



Bibliometric analysis of finance and natural resources: past trend, current development, and future prospects

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Abstract

The finance and natural resources revenue nexus play a critical role in an economy. The recent development and significant increase in academic literature regarding the resource-finance nexus are the primary motivations for conducting this study. This study aims to conduct a bibliometric analysis of 363 documents published between 1976 and 2021 collected from the Scopus database. The results have been demonstrated via graphs, tables, knowledge maps about the past trends, growth, and prospects using co-occurrence, co-authorship, and co-citation analysis via the VOSviewer tool. This study has identified prolific authors, journals, countries, academic institutions, and future pathways. The findings indicate that China has the highest share of publications (88, 24.2%), followed by Pakistan (58, 15.9%) and Turkey (37, 10.2%). The most productive academic institution is the Beijing Institute of Technology in China (13, 3.6%). This study proposes new avenues for further research concerning the resource-finance nexus, such as ecological footprint, sustainability, fiscal decentralization, green investment, energy prices, environmental quality, technological innovation, financial resource curse (especially the stock market resource curse), human capital, and renewable energy in policy development and sustainability towards the achievement of the SDGs.

Keywords Financial development · Natural resources rents · Bibliometric analysis · Energy · Financial resource curse · Institutional quality

1 Introduction

Natural resources revenues play an essential role in the development of any country. The natural resource windfall revenues are channeled through the financial system, specifically the banking system and stock market, into the economy, and hence, financial development is one of the critical aspects of this development process (Shahbaz et al., 2018). Such an optimistic viewpoint can be traced back to Adam Smith and David Ricardo, who contended that countries blessed with natural resources such as oil and gas could base

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their development on these resources revenues, especially in the early stages of economic development.

However, more than three decades ago, it was realized that natural resources could lead to a natural resource curse rather than a blessing for an economy, i.e., lower economic growth (Auty, 1993). Similarly, a decade ago, it was determined that such natural resource revenues could cause a financial resource curse rather than a blessing and hence lower financial development (Beck, 2011; Shahbaz et al., 2018). Consequently, due to its increasing importance, there has been a recent growth in the number of articles published on the resource-growth-finance nexus; however, the scope of the published literature is large and fragmented. To consolidate the learning on resource-growth-finance, previous researchers have attempted to conduct a review of the literature on the resource-growth nexus, such as (Badeeb et al., 2017; Deacon, 2011; Frankel, 2010; Gilberthorpe & Papyrakis, 2015; Van Der Ploeg, 2011; Van Der Ploeg & Poelhekke, 2017; Venables, 2016). Nevertheless, despite the recognized social and economic importance of financial development and natural resources, there is no literature review or systematic literature review of the resource-finance nexus. Moreover, a comprehensive performance analysis of scientific actors and knowledge mapping, or in other words, a bibliometric or scientometric analysis of the resource-finance nexus, has not been conducted.

The first reason we came across, is that since the resource-finance nexus is just a decade old which divert the researcher attention more towards the empirical side rather than the literature review and bibliometric analysis (as the trend can be confirm from Fig. 2), hence we tried to hold this opportunity. Second, bibliometric analysis requires large number of publications and to some extent a wide range of time period which was not possible earlier due to a smaller number of articles and duration. Third, because of new developments in econometric techniques which overcomes the conventional econometric techniques and thus spike in publications to give new evidences of curse or blessings in resource-finance nexus. Fourth, due to the differentiation between the measures, natural resource abundance and natural resource dependence. Fifth, the nonlinear and asymmetric relationship investigation leading to re-visits of the studies making the spike in publication output.

To fill this research gap, the current study aims to conduct a comprehensive performance analysis consisting of both qualitative and quantitative approaches, as well as science mapping consisting of intellectual and conceptual structures for future resource-finance research avenues. In other words, this paper aims to analyze the bulk of research publications covering approximately 46 years of the resource-finance nexus literature, with the purpose of uncovering the past trends, current developments, and future prospects. In order to achieve this objective, the current study aims to answer the following research questions: (1) What are the annual and cumulative publication trends over time? (2) What are the productive journals and articles? (3) Who are the most prolific authors? (4) Which countries and academic institutions are most productive? (5) What is the pattern of co-occurrence and co-citations of author keywords? (6) What are the emerging hotspots based on average publication years of author keywords? Therefore, to answer the research questions of the current study, bibliometric analysis with new visualizing techniques is the ideal approach (Zyoud & Zyoud, 2021). The performance analysis of scientific actors such as keywords, documents, authors, and journals will help to understand the spike of the publications and the impact of the research area. Similarly, science mapping with co-occurrence and co-citation analysis, knowledge maps, and network diagrams will help to understand the conceptual structure of the resource-finance nexus research domain (Verma & Yadav, 2021). Finally, in-depth analysis of the co-occurrence and co-citation analysis and bibliometric knowledge maps will help to identify the allied themes in the resource-finance

nexus avenue as well as the emerging hotspots for future research direction. Furthermore, literature reviews or surveys often suffer from subjectivity bias; hence, bibliometric analysis provides a solution to resolve the issue of subjectivity bias and produce a realistic outcome of the analysis. Thus, conducting a bibliometric study of the resource-finance nexus seems judicious, valid, and appropriate.

In addition, this study is the most inclusive and comprehensive in terms of the time frame and number of documents. Taking into account the global financial crisis, oil price volatility across the globe along with other natural resources, the recent significant impact of the COVID-19 pandemic on economies, and technological advancements, especially in the field of finance such as FinTech and financial digitalization, it is essential that developments are tracked for future directions in managing resource rents and the financial development nexus. This study will act as a basis for the identification of research themes and determination of emerging topics to guide research scholars, academicians, practitioners, and policy-making authorities for future research on the aforementioned nexus.

This article is structured into five sections. Section two elaborates on the literature and theoretical support for the resource-finance nexus. Section three describes the research methodology, a detailed stepwise explanation, and various software used in the analysis. Section four elucidates the results and discussion of the emerging hotspots for future research directions. Finally, section five focuses on the conclusion and the study limitations.

2 Literature review

The optimistic view that natural resources are a blessing for an economy dominated until the 1980s, with limited opposition to this conventional wisdom (Nankani, 1979; Singer, 1975). Subsequently, the Dutch disease phenomenon was modeled, suggesting an adverse effect on the economy (Corden & Neary, 1982) and (Corden, 1984). Similarly, the term resource curse was coined in 1993; for instance, (Auty, 1993) was considered the pioneer of the natural resource curse (NRC) theory in the literature. The natural resource curse suggests that countries rich in natural resources have lower economic growth than countries deficient in natural resources. Following (Auty, 1993), many empirical studies have reported on the natural resources curse; for instance, see (Sachs & Warner, 1995, 1997, 1999, 2001). Similarly, others have focused on broader channels whereby natural resources can affect sustainable economic growth, such as human capital, savings, and investments, see (Gylfason, 2001, 2006; Gylfason & Zoega, 2006).

The resource-finance-growth nexus is largely discussed in the context of the natural resource curse; however, a paradigm shift in the shape of the financial resource curse (FRC) see (Beck, 2011) has recently attracted the attention of researchers (Shahbaz et al., 2018). According to this theory, countries with abundant natural resources have lower financial development. The financial resource curse (FRC) hypothesis suggests that this is another economic channel through which a surge in capital can harm economic performance. Therefore, the FRC links easy and cheap access to abundant foreign capital and weak productivity growth (Dogan et al., 2020b). Natural resource revenues are an essential source of income for any economy, and a country's financial system facilitates the smooth transfer of this income to the private sector effectively and accurately (Asif et al., 2020). However, as natural resource income is an easy alternative to other revenue sources, insufficient focus

on sectoral development leads to the neglect of the credit system and the institutional infrastructure and harms financial development (Bhattacharyya & Hodler, 2014).

The role of natural resources in economic growth and financial development has undeniable importance and a long history and is primarily addressed within the framework of the NRC-FRC hypothesis (Dogan et al., 2020a). On the other hand, the resource-finance nexus is a dynamic issue, and researchers have tried to determine various theories and models to explain the relationship. However, literature reviews and bibliometric studies on FRC are limited. Hence, a gap exists in terms of both a literature review and bibliometric study considering the resource-finance nexus. However, this article primarily focuses on bibliometric analysis.

3 Research methodology

This bibliometric study systematically examines articles on the resource-finance nexus indexed in the Scopus database. Bibliometric analysis is considered a robust instrument for assessing scientific publications (Liu et al., 2014; Zhang et al., 2019). Bibliometrics is a persuasive and reliable tool used for managing information and producing analytical results (Liu et al., 2020). However, its use in finance is relatively new (Zaby, 2019). By utilizing network mapping and quantitative techniques for analyzing the resource-finance nexus literature, the authors expect to make a substantial contribution by identifying the evolution of past trends and current developments and thus present a valuable reference for future research prospects (Ali et al., 2022b; Maia et al., 2019).

Every research generally suffers from limitations and is not free from bias; hence, the authors recognize this possibility. The authors acknowledge the linguistic problems related to the keyword terms used and database biases (Aromataris & Pearson, 2014; Taşkın & Al, 2014). To avoid such biases, minimize errors, and be practical, by following (Maia et al., 2019), the authors developed and used a systematic approach grounded on (Costa et al., 2017; Do Prado et al., 2016), as shown in Fig. 1.

Step 1: Planning

We started by identifying the importance of a research area that seems more critical to economic development across the globe (Stage 1.1). An initial thorough literature review revealed the historical importance of natural resources, growth, and financial development across the globe in raising living standards and transforming from a developing economy into a developed one (Faisal et al., 2019; Nawaz et al., 2019). The authors conducted a preliminary search by using the term “financial development” and its synonym keywords in combination with other keywords including “economic growth” and “natural resources”. The resource-growth nexus was identified over a century ago, and since the first empiric study by (Schumpeter, 1911), the topic has been widely discussed, and numerous literature surveys have been conducted. However, in his preliminary study, Beck (2011) identified the relationship between financial development and natural resources, and this led to a paradigm shift in the research from the resource-growth to the resource-finance nexus. A decade has passed since that time and no study has been able to determine the synthesis, direction, and prospects of the resource-finance nexus.



Fig. 1 Steps of the systematic process for conducting bibliometric analysis. Sources: adapted from (Costa et al., 2017; Do Prado et al., 2016; Maia et al., 2019)

Given the topic importance and the identification of the gap in the literature, the authors confirmed the lack of any “literature review”, “systematic literature review,” and bibliometric studies on the resource-finance nexus (stage 1.2). The authors failed to find any review or bibliometric study after a thorough search on the topic. Various search terms such as “literature review”, “systematic literature review,” and “bibliometric studies” were used in the Scopus database as well as Google Scholar and Web of Science (WOS) databases for a robustness check. However, no relevant records were returned, even after allowing for all fields. Hence, this study scope allows detailed bibliometric analysis and open choice without limiting or filtering by subject area, time, affiliation etc. (Stage 1.3).

Further to the quantitative techniques and descriptive analysis used in answering questions regarding document types and developments over time, other interactive networks are also helpful to answer collaborations and networking questions in bibliometric analysis (Mingers & Leydesdorff, 2015). Different types of software are used for bibliometric analysis, the most common of which are CitNetExplorer, CiteSpace, and VOSviewer. CitNetExplorer focuses on the analysis at the level of the individual publication, while VOSviewer focuses on the analysis at an aggregate level. Furthermore, CitNetExplorer analyzes citation networks of publications with explicit consideration of the time dimension, while VOSviewer analyzes any bibliometric network along with co-citation and bibliographic coupling (Gutiérrez-Nieto & Serrano-Cinca, 2019; Van Eck & Waltman, 2017). The size of a visualized network in CiteSpace influences its clarity and complexity;

researchers are unlikely to know which configuration generates the most suitable visualization (Chen, 2016; Maia et al., 2019), while VOSviewer maps have excellent visualization features. Furthermore, CiteSpace requires the conversion of Scopus data files into a text file from RIS-file format (Maia et al., 2019), while VOSviewer allows for Scopus data files and no conversion is needed.

Therefore, we used VOSviewer developed by (Van Eck & Waltman, 2020) to visualize bibliographic information, authors' collaborations, and networks, and keywords co-occurrence analysis. The study aims to show the aggregate level overall trends and development and create knowledge maps broadly covered by VOSviewer (Gutiérrez-Nieto & Serrano-Cinca, 2019; Van Eck & Waltman, 2017). VOSviewer has been widely used in recent studies such as (Kapoor et al., 2018; Khudzari et al., 2018; Zaby, 2019). However, to the best of the authors' knowledge, no study has yet analyzed the resource-finance nexus literature using bibliometric analysis and VOSviewer.

Google Scholar, Web of Science, and Scopus are the primary databases used for bibliometric analysis regarding citation indexes and academic literature (Ayub et al., 2021; Gutiérrez-Nieto & Serrano-Cinca, 2019; Harzing & Alakangas, 2016; Mongeon & Paul-Hus, 2016). However, Google Scholar lacks a quality control process (Gutiérrez-Nieto & Serrano-Cinca, 2019). Despite offering a wide range of science coverage (Filser et al., 2017), WOS may not cover as wide a range of subjects as the Scopus database, which is regarded as the largest citation and abstract database of peer-reviewed literature and covers more topics compared to WOS (Ferreira Mercuri et al., 2016; Khudzari et al., 2018; Maia et al., 2019). Similarly, WOS may gather more points than the Scopus database with regard to scientific quality check for the publications they index, but in terms of the number of indexed journals, the WOS databases only have 12,000 titles, while Scopus has more than 20,000 (Verma & Yadav, 2021). Furthermore, Scopus has diverse and robust instruments for searching and analysis that help to perform more advanced evaluations on the extracted data than the WOS database (Zyoud & Fuchs-Hanusch, 2020). Moreover, Scopus has higher flexibility in terms of enabling a comprehensive overview of several scientific research fields (Yataganbaba & Kurtbaş, 2016). Because this study aims to focus on comparatively more topics and subjects and a wider scope of documents published in the resource-finance nexus, this study selected the Scopus database as it is more appropriate for the bibliometric analysis in this context (Stage 1.4).

Step 2: Search strategy

The authors performed various key search strings on 4 January 2021, using the key terms “financial development”, “financial deepening”, “banking development”, “stock market development”, “natural resource”, “natural resource curse”, “natural resources rents” in the title, abstract, and keywords and generated different results. Similarly, successive searches were made until 5th January 2022 using different keyword combinations to ensure that every keyword related to resource-finance nexus is included (stage 2.1 and 2.2). The variants identified for financial development and natural resources via preliminary analysis of the articles were noted and closed in quotation marks to search for exact terms. The Boolean operator “AND” was added to confine the search to the resource-finance nexus.

It is important to note that for the searches, the field tags used were title, abstract, and keywords; this is because the authors were only dealing with the Scopus database and wanted to reach every article that was concerned with the resource-finance nexus. This strategy was successful as some important articles were missing when field tags such

title, title and abstract were used. Secondly, the study was restricted to the year 2021 and excluded the year 2022 (8 articles) because it is a temporal analysis, and each time search string could show an increased number of articles due to the listing of new research articles in the journals indexed in the Scopus database.

Likewise, to give a wide range of coverage, in terms of the types of documents, the authors included all articles, conference proceedings, books, and book chapters after finalizing the terms, Boolean operators, and field tags. Likewise, no restrictions on scientific fields or language were imposed. The article titles, abstracts, and full articles (if needed) were examined the mark their relevancy and add records to “saved searches” in the database (Stages 2.3 and 2.4). The final query string was:

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TITLE-ABS-KEY ( "Financial Market Development" OR "Financial development" OR
"Financial sector Development" OR "Financial deepening" OR "Financial intermediation"
OR "Banking development" OR "Banking sector Development" OR "Financial Deepening"
OR "Stock Market Development" OR "Bond Market Development" OR "Insurance Market
Development" OR "Financial liberalisation" OR "financial liberalization") AND TITLE-
ABS-KEY ( "Natural resources" OR "Resource curse" OR "resources rent" OR "natural
resource abundance" OR "resources abundance" OR "natural resource rent" OR "natural
resources rent" OR "Resources curse" OR "natural Resource curse" OR "natural Resources
curse" OR "Dutch Disease" OR "Financial Resource Curse" OR "Financial Resources
Curse" OR "resource blessing" OR "resource blessing" OR "natural resource blessing" OR
"natural resources blessing" OR "oil" OR "crude oil" OR "forest" OR "coal" OR "min-
erals" OR "silver" OR "Precious commodities") AND NOT EID ( 2-s2.0-84,980,295,048
OR 2-s2.0-84,980,829,184 OR 2-s2.0-85,097,752,327 OR 2-s2.0-85,100,137,090 OR
2-s2.0-85,097,063,300 OR 2-s2.0-33,748,599,290 OR 2-s2.0-84,947,943,555 OR
2-s2.0-84,938,749,812 OR 2-s2.0-84,906,266,639) AND ( EXCLUDE ( PUBYEAR,
2022)).
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Step 3: Organization of data

In continuation of the previous sections, Step 3 covers the organization of downloaded data files in “CSV” and their importation into the different software for further analysis. The software used in the analysis included Microsoft Excel 365, Windows Text Document (Notepad), Google Earth, Thomson Reuters’s EndNote X9, and VOSviewer version 1.6.15. Similarly, the “export refine” file was downloaded to calculate the annual publication and cumulative publication graph (Stages 3.1 and 3.2).

The articles were scrutinized for missing author names, authors’ IDs, duplicates and review articles using MS Excel software. The “EIDs” of such articles were noted and added to the main search string with the Boolean operator “AND NOT EID” and thus excluded from the final list. The final list was then selected, saved to the “save to list” in the Scopus database and downloaded for further descriptive, quantitative analysis, while VOSviewer software was used to draw knowledge maps. For data analysis and graph, the downloaded “.csv” was first copied to a new MS Excel spreadsheet to use the data, and the final file was downloaded after excluding EIDs as “.csv” for it to be readable by VOSviewer for bibliometric maps (Stages 3.3, 3.4, 3.5, and 3.6).

Step 4: Data analysis

Data analysis was performed using Microsoft Excel 365, Windows Text Document (Notepad), Google Earth, Thomson Reuters's EndNote X9, VOSviewer, Bitly, and Pastebin. EndNote X9 was used for reference management and style formatting. Google Earth was used for mapping the top fifteen (15) academic institutions and their country locations in chronological order, with 1 meaning the top and the rest in descending order until 15.

Microsoft Excel was extensively used to plot the graph for annual and cumulative publication, resolve the missing authors' names and authors' IDs, locate duplicate articles using the conditional formatting tool, and locate EIDs for exclusion from the analysis, and finally, sorting and tabulation of the data. As a result of this process, several tables have been created describing the top tier journals and detailed information, the most cited articles and publishers, the top researchers in the resource-finance nexus, and their details such as the total number of documents listed and citations h-index along with current affiliation. The authors were listed based on the h-index obtained from their articles indexed in the Scopus database on the resource-finance nexus. The h-index is a metric that measures the productivity and impact of scholar's research work and is described as the h number of articles with citations number greater or equal to h (Hirsch, 2005), and is widely used in bibliometric research studies (Ali et al., 2022b; Bornmann et al., 2008; Maia et al., 2019; Rahman et al., 2022). Similarly, this table shows the top countries in terms of publications on the resource-finance nexus, single country publications, and most productive institutions (Stages 4.1 and 4.2).

Further to the above analysis, various network visualization analysis was performed using VOSviewer. VOSviewer is used for bibliometric maps. The bibliometric analysis was performed using co-authorship and co-occurrence analysis. The Windows Text Document (Notepad) was also used during thesaurus file creation to capitalize country and author names, cluster the countries into specific regions of the globe, and upload to VOSviewer. Similarly, it was also used during the creation of the short online link using Bitly and Pastebin. Bitly and Pastebin were used for creating a short online link for the bibliometric maps that can be accessed at any time by any reader to ease their understanding (Stages 4.3 and 4.4).

VOSviewer was used for this study in order to focus on development over time and the aggregate level in the resource-finance nexus (Ayub et al., 2021; Gutiérrez-Nieto & Serrano-Cinca, 2019). Bibliometric maps are created based on the author's keywords and countries, and there is a connection between these items. Nevertheless, it also illustrates clusters, networking, density, co-occurrence analysis, and co-authorship analysis in an area of interest (Van Eck & Waltman, 2020). This software covered the period from 1976 to 2021 because the key string used determined that the first article published and indexed in the Scopus database was in 1976, and the research beyond this year was limited. Similarly, the most prolific authors' networking was also shown in addition to the map for future hotspot research topics in the resource-finance nexus. After rigorous attempts to present a balanced and reasonable explanation of the resource-finance nexus, the final map and configuration obtained were obtained.

Step 5: Reporting the results

All the preceding sections explained the detailed step-by-step methodology used to conduct bibliometric analysis; however, this step presents the descriptive analysis of the figures, graphs, tables, Google maps, bibliographic maps, and analysis findings. The various stages in step 4 were grouped into five sub-parts: "research growth", "productive journals

and articles”, “prolific authors”, “listing and global mapping of countries and academic institutions”, “author keywords and emerging trends/hotspots and future pathways”. These sub-parts were arranged in such a way that a broader general map was displayed to specific future directions and topics of interest for researchers (Maia et al., 2019). To facilitate the understanding of the literature mapping, several figures, tables, and graphs have been added to guide the analysis in each sub-part. Moreover, in addition to other studies such as (Ayub et al., 2021; Khudzari et al., 2018), this study has introduced a short online link for bibliometric maps for the readers in resource-finance nexus (stage 5.1, 5.2, 5.3, 5.4, and 5.5).

4 Results and discussion

4.1 Research growth in the financial development and natural resources nexus

This study considered articles, conference proceedings, book chapters, books, etc., to give an overview of the resource-finance nexus. Figure 2 portrays the research output growth over time, and the oldest article is by (Landsberg & Landsberg, 1976) with a single citation. A total of 363 documents have been published and indexed in the Scopus Database until year 2021 covering a period of approximately 46 years. This further shows that until 2015, very few articles had focused on this phenomenon of interest; however, since 2016, it has grown enormously in terms of publication output. Figure 2 shows that the cumulative publications graph increases at steady rate. Furthermore, the results depict that the articles have been published in 6 different languages, with the majority in English (353). Other languages include Russian (4), French (3), Chinese (2), Croatian (1), and German (1).

There has been significant growth in the number of published articles on the resource-finance nexus in the last five years, as shown in Fig. 2. There was steady growth in the number of articles until 2019. More specifically, in 2020, it increased two-fold compared to the previous year and even more were published in 2021. Overall cumulative growth exhibited a slow increase until 2015, a steady increase until 2019, and an abrupt increase

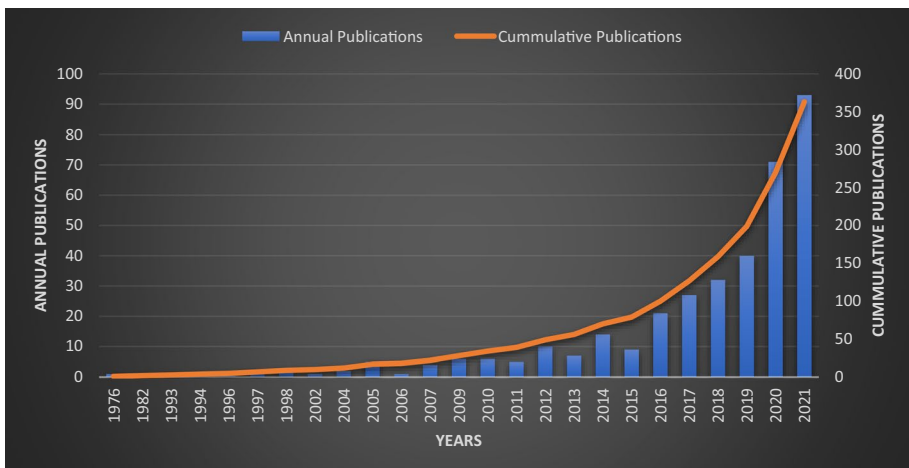


Fig. 2 Annual and cumulative publications between 1976–2021 (Scopus Database)

in 2020 and 2021. The reasons for this increase since 2015 could be as follows. First, as suggested in the literature, the effect of natural resources on economic growth realized through financial channels has recently attracted the attention of researchers (Beck, 2011; Dogan et al., 2020a; Shahbaz et al., 2018). Secondly, recent literature has both theoretically and empirically investigated the relationship between financial development and natural resources; however, the results are still inconclusive and conflicting (Badeeb et al., 2016; Canh & Thong, 2020; Dogan et al., 2020a; Farzanegan et al., 2018; Khan et al., 2020a, 2020c). Third, due to such variations, the topic is attracting interest from various domains, and many researchers have tried to determine the resource-finance nexus utilizing the latest econometric techniques. Fourth, journals are usually multidisciplinary in scope allowing for publications with new conceptual models, new empirical findings, employing new econometric techniques, different contextual backgrounds, and other focuses on mixed articles, including review and empirical studies. Fifth, over time, econometricians have also upgraded the econometric models by removing existing limitations and enabling them to produce more reliable results for the use of policy-making bodies. Hence, such techniques bring novelty and a methodological contribution to research and have been employed to investigate the newly-emerged topic of the resource-finance nexus and the economy, environment, and energy, resulting in more publications.

Consequently, these articles have received a higher number of citations, and resultantly, a high impact factor and CiteScore to the indexed journals where applicable. Sixth, resource-abundant countries receive windfall revenues and are attractive investment hubs for private investment as well as a significant source of revenue for an economy itself, such as the oil sector. Furthermore, they usually incur fewer losses compared to the other sectors; for instance, these natural resources also serve as a source of energy, and therefore contain more margin of risk absorbance. Hence, since this research area is becoming more interesting with a diversity of topics, allowing for more scope with a transversal character, and therefore, the number of articles on this nexus is rising.

Further, the subject area analysis focused on economics, econometrics, and finance. The subject areas are classified as economics, econometrics, and finance (208), social sciences (135), environmental science (116), Business, Management, and Accounting (70), Energy (59), Engineering (21), Arts and Humanities (14). This demonstrates the multidisciplinary and transversal nature of the resource-finance nexus as well as the relevance to other disciplines such as energy, economy, and the environment, among others. Natural resources can lead to economic development and advancement from a developing economy to a developed one (Faisal et al., 2019; Nawaz et al., 2019). Consequently, in this development process, energy undeniably plays a critical role. However, higher energy consumption causes air pollution that negatively impacts biodiversity and the environment, which in turn affects sustainable economic growth (Destek, 2019; Faisal et al., 2020; Zhang et al., 2013). Thus, investment is required in to protect/mitigate against the negative effect on the environment while dealing with natural resources and the development process.

Moreover, economies extract natural resources, such as oil and gas, coal etc., which are also a source of energy and subsequently a source of windfall revenues. These revenues/rents (used interchangeably) thus generated increase liquidity and make it easy for banks and financial markets such as the stock market to provide financial services such as loans and equities to households. small and medium businesses and large companies, and therefore, contribute to financial development as well as economic growth (Ali et al., 2022a; Beck, 2011; Dogan et al., 2020a). Moreover, natural resource exports represent a competitive advantage to economies and are a significant source of foreign exchange revenues (Khan et al., 2019a). Hence, the resource-finance nexus is linked to humankind at the

micro level, while the economy, environment, and energy are connected at the macro level, as shown in Fig. 3.

The subject areas such as engineering (21) and computer science (10) depict that financial development is facilitating digitalization across the globe with the emergence of digital currencies-cryptocurrencies such as Bitcoin, Litecoin, Ethereum as well as technology such as FinTech and crowdfunding. These digital currencies could reduce the role of financial intermediaries and become a source of direct dealing between transacting parties that offers instantaneity at low cost. Moreover, this can be the cheapest source of trading currencies.

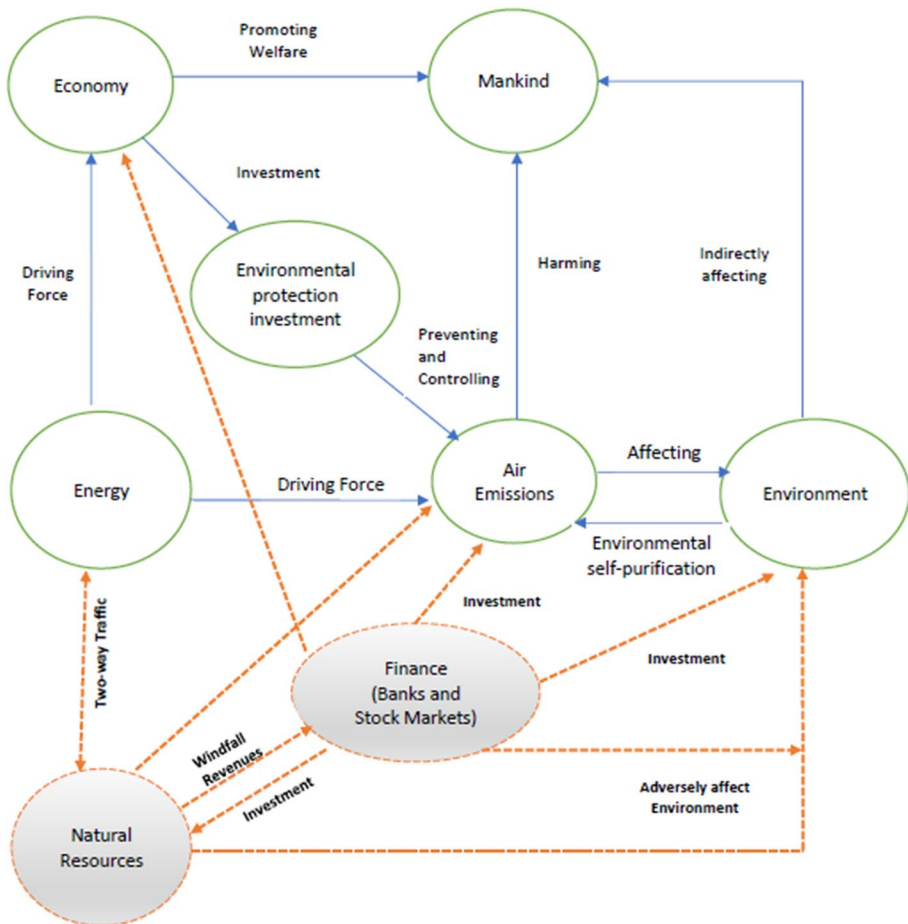


Fig. 3 Resource-finance nexus relevance to energy, economic, environment. Sources: Adapted from (Zhang et al., 2013) modified by Authors with dotted lines

4.2 Productive journals and articles

Table 1 presents the top 10 most productive journals in the resource-finance nexus literature. The result demonstrates that four journals are owned by Elsevier, followed by Wiley-Blackwell (2), MDPI (2), Springer Nature (01), and Econ Journals (01). The 363 publications in this search were published in distinct journals, various books, and conference proceedings. Resources Policy (Elsevier) is at the top of the list, with 48 publications accounting for 16.72% of all publications. These 48 publications have received 1049 citations, and the Scopus coverage year was from 1974 to the present. Resources Policy focuses on economics and public policy issues such as economics, finance, social science relating to minerals, metals, fossil fuel extraction, production, and its uses and aims at publishing empirical, review, and case study articles to make a clear contribution to the literature.

The second journal is Environmental Science and Pollution Research (Springer Nature), with 23 (8.01%) publications and 469 citations, followed by the International Journal of Energy Economics and Policy (Econ Journals) with 10 (3.48%) publications and 94 citations. The fourth journal listed by the number of publications is Sustainability (Switzerland) with 7 (2.44%) publications and 25 total citations, followed by the Energy Policy with 6 (2.09%) publications and 89 total citations. Journal of Environmental Management (Elsevier) has (6, 2.09%) publications and ranked 6th with 204 citations, but is third to Resources Policy in the list based on its high citations. Although the Journal of Environmental Management ranked 6th and Energy Economics ranked 7th in the list, but these are high impact factor journals and are (categorized in Q1, the 2020 Journal Impact Factor, Journal Citation Reports (JCR) (Analytics, 2020).

Besides the impact factor, the CiteScore metric is considered an alternative for determining journal impact and is based on citation data from the Scopus database (Ali et al., 2022b; Khudzari et al., 2018). Examining the impact factor of these journals, Table 1 illustrates that Energy Economics with IF (7.042) is in the lead, followed by the Journal of Environmental Management (6.789), Energy Policy (6.142), Resources Policy (5.634), and Environmental Science and Pollution Research (4.223). Similarly, Table 1 shows that only five journals have a CiteScore greater than 5, with Energy Policy (10.2) at the top, followed by Energy Economics (10), the Journal of Environmental Management (9.8), Resources Policy (6.3), and Environmental Science and Pollution Research (5.5). Both the impact factor and CiteScore indicate high rankings. These high-ranking journals suggest that the resource-finance nexus research is highly appropriate for economics, finance, and econometrics on the one hand, and environmental and energy disciplines on the other hand.

Figure 4 shows the journals in which the articles are published and demonstrates the results of co-citation analysis in the resource-finance nexus. This was performed to cluster the journals on the basis of cited sources using VOSviewer. The journals are the items that are represented by their names in boxes. The higher the weight of the journal, the larger the label and box of the journal (Van Eck & Waltman, 2020). For pictorial brevity, the authors have drawn the map based on a particular criterion, i.e., having at least 20 citations. The connections among the journals on the map are shown through the lines, and the distance shows the relatedness of journals in terms of co-citations. The journals are grouped into clusters of two colors, and it is shown that the resource-finance nexus literature is broadly published in the journals related to the field of Economics, Finance & Econometrics (red color), and Energy & Environmental Sciences (green color). These results are coherent with Table 1. Finally, the most cited articles of these journals are (Shahbaz et al., 2013),

Table 1 Top 10 most productive journals on the financial development and natural resources nexus

Rank	Journal Name with Impact Factor 2020	No. of Publications	No. of Publications %	No. of Citations	Cite Score 2020	Most cited article	Times cited	Publisher
1	Resources Policy (5.634)	48	16.72%	1049	6.3	(Shahbaz et al., 2018)	80	Elsevier
2	Environmental Science and Pollution Research (4.223)	23	8.01%	469	5.5	(Al-Mulali et al., 2015)	117	Springer Nature
3	International Journal of Energy Economics and Policy (Scopus index)	10	3.48%	94	3.5	(Balogh & Jámbor, 2017)	42	Econ Journals
4	Sustainability (3.251)	7	2.44%	25	3.9	(Paun et al., 2019)	12	*MDPI
5	Energy Policy (6.142)	6	2.09%	89	10.2	(Shahbaz et al., 2013)	345	Elsevier
6	Journal of Environmental Management (6.789)	6	2.09%	204	9.8	(Nguyen et al., 2020)	63	Elsevier
7	Energy Economics (7.042)	5	1.74%	158	10	(Khan et al., 2019c)	54	Elsevier
8	Journal of Public Affairs (**ESCI)	5	1.74%	17	1.1	(Pandikasala et al., 2020)	6	Wiley-Blackwell
9	African Development Review (Scopus index)	4	1.39%	21	2.8	(Ogbeide & Adeboje, 2020)	8	Wiley-Blackwell
10	Economics (**ESCI)	4	1.39%	24	2.4	(Iheanacho, 2016)	16	*MDPI

*MDPI = Multidisciplinary Digital Publishing Institute, **ESCI = Emerging Source Citation Index

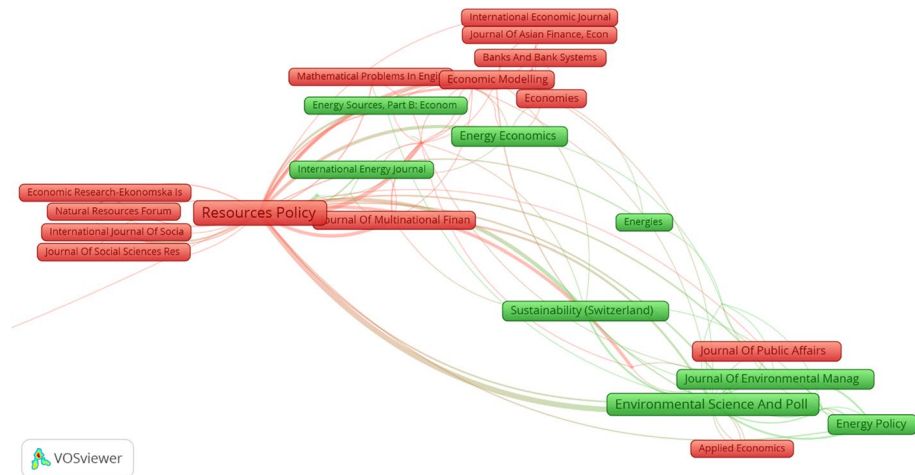


Fig. 4 Knowledge maps acquired from co-citation analysis of FD and NRR publications. The economics, finance and econometrics field is shown in red color, and energy and environmental sciences in green. This knowledge map can be online accessed at <https://bit.ly/3f72ZDW>

(Al-Mulali et al., 2015), (Nguyen et al., 2020), and (Shahbaz et al., 2018). There are also recent publications suggesting future research agendas, which we will discuss in the emerging trends sections.

4.3 Prolific authors

The search disclosed that 864 authors contributed to 363 documents, among which the largest set of connected items (authors) consisted of 200 items (authors). Table 2 depicts the top 10 most prolific authors in the resource-finance nexus literature ranked with the highest h-index for the documents listed in this analysis. Furthermore, the Scopus h-index, Scopus ID, and year of first publication show whether the author is the first or subsequent author, total publications indexed in the Scopus database, total citation count, and their respective organizations and country of affiliation. These authors are affiliated to five countries China (04), Malaysia (02), Pakistan (02), Turkey (01), Saudi Arabia (01). The terms a, b, c, etc., with the year show the author's first publication and whether the role of the author was primary, secondary, tertiary, and so on. Likewise, total publications (TP) refer to the total publications indexed in the Scopus database and its h-index column (General h-index). In contrast, the documents listed using the key string in this analysis (DKS) refer to the documents related to the resource-finance nexus—our primary concern—and its h-index column as (DKS h-index).

On this basis, Shahbaz, Muhammad is the top author whose first publication was in 2013 as a primary author and who has 13 publications with an h-index of 10, 788 total citations and a country affiliation China, followed by Zaman, Khalid with an h-index of 6 arising from 193 total citations and 9 articles. Similarly, Umar, Muhammad (7, 6) had 235 citations, and Anser, Muhammad Khalid (6, 4) had 89 citations. Finally, our results indicated that there were five authors who had more than 100 citations: Shahbaz, Muhammad (788), Umar Muhammad (235), Zaman, Khalid (193), Khan Zeeshan (162), Kirikkaleli, Dervis (142), and their countries of affiliation are China, Pakistan and Turkey. As shown

Table 2 List of most prolific authors in the financial development and natural resources nexus

#	Author*	Scopus Author ID	+Year	TP	G h-index	DKS	DKS h-index	TC	^a Country	Current Affiliation
1	Shahbaz, Muhammad	57,218,886,081	2013 a	418	73	13	10	788	CH	Beijing Institute of Technology, Beijing, China
2	Zaman, Khalid	36,544,506,000	2015 h	243	36	9	6	193	PK	University of Haripur, Paktunkhwa, Pakistan
3	Umar, Muhammad	57,216,355,865	2020 b	64	24	7	6	235	CH	Qingdao University, Qingdao, China
4	Anser, Muhammad Khalid	57,201,617,089	2020c	100	20	6	4	89	CH	Xi'an University of Architecture and Technology, Xi'an, China
5	Khan, Muhammad Kamran	57,202,217,278	2020c	33	12	6	5	62	PK	Bahria University, Islamabad, Pakistan
6	Khan, Zeeshan	57,204,108,102	2020 a	43	24	5	3	162	CH	Tsinghua University, Beijing, China
7	Kirikalleli, Dervis	57,188,848,531	2020b	120	23	5	4	142	TK	European University of Lefke, Mersin, Turkey
8	Lean, Hooi Hooi	15,849,147,600	2016 b	147	34	5	5	74	MY	Universiti Sains Malaysia, Minden, Malaysia
9	Nassani, Abdelmohsen A	57,192,275,707	2019d	77	16	5	4	91	SA	College of Business Administration, Riyadh, Saudi Arabia
10	Badeeb, Ramez Abubakar	57,189,874,864	2016 a	9	7	4	4	63	MY	Curtin University, Malaysia, Miri, Malaysia

TP = Total Publications; G h-index = General h-index; TC = Total Citations; DKS = Documents listed using the key string

*The authors are listed based on the document listed in this analysis (DLA)

+ Year of 1st publication and author position as 1st (a) author, 2nd (b), 3rd (c) and so on

^aCH = China, PK = Pakistan, MY = Malaysia, TK = Turkey, SA = Saudi Arabia

in Table 2, the majority of the authors are affiliated with China, which shows that China is leading the research in the resource-finance nexus across the globe.

4.4 Listing and global mapping of most productive countries, institutions, and collaboration

Based on the Scopus Database data, Fig. 5 portrays the locations of the top 15 most productive academic institutions with country affiliation on Google Maps 2022 regarding publications on the resource-finance nexus. The map demonstrates that a substantial volume of research is concentrated in Asian and European countries, particularly China. Similarly, Fig. 5 reveals that regions also contribute to a lesser extent, such as the United States, Africa, and Australia.

Table 3 illustrates the most productive academic institutions with country affiliation in the resource-finance nexus. However, non-academic organizations are excluded, such as the World Bank Group, Agence Nationale de la Recherche-a French research agency funding scientific research, Ministry of Finance, among others. China, with 88 publications, is at the top of the list, followed by Pakistan (58), Turkey (37), Malaysia (35), the United Kingdom (35), and Saudi Arabia (30). It is interesting to note that many authors with affiliations to China are in fact Pakistani Scholars studying in Chinese universities. China offers many scholarships globally and has partners in the China Pakistan Economic Corridor (CPEC), allowing more Pakistani students to have cultural exchange opportunities besides studying.

The single country publications in terms of percentage ScPb (%) are calculated using the following formula.

$$\text{Calculations for ScPb (\%)} = \text{No. of docs of respective country excluding all affiliations/TPb} \times 100$$

This ScPb (%) shows the percentage of articles that the authors of the respective country publish alone without any external collaboration/affiliations. Albeit positioned downward in the list, Nigeria, with 17 (73.913%) single country publications, is leading, followed by India with 14 (70.00%), Iran with 6 (66.66%), and the Russian Federation with 6 (54.545%). Similarly, South Africa has 7 (46.667%), Malaysia has 16 (45.714%), and



Fig. 5 Global mapping of the top 15 most productive countries and their academic institutions with regard to the financial development and natural resources nexus

Table 3 Top 15 most productive countries and academic institutions in terms of resource-finance nexus publications

#	Territory	Total Publications of a given country TPb	No. of Docs of the respective country	Single country publications ScPb %	Most Productive Academic Institution	Total publications of a given academic institution TPAI
1	China	88	30	34.091	Beijing Institute of Technology	13
2	Pakistan	58	7	12.069	Bahria University Islamabad	4
3	Turkey	37	16	43.243	European University of Lefke	8
4	Malaysia	35	16	45.714	Universiti Sains Malaysia	8
5	United Kingdom	35	9	25.714	University of Cambridge	6
6	Saudi Arabia	30	6	20.000	King Saud University	9
7	United States	26	9	34.615	University of New Orleans	2
8	Nigeria	23	17	73.913	Covenant University	4
9	France	21	5	23.810	Montpellier Business School	6
10	India	20	14	70.000	Amity University	3
11	South Africa	15	7	46.667	University of Johannesburg	3
12	Tunisia	13	1	7.692	Université de Sousse	4
13	Australia	11	4	36.364	La Trobe University	2
14	Russian Federation	11	6	54.545	New Economic School	2
15	Iran	9	6	66.667	Bu Ali Sina University	2

Turkey has 16 (43.243%), while the rest all have less than 40%. These figures show that countries with higher single country publications have strong intra country collaboration but need to enhance their external collaboration to generate more publications and contribute to the resource-finance nexus literature. In contrast, countries with fewer single-country publications have fewer intra country and more inter-country collaborations. It is evident that in China and Pakistan, both countries offer scholarships to students, thus enhancing their contribution.

The Total Publications of a given Academic Institution (TPAI) metric exhibits that the Beijing Institute of Technology has 13 publications in the resource-finance nexus in China, which is more significant than any other academic institution in the list. This is followed in the list by King Saud University in Saudi Arabia (09), the European University of Lefke in Turkey, and the Universiti Sains Malaysia in Malaysia (08). At the same time, the University of Cambridge in the UK, and Montpellier Business School both have 6 publications on the resource-finance nexus. Nonetheless, cross-border collaborations have certain advantages compared to intra country collaborations. Such advantages include the ability to exchange knowledge, ease, reliable data collection, enhancement of the academic institution's ranking globally as well as the respective authors, and hence countries, less research costs, shared time and energy, and exchange of expertise. Pakistan, a developing country, is ranked second in the list of most productive countries in terms of resource-finance research although with high population pressure, less developed infrastructure and resources, it has 58 publications with international collaborations and affiliations.

Although the resource-finance nexus is a recent development, it is an essential aspect of the sustainable development goals set by the United Nations, receiving extensive consideration in the world's top universities. As can be seen in Table 3, three academic universities, namely the University of Cambridge (7), Universiti Sains Malaysia (142), and King Saud University (287), are included in the top 300 best universities (Qs World University Rankings, 2021) and have focused on the resource-finance nexus followed by others.

Figure 6 shows the bibliometric knowledge map based on co-authorship with network visualization using VOSviewer. The countries are clustered into seven regions (Ali et al., 2022b; Roser Max and Ortiz-Ospina Esteban, 2013; World Bank, 2020) by assigning different colors for clarity. The distance and line thickness between the countries show their relatedness and link strength, respectively. The results are in line with Fig. 5 and Table 3. The highest number of countries belong to Europe and Central Asia (24), followed by the Middle East and North Africa, East Asia and the Pacific with (11) each, then Africa (06), South Asia, Latin America, and the Caribbean with (03) each, and finally. North America (02). The co-authorship result shows that Pakistan (red color) is close behind China as the most affiliated country with 28 links and a link strength of (97). This means that Pakistan is affiliated to 28 countries and 97 times co-authorship. Subsequently, China has links (27) and total-link strength (105), followed by the United Kingdom (25, 45), Saudi Arabia (18, 45), Turkey (18, 39), United States (18, 25), Malaysia (16, 38), while the links of other countries are less than 15. The link strength between China and Pakistan is 38, which is higher than any other country affiliation and depicts strong co-authorship between the two countries.

International collaboration is essential to create quality publications and share experts' thoughts through research partner diversity, student and cultural exchange, and to facilitate research funding. Similarly, it helps devise policy guidelines for the weaker economies through collaboration with researchers from developed economies via their research output.

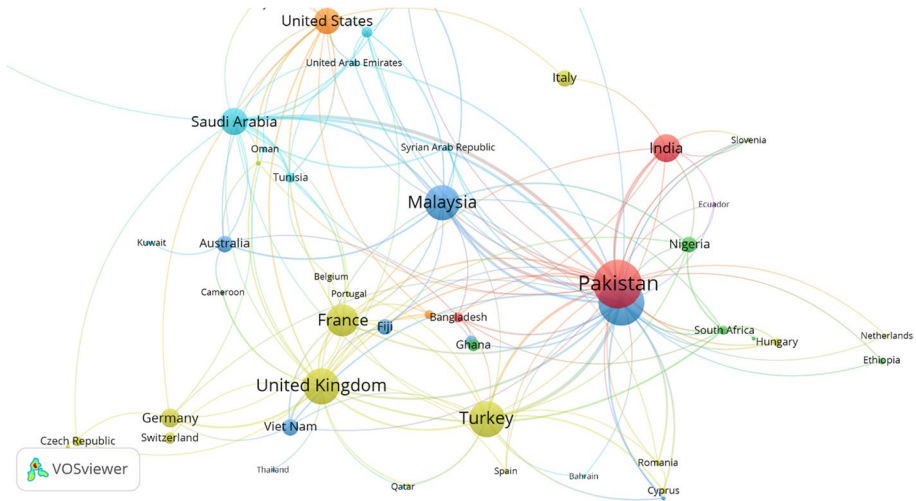


Fig. 6 The knowledge map of the bibliometric map based on co-authorship with network visualization. It can be accessed through the URL; <https://bit.ly/31FP2cY>

4.5 Author keywords, emerging trends-hotspots and future pathways

This subsection discusses the emerging trends-hotspots based on author keywords using VOSviewer. The keywords and their average year of publication identify the emerging trends-hotspots, while fewer occurrences reveal niche areas (Ayub et al., 2021; Gutiérrez-Nieto & Serrano-Cinca, 2019; Khudzari et al., 2018). Initially, 885 keywords were recorded, the various synonyms/variants keywords were re-labeled using a thesaurus, and 99 keywords were obtained that met the threshold of a minimum of two occurrences and were linked to each other. The results in Fig. 8 reveal that financial development with an average publication year 2018.59 is the most reflected keyword with 148 occurrences, 76 links to other keywords, and a total link strength of 306. Similarly, other frequent keywords are economic growth (55), natural resources (35), globalization (27), oil prices (25), trade openness (24), CO₂ emissions (23), oil prices (22), natural resources rents (21), institutional quality (20), natural resource curse (21), energy consumption (21), economic development (16), and environmental Kuznets curve (06), which are essential keywords connected to financial development. Moreover, the link strength between financial development and economic growth (43), natural resources (28), and natural resources rents (19) is more significant than any other keywords, which depicts that, among other topics, most of the research is carried out in this connection in the resource-finance nexus. However, while specific keywords (topics) are connected through a single or several links, others are rarely connected and should be the focus of future research, such as green investment, financial resource curse, human capital, technological innovation, environmental quality, environment sustainability, renewable energy, energy security, among others.

Furthermore, financial development is further decomposed into banking development and stock market development (Schwab et al., 2008; Svirydzhenka, 2016); the authors analyzed these keywords separately for financial development. Banking development with an average publication year of 2018.75 has 20 occurrences, 19 links, and a total link strength of 41. The analysis of the keywords indicates that at a threshold of a minimum of two

occurrences, banking development is connected to keywords such as financial development, economic growth, natural resources, natural resources curse, and stock market development. However, the connection to keywords like technological innovation, human capital, environmental quality, oil prices, oil price volatility, energy prices, energy consumption, and renewable energy is limited. This suggests that future researchers can exploit these areas and suggest policy recommendations from the perspective of a specific country or region. Likewise, stock market development is also analyzed and the results indicate that it has an average publication year of 2017.67 with 15 occurrences, 20 links, and a total link strength 35, showing that it has a limited role in the resource-finance nexus. After reducing the links to a threshold of a minimum of two occurrences, stock market development is connected to economic growth, oil consumption, and foreign direct investment. Nevertheless, the connection is less than 2 or limited with regard to technological innovation, human capital, institutional quality, climate change, environmental quality, renewable energy, energy efficiency, and natural resources rents, thus indicating that they are emerging trends for future research.

Regarding the resource-finance nexus, Khan et al. (2020b) proposed that financial development broadly comprises financial intermediaries such as banks and financial markets such as stock markets, and the resource-finance research is only explored by using banks in the current literature. Levine (2005) argued that the banking sector and stock market complement each other in providing financial services to the economy. According to Moradbeigi and Law (2017), a more developed financial market can channel revenues from natural resources into more productive activities and offset the adverse effects of natural resources on the economy. Therefore, focusing on the stock market in the financial resource curse (FRC) context could be a new development and hence cannot be ignored. Therefore, the authors also argue that research in stock market development in the FRC context and more countries and regions could trigger new developments and enrich the literature. The bibliometric maps also support this argument, as shown in Fig. 7. Nonetheless, the argument seems to be associated with the recent increase in the resource-finance nexus literature, as shown in Fig. 2, and thus indicates the need to develop more literature in future, with more collaboration among authors, academic institutions, and countries.

Similarly, focusing on the areas shown in the bibliometric knowledge map in Fig. 8, the resource-finance literature could grow extensively in the upcoming years. Similarly, it should be noted that the keyword “poverty” is linked to financial development, economic growth, and natural resources. This also depicts that such natural resource rents might play a role in raising a country’s financial development, leading to increased financial inclusion through microfinance programs that can curb poverty and enhance economic growth in the long run. This is supported by (United Nations, 2015), who claimed that microfinance is a poverty alleviating tool. Moreover, financial inclusion is only possible if the financial development of the country is ensured.

Financial development could be possible with the help of technological innovation leading to economic growth (Adak, 2015; Ahmad et al., 2020; Khan et al., 2020c; Pan et al., 2019) as well as through technology like FinTech and crowdfunding (Ali et al., 2022b; Liu et al., 2020; Loo, 2019; Wu, 2017) especially in crises such as the global pandemic caused by COVID-19. Such financial development might help mitigate the risks associated with contract enforcement, transaction costs, and expanding the financial inclusion network to remote areas. Financial development together with human capital and technological innovation can better manage the windfall revenues received from natural resources rents to channel them into the economy through financial intermediaries and the stock market for optimal resource allocation and investment, thus avoiding the Dutch disease, rent-seeking,

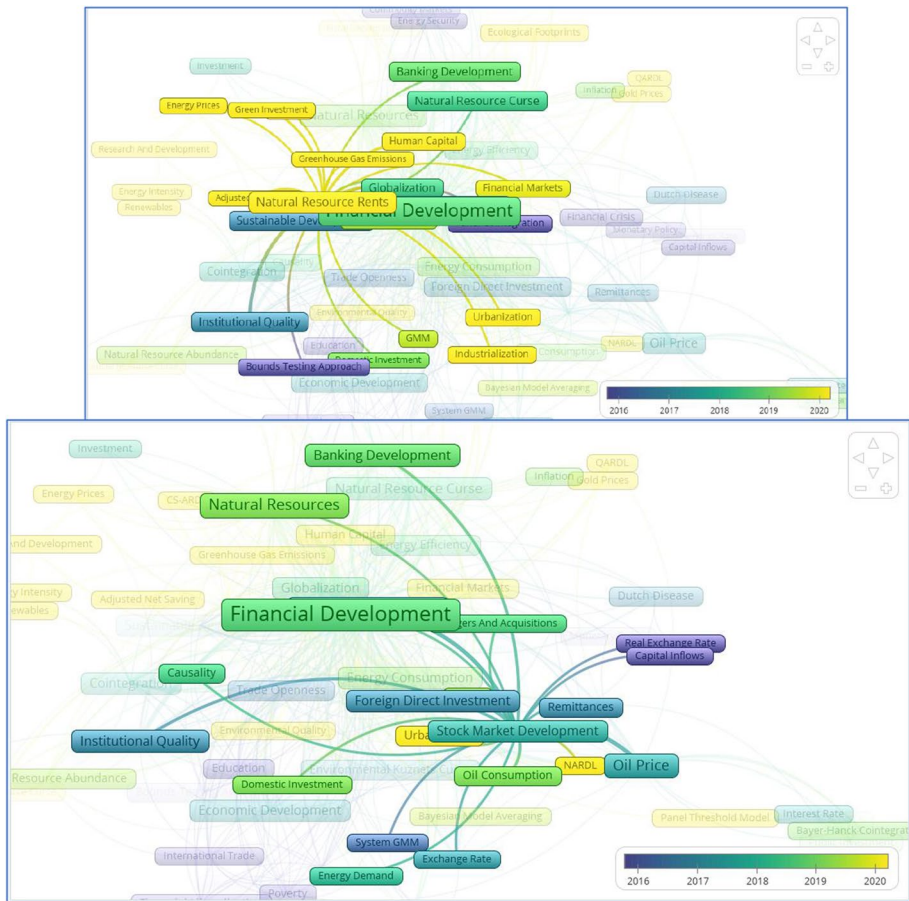


Fig. 7 Knowledge maps-overlay visualization mode of financial development and natural resources nexus based on author keywords co-occurrence, suggesting a research gap. The above map shows that financial development is linked to natural resources, while the below map shows that the role of stock market development is yet to be analyzed. This map is online accessible through @<https://bit.ly/3JQgyrk>

and corruption (Gerelmaa & Kotani, 2016; Khan et al., 2020c). Furthermore, investment in human capital and technological innovation enhance financial development (Khan et al., 2020c) through FinTech leading to greater financial inclusion, thus avoiding income inequality, poverty alleviation, and hence promoting economic growth (Ali et al., 2022b; Liu et al., 2020; Loo, 2019).

Similarly, oil prices and access to energy improve income inequality (Achceampong et al., 2021; Gorus et al., 2019). Likewise, financial development could efficiently channel funds for financing future consumption expenditures and infrastructure development (Mohammed et al., 2020; Van Der Ploeg, 2011; Van Der Ploeg & Poelhekke, 2017). Consequently, natural resource rents help advance financial development, defined as the financial resource blessing (Dogan et al., 2020a; Shahbaz et al., 2018). In contrast, the negative impact of natural resource rents on financial development is regarded as a natural resource curse (Asif et al., 2020; Guan et al., 2020; Khan et al., 2020c; Li et al., 2020).

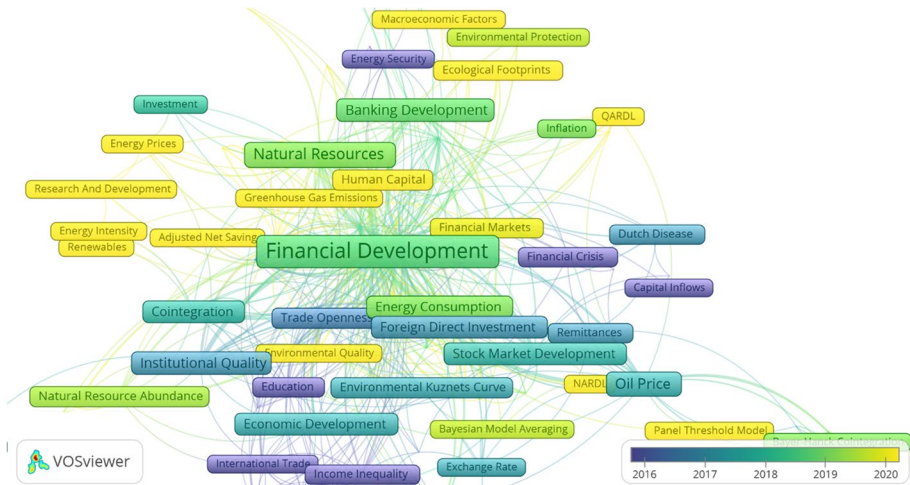


Fig. 8 Knowledge map-overlay visualization mode of financial development and natural resources nexus based on author keywords co-occurrence online accessible through @ <https://bit.ly/3JQgypk>

Most importantly, natural resource abundance and natural resources dependence are widely used in the resource-finance nexus, even though they are different (Badeeb et al., 2017). Therefore, the natural resource curse or blessing needs to be objectively reinvestigated using appropriate indicators. Secondly, as indicated, the term financial resource curse has an average publication year of 2020.33 with three occurrences, which shows that it is yet to be investigated from many perspectives, especially in terms of the stock market (Khan et al., 2020b). Thirdly, the recent literature has shown that whether natural resources are a curse or blessing depends on the country's institutional quality (Islam et al., 2020; Khan et al., 2019b, 2020a, 2020b). More importantly, under the standard economic growth model, incentives are provided for such activities that unintentionally lead to deterioration of ecosystems and biodiversity, the protection of which is usually hindered by a lack of institutional quality and governance structures (Teeb, 2012).

Similarly, the degradation of the ecosystem serves as a barrier to achieving the Millennium Development Goals concerning natural capital (Ma, 2005). Therefore, investigating the financial resource curse from an institutional quality perspective is a new dimension for the researchers to focus on in terms of banking and stock market development. Besides these, further emerging trends-hotspots are mentioned in detail in Table 4.

Figure 9 illustrates the density visualization mode of the keywords used in this analysis. It provides a bigger picture of the keywords used in the resource-finance nexus. The knowledge map shows that the research is condensed around a few keywords: financial development, economic growth, natural resources, banking development, foreign direct investment, and oil prices. Other condensed keywords include institutional quality, natural resource curse, economic development, and sustainable development. Despite the minimal appearance of other keywords in Fig. 8, it indicates the need for future research in all the keywords on the map. For exploration purposes, all the bibliometric knowledge maps can be accessed online and studied for future research by new or beginner researchers and experts for collaboration and exploration, as well as suggesting policy recommendations.

Table 4 Financial development and natural resources nexus hotspots

Term*keyword	Total link strength	No. of occurrences	Avg. publication year	Avg. citations	Avg. normalized citations
<i>(a) Based on average publication year</i>					
Ecological Footprint	8	4	2021	10	2.2
Sustainability	4	2	2021	5.5	1.25
Fiscal Decentralization	5	2	2021	9	2.05
QARDL	8	3	2021	1.67	0.38
Green Investment	8	3	2021	37	8.41
Green House Gas Emissions	5	2	2021	3	0.68
CS-ARDL	7	3	2020.67	23	4.52
Energy Intensity	5	3	2020.67	2.33	0.48
Urbanization	22	6	2020.50	16.5	1.11
Renewable Energy Consumption	19	8	2020.50	7.68	1.01
Human Capital	24	8	2020.38	17.50	1.53
Financial Resource Curse	4	4	2020.33	5	0.43
Technological Innovation	6	3	2020.33	10.33	0.93
Natural Resource Rents	52	23	2020.17	17	2.11
Energy Prices	9	3	2020	17.33	1.31
Environmental Quality	8	3	2020	8.33	1.06
Financial Markets	15	5	2019.80	4.6	0.49
<i>(b) Based on high average citations</i>					
Coal Consumption	9	4	2018.75	95	2.97
Migration	11	2	2011.50	55	1.66
Income Distribution	11	2	2005.50	45	1.00
Trade Openness	35	9	2016.67	44.67	1.92
International Trade	15	3	2014.67	39.67	1.40
Domestic Investment	5	2	2019	39.50	2.75
CO ₂ Emissions	56	24	2019.33	33.17	2.54
Globalization	50	14	2018.36	33.14	2.42
Panel Cointegration	7	4	2015.75	31.25	1.90

The yellow color keywords represent the hotspots based on average publication years and those used very recently.

Based on the keywords co-occurrence analysis of the bibliometric knowledge maps, Table 4 lists the potential emerging, most recently used, and hotspot topics in the resource-finance nexus and illustrates various features of the keywords such as the total link strength, number of occurrences, average citations, and average normalized citations. Table 4 indicates that ecological footprint is at the top of the list based on average publication year (2021) with a total link strength of (08) and its number of occurrences of (04). The total link strength shows that 8 articles contained both keywords in the author keywords. If the number of occurrences, link strength, and very recent average publication years is low, this indicates that the area should be a critical focus for future research avenues. This is followed by sustainability (2021, 4, 2), fiscal decentralization (2021, 5, 2), Quantile Cointegration in the Autoregressive Distributed-Lag (QARDL) (2021, 8, 3), green investment

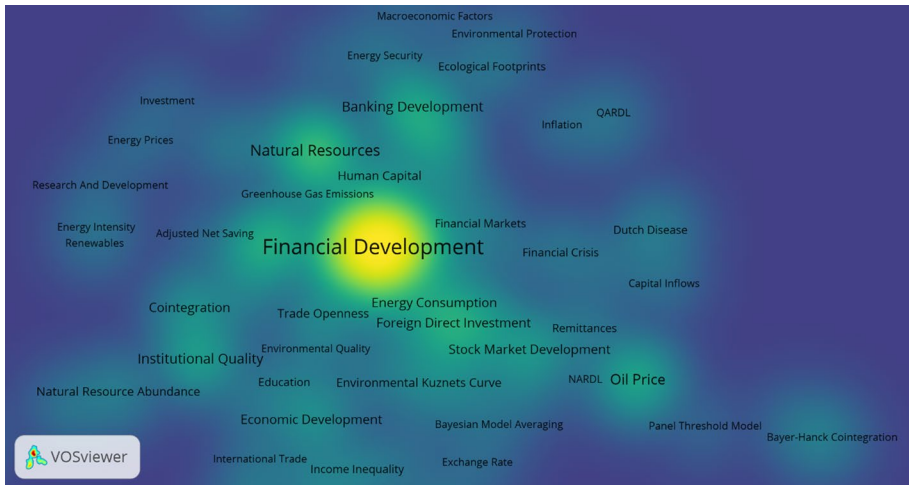


Fig. 9 Knowledge map-density visualization mode, based on keywords co-occurrence online @<https://bit.ly/3JQgypk>

(2021, 8, 3), and greenhouse gas emissions (2021, 5, 2) etc. Similarly, along with QARDL, other econometric techniques are also emerging in the resource-finance nexus, such as CS-ARDL, NARDL, and Pedroni's Panel Cointegration. Besides these, other recently developed econometric techniques with Fourier functions are yet to be introduced to the resources-finance nexus, such as Fourier GLS, Fourier ARDL, Fourier Bootstrap ARDL, etc., (Ali et al., 2022a). Finally, the high average citations received by the keywords shows that these areas are highly cited in recent research on the resource-finance nexus.

5 Conclusion

This article presents an overview of the literature on the resource-finance nexus for researchers in this area, especially due to the absence of any existing literature review study. This article analyzed 363 documents saved in the Scopus database. The findings indicated that there was steady growth until 2015; however, since 2016, the growth has been tremendous, and this study predicts future growth prospects in this area. Researchers from China lead the globe in resource-finance publications output, followed by Pakistan and Turkey. The bibliometric approach analyzes the co-occurrence, co-authorship, and co-citation analysis to obtain resource-finance nexus knowledge maps. Furthermore, this article has focused on illustrations from the Scopus database listing top journals, prolific authors with their highly cited articles, countries, along with their most productive academic institutions. The knowledge maps obtained through VOSviewer offer an excellent base of knowledge for the documents published, and we have also provided future research pathways to any researcher interested in the aforementioned nexus.

The main findings reveal that economics, finance, and econometrics along with energy, environment, and sustainability are the key areas of resource-finance nexus research. The leading authors are from China and Pakistan, while the top-ranked journal is Resources Policy with the largest number of articles and citations published in the said nexus. Similarly, we found that top journals on the energy and environment side were Environmental Science and

Pollution Research, International Journal of Energy Economics and Policy, Energy Policy, Energy Economics, and Journal of Environmental Management. The scope of these journals, documents published, and the knowledge maps obtained show how resources and finances are linked to each other as well as energy and the environment and that their role is enduring. The orthodox notion that natural resources are a blessing was recently reconsidered to be a curse; however, different views are presented in the literature, and many channels have been identified as being causes of curses. Furthermore, the technological innovation and advancement in human capital could develop financial development through financial technology leading to greater financial inclusion, thus avoiding income inequality, poverty alleviation, and hence promoting economic growth.

Finally, this study suggests certain avenues as future pathways for further research, such as Green Investment, Technological Innovation, Financial Resource Curse (especially stock market), Energy Prices, Environmental Quality, Human Capital, and Renewable Energy in policy development and sustainability towards the achievement of the SDGs. In addition to this, future studies can investigate the resource-growth nexus using Bibliometric analysis. Moreover, other studies can use the WOS database to explore the resource-finance nexus. Furthermore, a bibliometric analysis can be combined with the Scopus and WOS databases to research either the resource-finance nexus or resource-growth nexus. Nonetheless, institutional quality, an essential determinant of the resource-finance-growth nexus, can also be utilized in the bibliometric analysis by future studies. This study may act as stimulus to attract researchers to conduct further studies in the resource-finance nexus, linking it to energy and the environment. Nevertheless, although future researchers and studies are not required to follow the suggestions of this research, it may serve as a helpful pathway.

Lastly, similar to all other studies, this article has certain limitations. First, the scope of this study was limited to formal markets of finance such as financial development, banking development, and stock market development. However, as mentioned earlier, a large informal market such as shadow banking could be a new development in the nexus. Secondly, the current study is restricted to the Scopus database; others can explore it using the WOS and Google Scholar databases.

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