vasylieva.
Software: Tetiana Vasylieva, Karina Taraniuk.
Supervision: Andreas Horsch.
Validation: Tetiana Vasylieva, Martina Mateášová.
Visualization: Tetiana Vasylieva, Martina Mateášová.
Writing – original draft: Tetiana Vasylieva, Martina Mateášová, Karina Taraniuk, Andreas Horsch.
Writing – review & editing: Tetiana Vasylieva, Martina Mateášová, Karina Taraniuk, Andreas Horsch.

ACKNOWLEDGMENT

Tetiana Vasylieva contributed to this article within the framework of the MSCA4Ukraine project 06030419, which is funded by the European Union. Views and opinions expressed are, however, those of the authors only and do not necessarily reflect those of the European Union, the European Research Executive Agency or the MSCA4Ukraine Consortium. Neither the European Union, the European Research Executive Agency, nor the MSCA4Ukraine Consortium, nor any individual member institution of the MSCA4Ukraine Consortium can be held responsible for them.

http://dx.doi.org/10.21511/ppm.24(3).2026.52

REFERENCES

1. Abid, I., Benkraiem, R., Mzoughi, H., & Urom, C. (2024). From black gold to financial fallout: Analyzing extreme risk spillovers in oil-exporting nations. *Journal of International Financial Markets, Institutions and Money, 91,* Article 101948. https://doi.org/10.1016/j.intfin.2024.101948
2. Ahmed, H., Siddiqui, T. A., & Naushad, M. (2025). Navigating global economic turmoil: The dynamics of oil prices, exchange rates, and stock markets in BRICS. *Investment Management and Financial Innovations, 22*(1), 94-106. https://doi.org/10.21511/imfi.22(1).2025.08
3. Alshater, M. M., Hanif, W., El Khoury, R., & Mensi, W. (2024). Interplay of crises: Unpacking intraday spillovers in oil and European equities in the shadow of the COVID-19 and the Ukraine-Russia war. *Borsa Istanbul Review, 24*(4), 747-771. https://doi.org/10.1016/j.bir.2024.04.007
4. Alvarez, J., & Kroen, T. (2025). *The energy origins of the global inflation surge* (IMF Working Paper No. 25/91). International Monetary Fund. Retrieved from https://www.imf.org/-/media/files/publications/wp/2025/english/wpiea2025091-print-pdf.pdf
5. Alves, A., & Marques da Costa, N. (2024). Changes in fuel prices and the use of public transport: Insights from the European Union following the invasion of Ukraine. *European Journal of Geography, 15*(4), 232-243. https://doi.org/10.48088/ejg.a.alv.15.4.232.243
6. Anas, M., Bouri, E., & Shahzad, S. J. H. (2025). A comparative bibliometric analysis of five major energy journals. *Energy Economics, 151,* Article 108899. https://doi.org/10.1016/j.eneco.2025.108899
7. Aria, M., & Cuccurullo, C. (2017). *bibliometrix:* An R-tool for comprehensive science mapping analysis. *Journal of Infometrics, 11*(4), 959-975. https://doi.org/10.1016/j.joi.2017.08.007
8. Aria, M., & Cuccurullo, C. (2026). *Science mapping analysis: A primer with Biblioshiny.* McGraw-Hill. Retrieved from https://www.researchgate.net/publication/403912727_Science_Mapping_Analysis_-_A_Primer_with_Biblioshiny
9. Aria, M., Cuccurullo, C., D'Aniello, L., & Spano, M. (2026). Biblioshiny and the SAAS Workflow: An integrated framework for transparent and reproducible science mapping. A demonstration through the replication of a study. *Journal of Informetrics, 20*(3), Article 101837. https://doi.org/10.1016/j.joi.2026.101837
10. Balahurovska, I., Kolosok, S., & Yevdokymova, A. (2025). Comprehensive study of the renewable energy market development and management of the energy system in Ukraine. In V. Babak & A. Zaporozhets (Eds.), *Systems, Decision and Control in Energy VII. Studies in Systems, Decision and Control* (vol. 595, pp. 489-502). Springer. https://doi.org/10.1007/978-3-031-90466-0_21
11. Becker, T., Gorodnichenko, Y., & Weder di Mauro, B. (2025). How to rebuild Ukraine: A synthesis and critical review of policy proposals. *Annual Review of Economics, 17*(1), 293-320. https://doi.org/10.1146/annurev-economics-081324-093012
12. Belghouthi, H. E., & Boubaker, A. (2026). Multiscale connectedness between stocks, energy, and green bonds under economic and climate policy uncertainty: Evidence from the G7. *Economic Change and Restructuring, 59*(4), Article 85. https://doi.org/10.1007/s10644-026-10042-4
13. Belgibayeva, A., Artyukhov, A., Kubičková, V., Čukanová, M., Myroshnychenko, I., Ruzhytsky, I., & Lyeonov, S. (2025). Interrelationship between decentralization of energy sources and their renewability: A bibliometric analysis of research trends and thematic evolution. *Environmental Economics, 16*(3), 41-66. https://doi.org/10.21511/ee.16(3).2025.04
14. Boubaker, S., Karim, S., Naeem, M. A., & Sharma, G. D. (2023). Financial markets, energy shocks, and extreme volatility spillovers. *Energy Economics, 126,* Article 107031. https://doi.org/10.1016/j.eneco.2023.107031
15. Callon, M., Courtial, J. P., & Laville, F. (1991). Co-word analysis as a tool for describing the network of interactions between basic and technological research: The case of polymer chemistry. *Scientometrics, 22*(1), 155-205. https://doi.org/10.1007/BF02019280
16. Cevik, S., & Zhao, Y. (2026). Shocked: Electricity price volatility spillovers in Europe. *International Economics and Economic Policy, 23*(2), Article 31. https://doi.org/10.1007/s10368-026-00729-4
17. Cobo, M. J., López-Herrera, A. G., Herrera-Viedma, E., & Herrera, F. (2011). An approach for detecting, quantifying, and visualizing the evolution of a research field. *Journal of Informetrics, 5*(1), 146-166. https://doi.org/10.1016/j.joi.2010.10.002
18. Cosmulese, C. G. (2026). Weaponization of energy: A geopolitical analysis of the 2022 energy crisis and the redesign of the European order. *Geopolitics under Globalization, 7*(1), 1-7. https://doi.org/10.21511/gg.07(1).2026.01
19. Coutinho, L., & Licchetta, M. (2025). Inflation differentials in the euro area during high energy prices. *Open Economies Review, 36*(5), 1463-1497. https://doi.org/10.1007/s11079-025-09802-y
20. Cui, J., Maghyereh, A., & Ziadat, S. (2025). Crude oil, forex, and stock markets: Unveiling the higher-order moment and cross-moment risk spillovers in times of turmoil. *Humanities and Social Sciences Communications, 12*(1), Article 1158. https://doi.org/10.1057/s41599-025-05308-7
21. Cui, L., Yue, S., Nghiem, X.-H., & Duan, M. (2023). Exploring the risk and economic vulnerability of global energy supply

chain interruption in the context of Russo-Ukrainian war. *Resources Policy, 81,* Article 103373. https://doi.org/10.1016/j.resourpol.2023.103373

22. D'Arcangelo, F. M., Levin, I., Pagani, A., Pisu, M., & Johansson, A. (2022). *A framework to decarbonise the economy* (OECD Economic Policy Paper No. 31). OECD. Retrieved from https://read.oecd-ilibrary.org/content/dam/oecd/en/publications/reports/2022/02/a-framework-to-decarbonise-the-economy_642a6827/4e4d973d-en.pdf
23. European Commission. (n.d.). *REPowerEU – 4 years on*. European Commission. Retrieved from https://energy.ec.europa.eu/strategy/repowereu-phase-out-russian-energy-imports/repowereu-4-years_en
24. Fabra, N. (2023). Reforming European electricity markets: Lessons from the energy crisis. *Energy Economics, 126,* Article 106963. https://doi.org/10.1016/j.eneco.2023.106963
25. Fang, Y., & Shao, Z. (2022). The Russia-Ukraine conflict and volatility risk of commodity markets. *Finance Research Letters, 50,* Article 103264. https://doi.org/10.1016/j.frl.2022.103264
26. Gajdzik, B., Wolniak, R., Nagaj, R., Žuromskaitė-Nagaj, B., & Grebski, W. W. (2024). The influence of the global energy crisis on energy efficiency: A comprehensive analysis. *Energies, 17*(4), Article 947. https://doi.org/10.3390/en17040947
27. Gao, D., Li, S., & Tian, Z. (2025). Geopolitical risk, energy market volatility, and corporate energy dependence: The role of green Total factor productivity and decentralized top management team network. *Energy Economics, 148,* Article 108545. https://doi.org/10.1016/j.eneco.2025.108545
28. Genc, T. S., & Kosempel, S. (2023). Energy transition and the economy: A review article. *Energies, 16*(7), Article 2965. https://doi.org/10.3390/en16072965
29. Gong, X.-L., Feng, Y.-K., Liu, J.-M., & Xiong, X. (2023). Study on international energy market and geopolitical risk contagion based on complex network. *Resources Policy, 82,* Article 103495. https://doi.org/10.1016/j.resourpol.2023.103495
30. Gualandri, F., & Kuzior, A. (2023). Home energy management systems adoption scenarios: The case of Italy. *Energies, 16*(13), Article 4946. https://doi.org/10.3390/en16134946
31. Guan, Y., Yan, J., Shan, Y., Zhou, Y., Hang, Y., Li, R., Liu, Y., Liu, B., Nie, Q., Bruckner, B., Feng, K., & Hubacek, K. (2023). Burden of the global energy price crisis on households. *Nature Energy, 8,* 304-316. https://doi.org/10.1038/s41560-023-01209-8
32. Gyamerah, S. A., & Asare, C. (2024). The impacts of global economic policy uncertainty on green bond returns: A systematic literature review. *Heliyon, 10*(3), Article e25076. https://doi.org/10.1016/j.heliyon.2024.e25076
33. Hakmi, N. A., Mgadmi, N., Abidi, A., Moussa, W., Draou, A., Imansouren, S., & Ouis, L. (2026). Quantile-based analysis of geopolitical risk spillovers across sustainable finance, energy markets, precious metals, and FinTech. *Geopolitics under Globalization, 7*(1), 8-26. https://doi.org/10.21511/gg.07(1).2026.02
34. International Energy Agency (IEA). (2025). *World energy investment 2025*. IEA. Retrieved from https://www.iea.org/reports/world-energy-investment-2025
35. Jaeger-Erben, M., Gram-Hanssen, K., Hansen, A. R., Frąckowiak, M., Guilbert, A., Pluciński, P., Sahakian, M., Wethal, U. B., & Wertheim-Heck, S. (2025). Policies for times of disruptions: How households in Europe dealt with the energy crisis in the winter 2022/2023. *Energy Policy, 205,* Article 114711. https://doi.org/10.1016/j.enpol.2025.114711
36. Kafoe, A. S., & Foh, B. M. (2026). Security risks of Gulf conflicts: How energy markets and migration generate systemic economic instability. *Safety and Security Advances, 2*(2), 1-19. https://doi.org/10.61093/ssa.2(2).1-19.2026
37. Karkowska, R., & Urjasz, S. (2023). How does the Russian-Ukrainian war change connectedness and hedging opportunities? Comparison between dirty and clean energy markets versus global stock indices. *Journal of International Financial Markets, Institutions and Money, 85,* Article 101768. https://doi.org/10.1016/j.intfin.2023.101768
38. Khan, K., Khurshid, A., & Cifuentes-Faura, J. (2023). Energy security analysis in a geopolitically volatile world: A causal study. *Resources Policy, 83,* Article 103673. https://doi.org/10.1016/j.resourpol.2023.103673
39. Kurbatova, T., Sidortsov, R., Trypolska, G., Hulak, D., & Sotnyk, I. (2024). Maintaining Ukraine's grid reliability under rapid growth of renewable electricity share: Challenges in the pre-war, war-time, and post-war periods. *International Journal of Sustainable Energy Planning and Management, 40,* 41-54. https://doi.org/10.54337/ijsepm.8112
40. Kuzior, A., Kostenko, A., Sotnyk, I., Chortok, Y., Tuliakov, O., & Podmanicka, M. (2023). Socio-economic sustainability and the solidarity economy formation under the war conditions in Ukraine. *Financial and Credit Activity Problems of Theory and Practice, 5*(52), 256-267. https://doi.org/10.55643/fcaptp.5.52.2023.4132
41. Kuzior, A., Vysochyna, A., Augustyniak, W., & Remsei, S. (2024). Forecasting of macroeconomic stability post-pandemic recovery: The case of European countries. *Journal of International Studies, 17*(4), 56-79. https://doi.org/10.14254/2071-8330.2024/17-4/4
42. Lee, R. G., & Powell, R. (2025). Weaponisation of energy systems and policy in the age of climate change. *Environmental Law Review, 27*(3), 203-223. https://doi.org/10.1177/14614529251369292
43. Li, Y., Hanif, M. W., Wen, M., Khoso, A. K., & Khoso, W. M. (2026). Geopolitical risks and the global renewable energy transition: Implications for energy

http://dx.doi.org/10.21511/ppm.24(3).2026.52

security and economic resilience. *Energy Reports, 15,* Article 108875. https://doi.org/10.1016/j.egyr.2025.12.012

44. Lin, F., Li, X., Jia, N., Feng, F., Huang, H., Huang, J., Fan, S., Ciais, P., & Song, X.-P. (2023). The impact of Russia-Ukraine conflict on global food security. *Global Food Security, 36,* Article 100661. https://doi.org/10.1016/j.gfs.2022.100661

45. Linn, J. (2008). Energy prices and the adoption of energy-saving technology. *The Economic Journal, 118*(533), 1986-2012. https://doi.org/10.1111/j.1468-0297.2008.02199.x

46. Lorente, D. B., Mohammed, K. S., Cifuentes-Faura, J., & Shahzad, U. (2023). Dynamic connectedness among climate change index, green financial assets and renewable energy markets: Novel evidence from sustainable development perspective. *Renewable Energy, 24,* 94-105. https://doi.org/10.1016/j.renene.2022.12.085

47. Lyeonov, S., Hrytsenko, L., Zamek, D., & Remsei, S. (2026). E-government development, armed conflict, and government revenue: A cross-country panel analysis. *Journal of International Studies, 19*(1), 160-184. https://doi.org/10.14254/2071-8330.2026/19-1/9

48. Marathe, S. R., Parab, S., Popkar, S., Bandekar, B. N., & Pandhre, S. S. (2025). Oil price shocks, market efficiency, and volatility spillovers: Evidence from BRICS countries. *Investment Management and Financial Innovations, 22*(3), 64-76. https://doi.org/10.21511/imfi.22(3).2025.05

49. Marhold, A. A. (2023). Towards a 'security-centred' energy transition: Balancing the European Union's ambitions and geopolitical realities. *Journal of International Economic Law, 26*(4), 756-769. https://doi.org/10.1093/jiel/jgad043

50. Melnyk, L., Vasa, L., Kubatko, O., Koblianska, I., & Hrytsenko, P. (2025). Contribution of modern industrial revolutions to securing socio-economic systems during the war against Ukraine. *Problems and Perspectives in Management, 23*(2), 921-937. https://doi.org/10.21511/ppm.23(2).2025.67

51. Nate, S., Colibășanu, A., Stavytskyy, A., & Kharlamova, G. (2024). Impact of the Russo-Ukrainian war on Black Sea trade: Geoeconomic challenges. *Economics and Sociology, 17*(1), 256-279. https://doi.org/10.14254/2071-789X.2024/17-1/16

52. Nose, M. (2023). *Inclusive GovTech: Enhancing efficiency and equity through public service digitalization* (IMF Working Paper WP/23/226). International Monetary Fund. Retrieved from https://ssrn.com/abstract=4619844

53. Noyons, E. C. M., Moed, H. F., & van Raan, A. F. J. (1999). Integrating research performance analysis and science mapping. *Scientometrics, 46*(3), 591-604. https://doi.org/10.1007/BF02459614

54. Pan, L., Wang, Y., Sun, X., Sadiq, M., & Dagestani, A. A. (2023). Natural resources: A determining factor of geopolitical risk in Russia? Revisiting conflict-based perspective. *Resources Policy, 85,* Article 104033. https://doi.org/10.1016/j.resourpol.2023.104033

55. Popp, D. (2002). Induced innovation and energy prices. *American Economic Review, 92*(1), 160-180. https://doi.org/10.1257/000282802760015658

56. Purwanto, E., Tannady, H., Susanto, & Muslim, A. C. (2025). Energy transition and renewable energy: A multidisciplinary bibliometric study of research trends and collaborations. *IOP Conference Series: Earth and Environmental Science, 1504*(1), Article 012013. https://doi.org/10.1088/1755-1315/1504/1/012013

57. Škare, M., Porada-Rochoń, M., & Veselica Celić, R. (2025). The impact of energy price dynamics on artificial intelligence adoption: A cross-country study. *Economics and Sociology, 18*(4), 40-60. https://doi.org/10.14254/2071-789X.2025/18-4/2

58. Sokhanvar, A., & Bouri, E. (2022). Commodity price shocks related to the war in Ukraine and exchange rates of commodity exporters and importers. *Borsa Istanbul Review, 23*(1), 44-54. https://doi.org/10.1016/j.bir.2022.09.001

59. Umar, Z., Hadhri, S., Abakah, E. J. A., Usman, M., & Umar, M. (2024). Return and volatility spillovers among oil price shocks and international green bond markets. *Research in International Business and Finance, 69,* Article 102254. https://doi.org/10.1016/j.ribaf.2024.102254

60. Van de Graaf, T. (2014). International energy agency. In J. Sperling (Ed.), *Handbook of Governance and Security* (pp. 489-503). Edward Elgar Publishing. https://doi.org/10.4337/9781781953174.00038

61. Vasylieva, T., Derkacz, A., Popp, J., & Horsch, A. (2025a). From energy dependency to energy security: How the war in Ukraine accelerated renewable deployment in Europe. *Economics and Sociology, 18*(3), 229-253. https://doi.org/10.14254/2071-789X.2025/18-3/13

62. Vasylieva, T., Gutowski, P., & Smiech, L. (2025b). Dynamic inflation responses to war-related electricity shocks: DTW-based evidence from European energy and renewables regimes. *Journal of International Studies, 18*(4), 180-203. https://doi.org/10.14254/2071-8330.2025/18-4/9

63. Vasylieva, T., Vakulenko, I., & Horsch, A. (2025c). The impact of electricity price shocks triggered by Russia's invasion of Ukraine on inflation in European countries: Insights for public governance. *Problems and Perspectives in Management, 23*(4), 486-512. https://doi.org/10.21511/ppm.23(4).2025.35

64. Verschuur, J., Lumma, J., & Hall, J. W. (2025). Systemic impacts of disruptions at maritime chokepoints. *Nature Communications, 16*(1), Article 10421. https://doi.org/10.1038/s41467-025-65403-w

65. Viet, L. T., & Thanh, H. P. (2024). A bibliometric analysis of research

on trade remedies. *Problems and Perspectives in Management, 22*(1), 578-592. https://doi.org/10.21511/ppm.22(1).2024.46

66. Wang, K.-H., Wang, Z.-S., Yunis, M., & Kchouri, B. (2023). Spillovers and connectedness among climate policy uncertainty, energy, green bond and carbon markets: A global perspective. *Energy Economics, 128,* Article 107170. https://doi.org/10.1016/j.eneco.2023.107170

67. Wang, Y., Bouri, E., Fareed, Z., & Dai, Y. (2022). Geopolitical risk and the systemic risk in the commodity markets under the war in Ukraine. *Finance Research Letters, 49,* Article 103066. https://doi.org/10.1016/j.frl.2022.103066

68. World Bank, Government of Ukraine, European Union, & United Nations. (2026, February). *Ukraine fifth rapid damage and needs assessment (RDNA5): Main report February 2022–December 2025*. World Bank. Retrieved from https://documents1.worldbank.org/curated/en/099022026094036395/pdf/P514499-22f93f3a-4278-42bc-b907-db9553d12069.pdf

69. Wu, R., Li, B., & Qin, Z. (2024). Spillovers and dependency between green finance and traditional energy markets under different market conditions. *Energy Policy, 192,* Article 114263. https://doi.org/10.1016/j.enpol.2024.114263

70. Yagi, M., & Managi, S. (2022). The spillover effects of rising energy prices following 2022 Russian invasion of Ukraine. *Economic Analysis and Policy, 77,* 680-695. https://doi.org/10.1016/j.eap.2022.12.025

71. Zhang, D., Chen, X. H., Lau, C. K. M., & Cai, Y. (2023). The causal relationship between green finance and geopolitical risk: Implications for environmental management. *Journal of Environmental Management, 327,* Article 116949. https://doi.org/10.1016/j.jenvman.2022.116949

http://dx.doi.org/10.21511/ppm.24(3).2026.52

APPENDIX A. Keyword preprocessing materials

Scopus search query

TITLE-ABS-KEY ((“Russia-Ukraine war” OR “Russia Ukraine war” OR “Russian-Ukrainian war” OR “Russo-Ukrainian war” OR “Russian Ukrainian conflict” OR “Russia-Ukraine conflict” OR “war in Ukraine” OR “Ukraine war” OR “Ukraine conflict” OR “Ukrainian crisis” OR “Russian invasion of Ukraine” OR “Russian invasion” OR “full-scale invasion” OR “full scale invasion” OR “Russian aggression” OR “military aggression” OR “Russia’s war” OR (war W/3 Ukrain*) OR (Russia* W/3 (war OR invasion OR aggression OR conflict*)) OR (armed W/2 conflict*) OR (military W/2 conflict*) OR “war-related shock*” OR “conflict-induced shock*” OR (geopolitical W/2 (conflict* OR crisis OR shock* OR tension* OR risk* OR disruption*)) OR sanction* OR embargo*) AND (“energy market*” OR “energy sector*” OR “energy system*” OR “power system*” OR “energy industr*” OR “energy suppl*” OR “energy demand” OR “energy secur*” OR “energy independen*” OR “energy resilien*” OR “energy dependenc*” OR “energy import*” OR “energy infrastructure” OR “critical energy infrastructure” OR “power infrastructure” OR electricity OR “power market*” OR “electricity market*” OR “electricity suppl*” OR “electricity price*” OR gas OR “natural gas” OR LNG OR oil OR petroleum OR coal OR “fossil fuel*” OR “fossil energy” OR renewable* OR “renewable energy” OR “clean energy” OR “green energy” OR “low-carbon energy” OR “energy transition” OR decarboni?ation OR “energy diversification” OR “supply diversification”) AND (((“energy market*” OR “energy sector*” OR “energy system*” OR “power system*” OR “energy suppl*” OR “energy price*” OR “electricity price*” OR “energy infrastructure” OR “energy import*” OR “energy dependenc*”) W/5 (transform* OR change* OR disrupt* OR shock* OR crisis OR volatil* OR restructur* OR reconfigur* OR adjustment* OR transition* OR damage* OR destruction OR shortage* OR interruption* OR instability OR vulnerab*)) OR (“energy polic*” W/5 (change* OR reform* OR adjust* OR response* OR transition* OR transform* OR intervention* OR measure* OR diversification OR securitisation OR adaptation OR resilience)) OR ((energy OR electricity OR gas OR oil OR coal OR “fossil fuel*”) W/5 (transmission OR spillover* OR contagion OR diffusion OR propagation OR “chain reaction*” OR “cross-sector*” OR “cross-country” OR asymmetr* OR interdependen* OR nexus)) OR (“energy crisis” OR “energy shock*” OR “energy supply shock*” OR “energy price shock*” OR “energy supply disruption*” OR “energy market disruption*” OR “energy market transformation*” OR “energy market restructuring” OR “energy market volatil*” OR “energy shortage*” OR “electricity shortage*” OR “gas supply disruption*” OR “fossil fuel disruption*” OR “energy infrastructure damage” OR “energy infrastructure destruction” OR “energy infrastructure attack*” OR “energy weapon*” OR “weaponisation of energy” OR “weaponization of energy”) OR ((government* OR regulator* OR authorit* OR polic*) W/5 (“energy crisis response*” OR “energy support measure*” OR subsid* OR compensation OR “price cap*” OR “state aid” OR rationing OR diversification OR “strategic reserve*”))) AND ((“macroeconomic stability” OR “macroeconomic instability” OR “macroeconomic resilience” OR “macroeconomic vulnerability” OR “macroeconomic risk*” OR “macroeconomic effect*” OR “macroeconomic impact*” OR (macroeconomic W/3 (stability OR instability OR resilience OR vulnerability OR risk* OR shock* OR adjustment* OR consequence*)) OR “economic stability” OR “economic instability” OR “economic resilience” OR “economic vulnerability” OR “economic security” OR “price stability” OR inflation OR “energy inflation” OR “food inflation” OR “cost-push inflation” OR “cost of living” OR “economic growth” OR GDP OR recession OR stagnation OR unemployment OR “industrial output” OR “industrial production” OR productivity OR “public debt” OR “government debt” OR “sovereign debt” OR “fiscal stability” OR “fiscal sustainability” OR “fiscal risk*” OR “fiscal balance” OR “public finance” OR “budget deficit” OR “government expenditure” OR “monetary stability” OR “monetary polic*” OR “interest rate*” OR “exchange rate*” OR “balance of payments” OR “current account” OR “trade balance” OR affordability OR “energy affordability” OR “energy poverty” OR welfare) OR (“systemic financial risk*” OR “systemic risk*” OR “systemic financial instability” OR “financial stability” OR “financial instability” OR “financial resilience” OR “financial vulnerability” OR “financial risk*” OR “financial stress” OR “financial distress” OR “finan-

cial shock*" OR "financial sector risk*" OR "banking stability" OR "banking instability" OR "banking risk*" OR "bank risk*" OR "credit risk*" OR "default risk*" OR "liquidity risk*" OR "market risk*" OR "sovereign risk*" OR "operational risk*" OR "climate-related financial risk*" OR "transition risk*" OR "financial contagion" OR "risk contagion" OR "financial spillover*" OR "financial market volatil*" OR "sectoral lending" OR "bank lending" OR "credit market*" OR "credit allocation" OR "credit structure" OR "credit standard*" OR "lending standard*" OR "credit condition*" OR "non-performing loan*" OR NPL OR "loan loss*" OR "financial regulation" OR "banking regulation" OR "prudential regulation" OR "macroprudential regulation" OR "microprudential regulation" OR "regulatory polic*" OR "regulatory response*" OR "regulatory reform*" OR "financial supervision" OR "stress test*" OR "risk management strateg*" OR "financial risk management" OR "energy risk management" OR "enterprise risk management") OR ("investment prospect*" OR "investment outlook" OR "investment potential" OR "investment opportunit*" OR "investment attractiveness" OR "investment climate" OR "investment risk*" OR "investment priorit*" OR "investment strateg*" OR "investment model*" OR "investment decision*" OR "energy investment*" OR "energy finance" OR "energy infrastructure investment*" OR "infrastructure investment*" OR "infrastructure finance" OR "infrastructure reconstruction" OR "infrastructure recovery" OR "infrastructure resilience" OR "renewable energy investment*" OR "clean energy investment*" OR "green investment*" OR "green finance" OR "transition finance" OR "climate finance" OR "sustainable finance" OR "reconstruction finance" OR "recovery finance" OR "project finance" OR "capital investment*" OR "capital expenditure" OR CAPEX OR "capital flow*" OR "capital formation" OR "foreign direct investment" OR FDI OR "private investment" OR "public investment" OR "government investment" OR "institutional investment" OR "public-private partnership*" OR PPP OR "blended finance" OR "energy project*" OR "energy financing" OR "stranded asset*" OR ((short-term OR "short term" OR medium-term OR "medium term" OR long-term OR "long term") W/3 (investment* OR priorit* OR strateg* OR infrastructure OR reconstruction OR recovery OR financing)) OR ((post-war OR postwar OR reconstruction OR recovery OR rebuilding) W/5 (energy OR infrastructure OR investment* OR finance OR financing)))) AND (Ukraine OR Ukrainian OR Russia* OR "European Union" OR Europe* OR "EU member state*" OR "European countr*" OR "Eastern Europe" OR "Central Europe" OR "Central and Eastern Europe" OR CEE OR Germany)) AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "ch") OR LIMIT-TO (DOCTYPE , "cp") OR LIMIT-TO (DOCTYPE , "bk")) AND PUBYEAR > 2013 AND PUBYEAR < 2027

Table A1. Custom exclusion list used for keyword preprocessing

Number of excluded keywords	Excluded keywords
25	Economic analysis, tvp-var, vector autoregression, rolling-window var method, rolling window, article, regression analysis, uncertainty analysis, empirical analysis, machine learning, wavelet analysis, network analysis, panel data, parameter vectors, wavelet coherence, 'current, auto-regressive, controlled study, covar, cost benefit analysis, frequency domain analysis, granger causality test, numerical model, model, models

Note: Terms were excluded because they represented generic methodological, statistical or indexing expressions rather than substantive concepts relevant to the research domain. The expression 'current is reproduced exactly as it appears in the supplied exclusion file; if the actual Biblioshiny entry was current, I would change it accordingly before submission.

Table A2. Keyword thesaurus used for harmonisation

Harmonised term	Variants merged under the term
Russian Federation	Russia; Russia Federation
energy market	energy markets; power markets; power market
renewable energy	renewable energies
geopolitical risk	geopolitical risks
investment	investments
financial markets	financial market
energy transition	energy transitions
exchange rate	exchange rates; currency exchange rate

http://dx.doi.org/10.21511/ppm.24(3).2026.52

Harmonised term	Variants merged under the term
crude oil and exchange rate market	crude oil and exchange rate markets
crude oil—geopolitic double layer network	crude oil—geopolitics double layer network
oil	crude oil; crude oils
Russia–Ukraine war	Russia-Ukraine war; Russo-Ukrainian war; Ukraine war; Russian-Ukrainian war; Russian invasion; war in Ukraine; Russian-Ukraine war; Russian-Ukrainian conflict; Russian–Ukrainian war; Russian invasion of Ukraine; RussiaUkraine war; the Russian-Ukrainian war; the war in Ukraine; Ukraine-Russia crises; Ukraine-Russia war; Russia-Ukraine conflict; Russia–Ukraine conflict; the Russia–Ukraine conflict
Russian gas and oil import	Russian gas and oil imports
geopolitical conflict	geopolitical conflicts
geopolitical crisis	geopolitical crises
economic growth	economic growths
greenhouse gases	greenhouse gas
human	humans
carbon emission	carbon emissions; carbon dioxide
decarbonisation	decarbonization; decarbonization of the economy
spillover effects	spillover effect
gross domestic product	GDP
energy poverty	energy poverties
energy investment	energy investments
commodity	commodities
commodity market	commodity markets
energy price	energy prices
energy system	energy systems
carbon market	carbon markets
energy shock	energy shocks
spillover	spillovers
gas	gases
oil price	oil prices
energy supply	energy supplies

Note: Duplicate mappings for geopolitical risk/geopolitical risks that appeared more than once in the original thesaurus file were consolidated in Table A2 because they represent the same mapping and add no additional information. Capitalisation in the table is used only for readability; preprocessing was based on the terms supplied in the thesaurus.

APPENDIX B

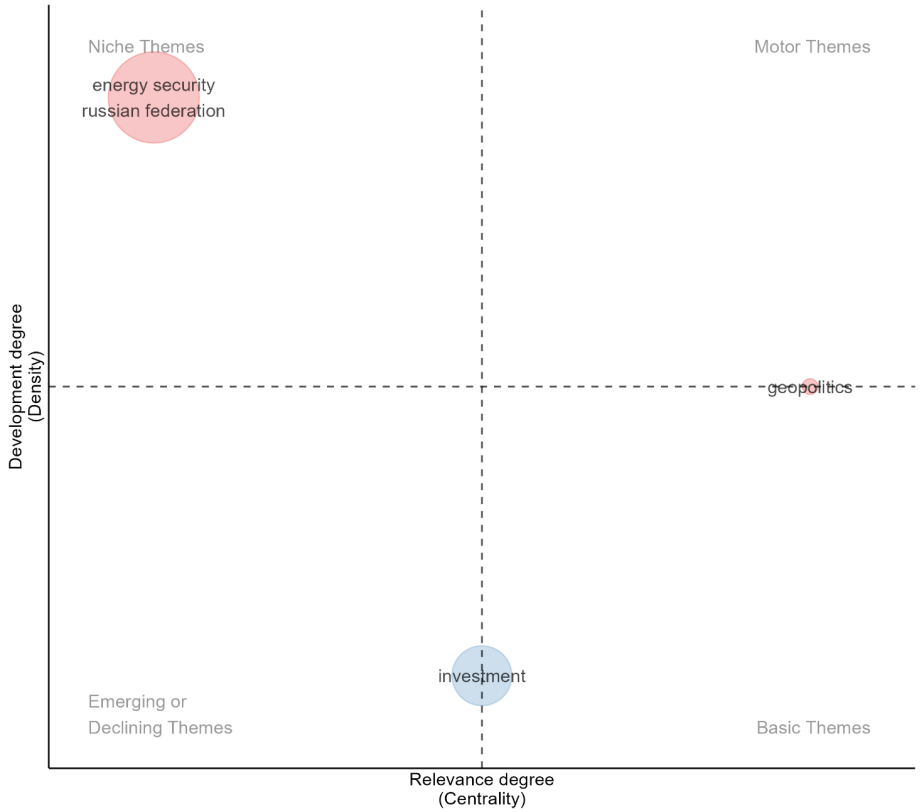
Table B1. Most cited papers and their citation performance by year of publication

Paper	Total Citations	TC per Year	Normalized TC
Guan et al. (2023)	363	90.8	9.028885
Lin et al. (2023)	306	76.5	7.611126
Wang et al. (2022)	276	55.2	9.03386
Lorente et al. (2023)	239	59.8	5.944638
Gajdzik et al. (2024)	237	79.0	17.86247
Fang and Shao (2022)	236	47.2	7.724605
Cui et al. (2023)	221	55.2	5.496924
Zhang et al. (2023)	128	32.0	3.183739
Wang et al. (2023)	120	30.0	2.984755
Karkowska and Urjasz (2023)	115	28.8	2.86039
Fabra (2023)	103	25.8	2.561915

Note: Table B1 includes only papers that received more than 100 total citations. Total Citations represents the cumulative number of citations received by a paper; TC per Year adjusts this value for the number of citable years; and Normalized TC compares the paper's citation impact with the average citation performance of all documents published in the same year.

Table B2. Most locally cited documents with at least five local citations

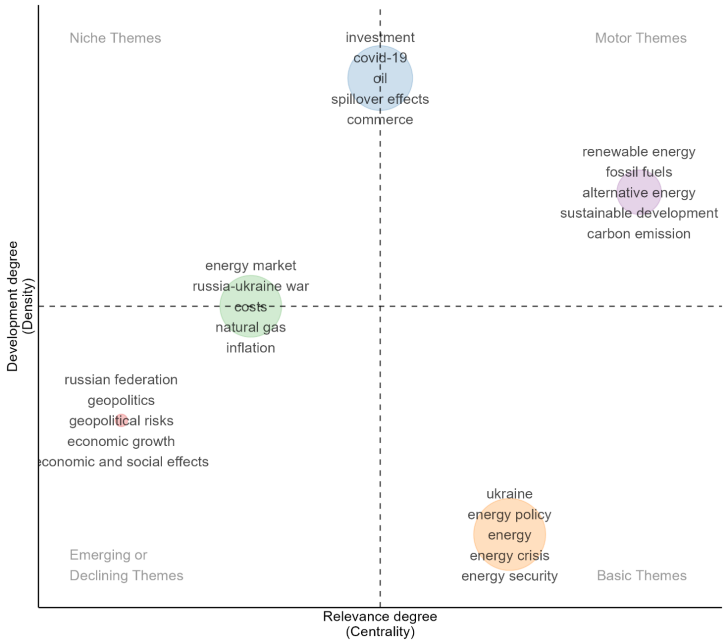
Paper	Local Citations	Global Citations	LC/GC Ratio (%)	Normalized Local Citations	Normalized Global Citations
Fang and Shao (2022)	19	236	8.050847	12.52273	7.724605
Van de Graaf (2014)	14	24	58.33333	1	1
Guan et al. (2023)	13	363	3.581267	8.574468	9.028885
Wang et al. (2022)	12	276	4.347826	7.909091	9.03386
Cui et al. (2023)	11	221	4.977376	7.255319	5.496924
Lorente et al. (2023)	11	239	4.60251	7.255319	5.944638
Sokhanvar and Bouri (2022)	9	93	9.677419	5.93617	2.313185
Gong et al. (2023)	6	77	7.792208	3.957447	1.915218
Yagi and Managi (2022)	5	80	6.25	3.297872	1.989837
Umar et al. (2024)	5	54	9.259259	9.897959	4.06993



Note: Local Citations denotes the number of times a paper was cited by other documents included in the analyzed bibliometric corpus. Global Citations represents the total number of citations the paper has received across all source databases. The LC/GC Ratio is the proportion of global citations originating from documents within the analyzed corpus, expressed as a percentage. Normalized Local Citations and Normalized Global Citations compare each citation count to the average citation performance of documents published in the same year. Table B2 includes only papers with five or more local citations.

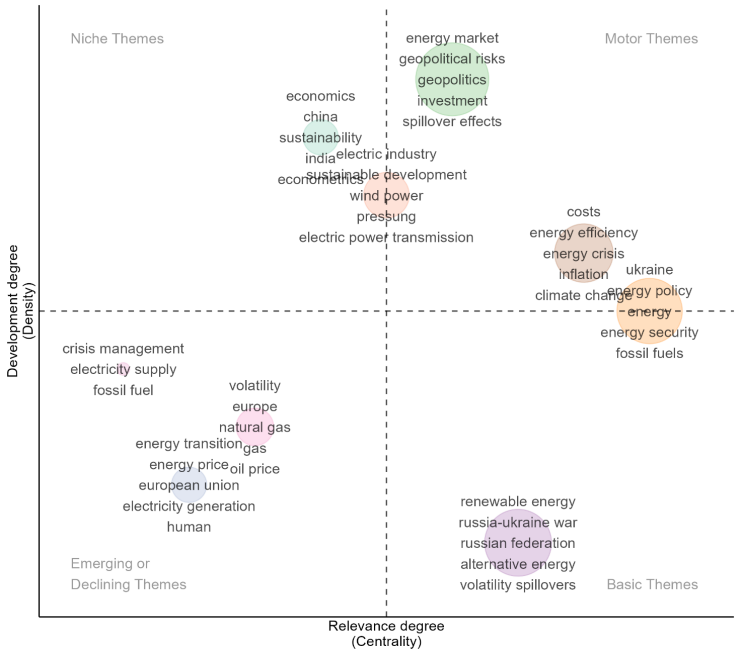
Figure B1. Thematic map of the research field, 2014–2021

http://dx.doi.org/10.21511/ppm.24(3).2026.52



Note: Thematic evolution was analyzed across three time slices: 2014–2021 (*n* = 14), 2022–2025 (*n* = 322), and the first half of 2026 (*n* = 81). For each strategic map, the analysis used the merged keyword field (All Keywords), retained up to 250 terms and was based on unigrams only. Stemming was not applied, and thematic clusters were identified using the Louvain community-detection algorithm. The graphical parameters were set to a node-size scaling factor of 0.3, a maximum of five labels per cluster and a community-repulsion value of 0.5. Connections between clusters indicate thematic continuity based on shared terms across consecutive periods. Because the three time slices differ substantially in duration and document count, differences in the number, size, and apparent development of thematic clusters should be interpreted with caution.

Figure B2. Thematic map of the research field, 2022–2025



Note: Thematic evolution was analyzed across three time slices: 2014–2021 (*n* = 14), 2022–2025 (*n* = 322), and the first half of 2026 (*n* = 81). For each strategic map, the analysis used the merged keyword field (All Keywords), retained up to 250 terms and was based on unigrams only. Stemming was not applied, and thematic clusters were identified using the Louvain community-detection algorithm. The graphical parameters were set to a node-size scaling factor of 0.3, a maximum of five labels per cluster and a community-repulsion value of 0.5. Connections between clusters indicate thematic continuity based on shared terms across consecutive periods. Because the three time slices differ substantially in duration and document count, differences in the number, size, and apparent development of thematic clusters should be interpreted with caution.

Figure B3. Thematic map of the research field, first half of 2026