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Mapping the Geography of Sustainability Transitions Research: A Bibliometric Analysis

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The transition towards sustainability is a global challenge, and in recent decades, Sustainability Transitions (ST) research has emerged as a promising approach to address climate change-led uncertainty. Despite the rapid rise in the sustainability transitions literature, it is primarily focused on developed or global north countries. The present paper attempts to use bibliometric tools to comprehend the intellectual landscape and distribution between global north-south and analyse the trends and hotspots in global south countries. The paper comprehensively examined ST literature on the Scopus citation database (from the inception of ST in 1994 to December 31, 2020). Based on statistical analysis performed on the dataset, there has been an exponential rise in research publications on ST since 2012. Globally, ST researchers mainly belong to OECD countries from Western Europe, especially in the UK, Netherlands and Germany. Conversely, the global south is lagging, except few developing nations such as China, South Africa, Brazil, and India. This skewed representation reflects the higher prevalence of ST initiatives in the global north, predominantly by a few European countries. About 40% of ST research is published in journals from the UK, Netherlands, the U.S., Switzerland and Canada. The citation analysis reflects that 60% of citations are from British and Dutch scholars, indicating a low academic influence of ST authors from developing countries. This study would stimulate more interest among Global South academics and policy researchers to put more effort into ST research and publication to bridge the existing gap.

Keywords: Multi-level perspective, Scopus, Socio-technical transitions, VOSviewer

Introduction

Recently, policymakers, academicians, and practitioners have been using Sustainability Transitions (ST) research to address the rising challenges of climate change and socio-economic disparity. Addressing these sustainability issues requires a transformative framework where sustainability transitions are a rapidly rising research approach widely used in the western European context.[1,2] The ST revolves around the argument that the world is facing complex and interconnected challenges and needs a radical transformation in ways of production and consumption which fulfil societal functions such as energy, transport, and agriculture. It conceptualises transformation as socio-technical, denoting technology's day-to-day relationship with the user, economy, institutions, and culture, which must be changed to achieve a successful systemic transition.[3,4]

The Sustainability Transitions framework has four significant sub-framework–multi-level perspective, strategic niche management, transitions management and technological innovation system–developed to explain the process of governance of ST and the unfolding of transitions. Multi-Level Perspective (MLP) is a cardinal model, forming the basis for the other three approaches. MLP recognises three levels. The socio-technical regime is the middle level, a set of rules and routines that direct the "way of doing things". Socio-technical regime accounts for stability, path dependency and lock-in, which prohibits the rise of radical innovations. The second level is the socio-technical landscape, the exogenous environment (war or crisis, demographic change), which is beyond the reach of regime actors and stabilises the regime.

Moreover, the regime transitions are also dependent on the third level, niche. Niches are the protected spaces facilitating birth and experimentation with novelty. Regarding MLP, the socio-technical transitions are propelled by mutually reinforcing changes happening at landscape, regime and niche levels. The path dependency of the regime inhibits radical innovations; landscape pressure pushes the regime to open up for innovation developed in niches.[5] Apart from MLP, Strategic Niche

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Management (SNM) proposes processes facilitating and steering radical innovation in the niche. SNM argues that protecting the niche actors' learning, networking, and expectations is crucial to upscale radical innovation.[6,7]

Further, Transitions Management emphasises navigating 'from the above' form of governance perspective.[5] Lastly, the Technological Innovation System (TIS) is the fourth sub-field of ST. TIS conceptualises transformation from the perspective of innovation studies and industrial economics and weighs more on the knowledge of technological systems and entrepreneurs.[8,9]

Despite the rapidly growing sustainability transitions (ST) literature, most ST research primarily focused on developed or global north countries.[10,11] However, it calls for a closer examination of the political questions such as transitions by whom, for whom, and what the nature of these transitions is; it still requires deeper investigation to comprehend the success or failure of transitions.[12] Given the historically embedded cultural and structural nuances between the global south and global north nations, the sustainability transitions in the global south context are anticipated to differ from northern peers.[13]

Due to the contested meanings associated with 'development and progress, which lacks acknowledgement of the reasons behind the 'underdeveloped, the idea of developed/global north and developing/global south is theoretically and politically disputed.[14] Nevertheless, this paper purposefully mentions the terms OECD countries as so-called' developed' or 'global north' and non-OECD as so-called' developing' or 'global south' nations. A similar classification was used in studies elsewhere to examine publication and collaboration patterns in various disciplines. Many previous studies have addressed the question of the geography of sustainability transitions; for instance, Wieczorek *et al*.[11] provided a systemic review of 115 articles published on ST research in developing countries but weighs more on expectation and upscaling. Ramos-Mejia *et al*.[10] uncovered the patterns of poverty alleviation in developing countries along with sustainability transitions; a bibliometrics study by Chappin & Logtvoet.[15] uses search query keywords 'transitions' and 'transformations' to compile the bibliometric data of 835 research articles and infers that till the year 2013, institutions and researchers from the Netherlands are predominately the leading ST research.

Similarly, Savaget *et al*.[16] conducted a bibliometric survey to conceptualise the linkages between sustainability and socio-technical systems change; however, the study focuses on 182 articles. At the same time, Kern *et al*.[17] conduct a bibliometric study to comprehend the linkages between policy mix and sustainability transitions research. There is, till now, sparse research which provides any bibliometric analysis of the distribution of ST literature in the context of the global north and the global south. Therefore, this study aims to fill the gap by applying scientometric indicators and constructing a bird-eye view of ST research regarding geographical distribution.

The present paper intends to address the following research questions: *How has sustainability transitions literature evolved over the period? What is the geographic location of sustainability transitions research? What are the geographical dynamics of ST research production and collaboration? What are the ST hotspot or research interests amongst developing countries?*

Methodology

Bibliometrics, a quantitative approach, is utilised to study the intricate patterns of research publications and draw the collaborative intellectual landscape between sources, authors, institutions and countries.[18] At the country level, for instance, it can yield a general assessment of how good a country's performance is in a particular discipline. The term 'bibliometrics' first appeared in 1969; then, 'scientometrics' appeared as another synonym for bibliometrics. Bibliometrics methods have been deployed in science policy and methodology research for decades.[19] The current study used bibliometric methods to systematically explore the evolution of ST literature and assess the geography of ST research about the participation of the global south in it.

Consequently, the study emulates the following research parameter proposed by the bibliometric study of Zupic & Cater.[20]

1. Research design,
2. Compilation of bibliometric data,
3. Analysis, Visualisation,
4. Interpretation.

Bibliometric Analysis Tools

The study used the Bibliometrix package of R, co-created by scholars from the University of Federico II,

Italy, and Luigi Vanvitelli, Italy. The R package Biblioshiny has numerous tools for analysing the intellectual, conceptual, and social structure of a research area.[21] These tools are utilised to draw co-citation analysis, co-word analysis and collaboration between various countries. Biblioshiny provides a coding-free platform to import, analyse and plot bibliometric data to develop the analysis of the social, conceptual and intellectual structure of the given scientific field. Furthermore, the study employed a VOS viewer, developed by the Centre for Science and Technology Studies, University of Leiden, the Netherlands, which can develop vast network maps. Lastly, Microsoft excel was utilised to pre-process and correct the information, including authors, research journals, and countries. The slight change in information might interfere with the bibliometric analysis.

Database Selection

The Scopus database, published by Elsevier, was utilised to extract article information on ST. Scopus is the world's most significant source of peer-reviewed scientific document information and broad coverage in social science. It includes 75 million indexed items. Due to the above reason, several studies preferred Scopus over other databases such as Web of Science and Google scholar.[22]

Search Query

The study takes the lead from the research by Markard *et al*.[23] , Geels *et al*.[24] & Wieczorek *et al*.[11] to prepare the search query in order to retrieve from the Scopus database; in these studies, the researchers have explained the four significant sub-fields of ST: Multi-level Perspective (MLP), Strategic Niche Management (SNM), Transition Management (TM), and Technological Innovation System (TIS). Moreover, keywords such as socio-technical transitions, socio-technical regime and niche regime interaction were included in the search query after studying keywords and abstracts of leading research documents for 2019 and 2020.

The search query, as shown in Fig. 1 was run in the advanced search interface of Scopus to extract the bibliographic data. The field type 'Article Title, Abstract, Keywords' were selected, and Boolean operators 'And' and 'OR', were used with keywords along with quote marks ""to identify loose phrases, which instructs Scopus that words in"" must come together and must be allowed for the wild card and lemmatisation. Further, the curly brackets '{}' were also employed to extract the exact phrases. The search query was limited to documents published in English.

Data Extraction

The initial search on Scopus found that many published documents generically mentioned search query keywords. Consequently, the study applied PRISMA guidelines proposed by Moher *et al*.[25] PRISMA approach offers four steps to clean, identify and retrieve the data for bibliometric analysis, see Fig. 1. The study was executed on 25 January 2022.

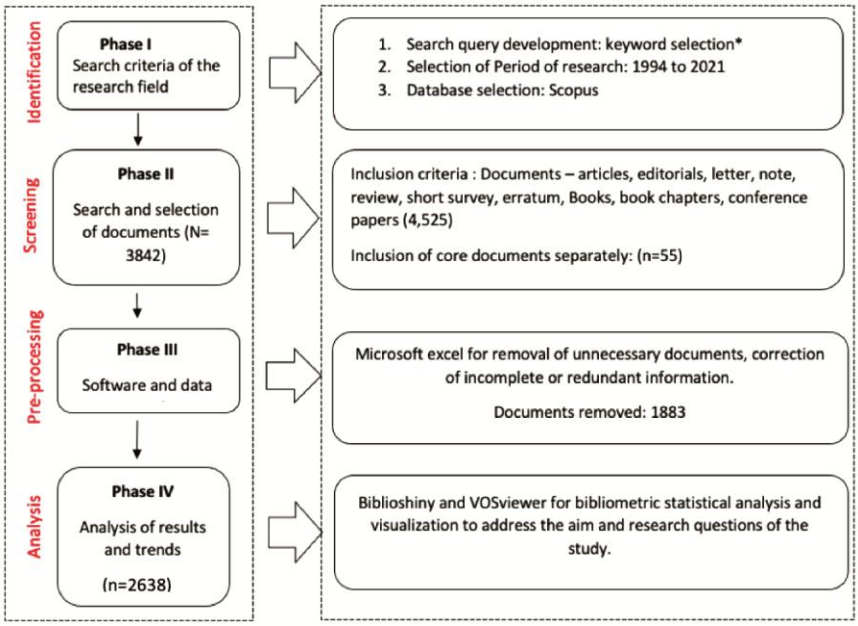

Fig. 1 — PRISMA diagram presents steps in identifying and selecting data set for bibliometric study. (adapted from Moher *et al*.[25])

The study was limited to documents written in the English language only. The search query extracted information from 4,525 documents.

Inclusion and Exclusion Criteria

The current study deployed Microsoft Excel to clean or pre-process the corpus drawn from the Scopus database. In the following step, all titles and abstracts of the corpus (4,525 documents) were evaluated to confirm that the documents correspond to the motive of this study. A large chunk of the corpus was deleted during the process after reading the abstracts of the publications. Many documents have mentioned keywords in generic manners or were associated with other research fields.

The outcome of the cleaning process secured the 'cleaned' corpus of ST literature containing 2,587 documents, and furthermore scrutinising the corpus provided that the corpus has omitted some core articles within the ST field. In this regard, the paper used the source list of relevant documents prepared by Geels *et al*.[24] to fill the gap. As a result, fifty-five (55) relevant documents of the sustainability transitions research were included in the corpus. Further, four errata were excluded from the corpus and thus the outcome of the above exercise prepared a corpus of 2,638 documents. The 'cleaned' corpus was then imported into the R environment using the R bibliometrics package. The Biblioshiny library was deployed to answer the research questions.

* *search query: TITLE-ABS-KEY (("socio-technical transition" OR {multi-level perspective} OR "multi-level perspective*" OR {sustainability transitions} OR {sustainability transition} OR "socio-technical transformation*" OR "sustainability transformation" OR "niche-regime interactio*" OR "socio-technical regime*" OR {strategic niche management} OR "socio-technical transition*" OR {system innovation*} OR "transition management*" OR "socio-technical transition*" OR {technological innovation system})) AND (EXCLUDE (PUBYEAR, 1976) OR EXCLUDE (PUBYEAR , 1980) OR EXCLUDE (PUBYEAR , 1981) OR EXCLUDE (PUBYEAR , 1982) OR EXCLUDE (PUBYEAR , 1988) OR EXCLUDE (PUBYEAR , 1989) OR EXCLUDE (PUBYEAR , 1990) OR EXCLUDE (PUBYEAR , 1991) OR EXCLUDE (PUBYEAR , 1993) OR EXCLUDE (PUBYEAR , 1994) OR EXCLUDE (PUBYEAR , 1995) OR EXCLUDE (PUBYEAR , 1996) OR EXCLUDE (PUBYEAR , 1997) OR EXCLUDE (PUBYEAR , 1998) OR EXCLUDE (PUBYEAR , 1999) OR EXCLUDE (PUBYEAR , 2000) OR EXCLUDE (PUBYEAR , 2001) OR EXCLUDE (PUBYEAR , 2022)) AND (LIMIT-TO (LANGUAGE , "English"))*

Data Analysis

The present study used bibliometric approaches advanced by Zupic & Cater.[20] In the first phase, a descriptive analysis was carried out. The paper uses Biblioshiny and Excel to draw basic analytics, including dynamics around publication sources, authors and documents. In the later phase, Biblioshiny and VOSviewer were deployed to answer the research question proposed by the study in the methodology section of the study.

Results and Discussion

Origin and Description of ST

The following section gives an understandable view of the evolution of ST literature. The corpus drawn for the bibliometric study has included 2,638 documents (2527 articles, 3 books, 13 book chapters, 16 conference papers, 47 reviews, 14 short surveys, 12 notes, 2 letters and 4 editorials published from 1994 to 2021, by 503 sources, by 5,210 authors. The first article on sustainability transitions was authored by Kemp (19). However, the growth of literature in this field remained embryonic until 2002, when Frank W. Geels produced significant articles that gained 215 citations per year. From 2012 onwards, publications received an intense rise. The corpus comprises 6,011 authors' keywords out of the five authors who published single-authored documents. Fundamental analysis of the Sustainability transitions corpus indicates that most researchers have published only one paper on ST, which is 78.7% of the authors. While many authors are involved in ST research, a few high-yield authors indicate that only a handful of researchers have focused on the ST arena. Perhaps authors with single publications are switching between the various research fields, thus diversifying the ST research domain. The examination of the corpus exhibits a collaboration index of 2.26, indicating that ST literature has an exemplary collaborative network. Moreover, 2,217 documents have gained a total citation of 100,308, where the average citation per document is 37.97. At the same time, 425 documents have yet to earn citations.

Annual Scientific Production

The sub-section explains the growth of ST publications. It is worth noting that the growth rate of a particular academic field is proportional to the size of the corpus of published documents.[19] The growth of ST publications and citations, as well as the annual growth rate of 32.17 per cent, are depicted in Fig. 2. The year 2021 has been the most productive in the number of publications, where 611 documents were published. On the other hand, articles published from 2002 to 2006 received the highest average citation per year.

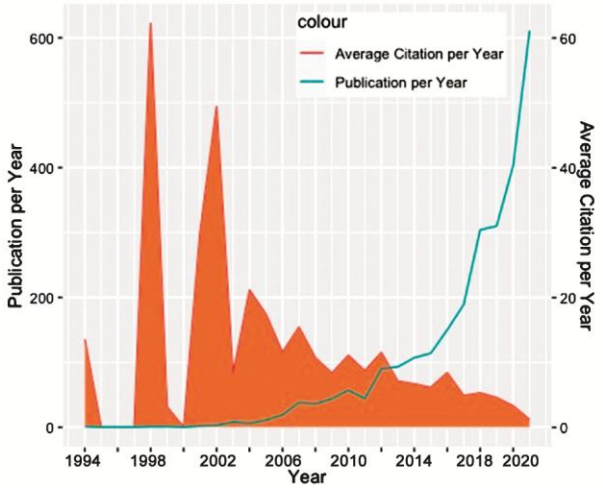

Fig. 2 — Annual scientific production

Most Significant Authors

The sub-section presents the top 20 researchers ranked in terms of the publication of documents from 1994 to 2021. These researchers display regularity in contributing to the body of ST; Further, Table 1 indicates the authors' h-index, along with the number of cited publications and total citations (the impact of the researcher is directly associated with the productivity of researchers.[26] It is shown that Geels has the highest h-index (36), with 51 documents and 15,775 citations.

Source Dynamics

To date, five hundred and three sources have published research on sustainability transitions. The top ten journals were selected according to the number of papers. In Table 2, the ranking of journals (based on H-indexed), the numbers of citations, publishing countries and their impact factors (in 2020) are listed. The top 10 journals have published 1107 documents on ST, accounting for 41.9% of the publications, with 65,682 citations (65.4% of total citations). Six of the top ten journals are British research journals; in contrast, the Netherlands, United States, Switzerland and Canada have one journal each. UK-based journal Research Policy has published 91 cited articles (3.4% of the published

Table 1 — Leading authors of ST

Authors	h index	Total Citation	Number of cited documents	Publication started
Geels F	36	15775	51	2002
Raven R	32	5343	46	2004
Hekkert M	26	3779	35	2007
Truffer B	23	4615	31	2002
Loorbach D	22	4055	29	2005
Smith A	21	6501	24	2003
Kern F	19	2552	24	2008
Markard J	18	3410	26	2008
Sovacool Bk	18	1946	35	2009
Kemp R	17	4904	21	1994

Table 2 — Top cited sources (TC= total citations; NP= number of cited documents, PY= publication year)

Sources	Rank (h-index)	TC	NP	PY	Country	Impact factor (2020)
Research Policy	1 (51)	21160	91	1999	United Kingdom	8.11
Technological Forecasting And Social Change	2 (50)	8014	146	2005	United States	8.59
Energy Policy	3 (41)	6565	101	2004	United Kingdom	6.142
Environmental Innovation And Societal Transitions	4 (40)	7366	220	2011	Netherlands	9.68
Journal Of Cleaner Production	5 (39)	5846	159	2007	United Kingdom	9.297
Energy Research And Social Science	6 (29)	3322	113	2014	United Kingdom	6.834
Technology Analysis And Strategic Management	7 (29)	7443	55	1998	United Kingdom	2.874
Sustainability (Switzerland)	8 (23)	2195	178	2009	Switzerland	3.251
Global Environmental Change	9 (20)	2181	25	2002	United Kingdom	9.523
Ecology And Society	10 (17)	1590	19	2007	Canada	4.403

Table 3 — OECD Country collaboration and productivity (SCP = Simple county publication, MCP = Multi country publication, TC = Total citations)

OECD Country	Articles	SCP	MCP	MCP Ratio	TC
United Kingdom	383	255	128	0.334	26116
Netherlands	382	273	109	0.285	28982
Germany	226	149	77	0.341	5164
Sweden	155	113	42	0.271	5973
USA	140	108	31	0.223	3133
Australia	127	93	34	0.268	2856
Finland	124	95	29	0.234	1620
Switzerland	82	48	34	0.415	5244
Canada	76	52	24	0.316	2415
Italy	72	43	29	0.403	1231
Norway	67	47	20	0.299	1047
Denmark	50	33	17	0.34	996
Belgium	49	30	19	0.388	1511
Spain	48	32	16	0.333	1284
France	45	28	17	0.378	358
Austria	40	24	16	0.4	1862
Japan	19	14	5	0.263	314
Portugal	17	12	5	0.294	98
Ireland	15	10	5	0.333	245
Poland	14	12	2	0.143	36
Hungary	12	10	2	0.167	54
Korea	12	6	6	0.5	235
New Zealand	11	6	5	0.455	282
Czech Republic	9	3	6	0.667	74
Greece	9	7	2	0.222	281
Colombia	7	5	2	0.286	12
Mexico	6	4	2	0.333	9
Chile	3	3	0	0	6
Estonia	2	1	1	0.5	14
Iceland	2	0	2	1	232
Israel	2	2	0	0	6
Latvia	2	2	0	0	4
Turkey	2	1	1	0.5	3
Lithuania	1	1	0	0	0
Slovenia	1	1	0	0	10

documents); nevertheless, it received the highest citation (21% of the total citation).

Geographical Distribution of ST research

This section emphasises the geographic dispersion of the ST research. The paper analyses the interconnectedness between the corresponding author's country affiliation, international collaboration, production citation, and bibliometric coupling.

Corresponding Author Analysis

Transitions toward sustainability in the context of climate change are a global challenge; however, OECD countries have contributed the most to ST research. The productivity of developed/OECD countries by analysing the corresponding author's country is given in Table 3. The comparison between OECD and non-OECD country contributions indicates that no other country in Asia has yielded a substantial number of publications except for China. The top 5 nations hosting corresponding authors on ST are the United Kingdom (383), the Netherlands (382), Germany (226), Sweden (115) and the USA (140). A comparison of Tables 3 & 4 explains that the top 10 OECD nations hosting corresponding authors

Table 4 — Non-OECD Country collaboration and productivity (SCP = Simple county publication, MCP = Multi country publication, TC = Total citations)

Non-OECD Country	Articles	SCP	MCP	MCP Ratio	TC
China	72	43	29	0.403	716
Brazil	25	21	4	0.16	124
South Africa	17	10	7	0.412	599
India	16	12	4	0.25	125
Iran	11	6	5	0.455	48
Hong Kong	9	5	4	0.444	78
Malaysia	7	3	4	0.571	32
Singapore	6	3	3	0.5	476
Russia	5	4	1	0.2	18
Pakistan	4	3	1	0.25	6
Philippines	4	2	2	0.5	22
Kenya	3	2	1	0.333	30
Bahrain	2	2	0	0	3
Egypt	2	2	0	0	1
Ethiopia	2	0	2	1	32
Indonesia	2	2	0	0	0
Nigeria	2	1	1	0.5	2
Ukraine	2	2	0	0	2
Argentina	1	1	0	0	0
Bangladesh	1	1	0	0	0
Barbados	1	1	0	0	4
Cuba	1	1	0	0	2
Cyprus	1	1	0	0	1
Ghana	1	1	0	0	0
Macedonia	1	0	1	1	3
Malta	1	1	0	0	0
Morocco	1	1	0	0	1
Paraguay	1	0	1	1	5
Serbia	1	1	0	0	0
Uganda	1	0	1	1	0
Uruguay	1	1	0	0	5

of ST have produced 66.8% of the total research. Out of 2642 documents, 2208 articles are from 35 OECD nations. It is also to be noted that in the ST corpus retrieved from Scopus, the meta-data of 226 documents are either incomplete or left blank. However, close scrutiny of such documents shows that the majority of these documents were published by OECD countries (containing 6161 citations).

Furthermore, none of the top 50 cited articles is from non-OECD countries. However, out of 31 non-OECD nations, China, Brazil, South Africa, India, and Iran have published 141 articles out of 204 articles. China, with 72 articles, is the top contributor among the developing countries, followed by Brazil (25), South Africa (17), India (16) and Iran (11), as illustrated in Table 4.

Publications from the 35 OECD nations published 92% of the documents and gained 98% of citations. This skewed representation of non-OECD countries reflects the higher prevalence of ST initiatives in global north/OECD nations, predominantly by a few western European countries. It also shows the low academic influence of ST in developing countries.

The citation analysis reflects that 60% of citations are from British and Dutch authors, indicating that Dutch and British scholars are the pioneer and most active researchers of the ST. The analysis shows that most productive journals are from a few OECD countries, which might be why major contributors are from a few OECD countries.

Furthermore, we have observed that the Netherlands and the United Kingdom are the most productive countries in frequency. The productive countries based on the Multi-Country Publication (MCP) ratio can be seen in Tables 3 & 4. The MCP

ratio is MCP proportional to the total of all the research publications. According to Zubic & Cater[20], countries with higher MCP ratios signify greater international collaboration. Except for the United Kingdom and Germany, the top ten most productive countries have low MCP ratios < 3, implying a moderate or low degree of collaboration between European countries and a low collaboration between Asian countries. Among developing countries, China and South Africa have scored relatively higher MCP ratios of 0.403 and 412, with 72 and 17 documents, respectively.

Collaboration and Productivity

According to the Country collaboration map (see Fig. 3), most collaborative countries can be easily recognised in Western Europe. Furthermore, it exhibits that the Netherlands and the United Kingdom have interacted most frequently and published 74 publications, followed by United Kingdom-Germany (62) and Netherlands and Germany (54). See Table 5. From another perspective, we can state that Western European countries hold a greater degree of collaboration and several publications in ST.

Bibliographic Coupling

Bibliographic coupling happens when two documents cite the same third research work in their bibliographies, reflecting that the two works probably focus on a similar subject. Further, any two documents are bibliographically coupled if they share at least one reference. In the same vein, two countries are bibliographically coupled if two publishing countries refer to the same third country. The strength and the degree of their coupling evolve with the increase in the number of citations they share.

In the bibliometric coupling analysis (minimum number of documents from the country = 3), 61 countries were selected from 116 countries in 5 clusters (see Fig. 4). Twenty-one countries were found in cluster red cluster, where the UK, Netherlands, and Sweden are the leading countries in this cluster, along with Switzerland, Norway, China, Japan, Hong Kong, Indonesia, Iran, Israel, Japan, Kenya, Malaysia, Nigeria, Norway, Pakistan, Philippines, South Korea, Taiwan, Thailand, United Arab Emirates. The blue cluster has 15 countries anchored by the United States, Canada and France, Brazil, Argentina, Chile, Luxembourg, Mexico, New Zealand, South Africa and Uruguay. Cluster 4 (Yellow) has 8 countries Austria, Egypt, Estonia, Hungary, Ireland, Russia and Ukraine. Finally, cluster 5 in Purple colour has 6 countries Australia, Bangladesh, Belgium, Ghana, Tanzania and Uganda. Clusters 1, 2 and 3 comprise a high level of bibliometrically coupled countries.

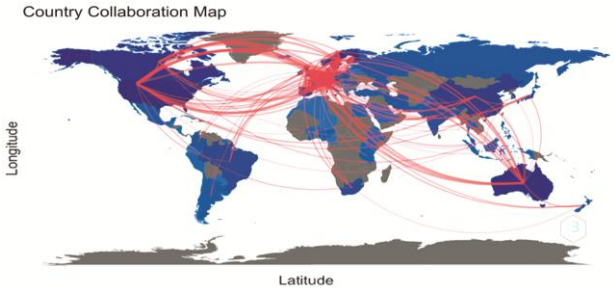

Fig. 3 — Global collaboration map (Thicker pink lines indicate greater research collaboration, and the grey regions in the world map reflect the absence of research. The darker shade of blue suggests the higher collaboration frequency of ST research

Table 5 — Collaboration between the top 25 countries

From	To	Frequency
Netherlands	United Kingdom	74
United Kingdom	Germany	62
Netherlands	Germany	54
Netherlands	Sweden	41
United Kingdom	Denmark	37
United Kingdom	Sweden	36
United Kingdom	USA	36
Netherlands	USA	33
Germany	Sweden	32
United Kingdom	Finland	30
Netherlands	Australia	28
Germany	USA	25
Netherlands	Belgium	21
United Kingdom	Italy	21
United Kingdom	Spain	21
United Kingdom	Australia	20
Germany	Finland	19
Germany	Switzerland	19
Netherlands	Austria	19
Sweden	USA	19
Netherlands	Switzerland	18
Sweden	Norway	18
United Kingdom	China	18
United Kingdom	Switzerland	18
Germany	Austria	17

Further, Fig. 4 indicates the high coupling strength among a handful of counties such as the United Kingdom, Netherlands, Germany, Sweden and the USA.

Moreover, Fig. 5 shows two phases. In phase 1, the average publication year for countries stands from 2015 to 2018. In this period, major contributor countries were the United Kingdom (Avg. Publishing

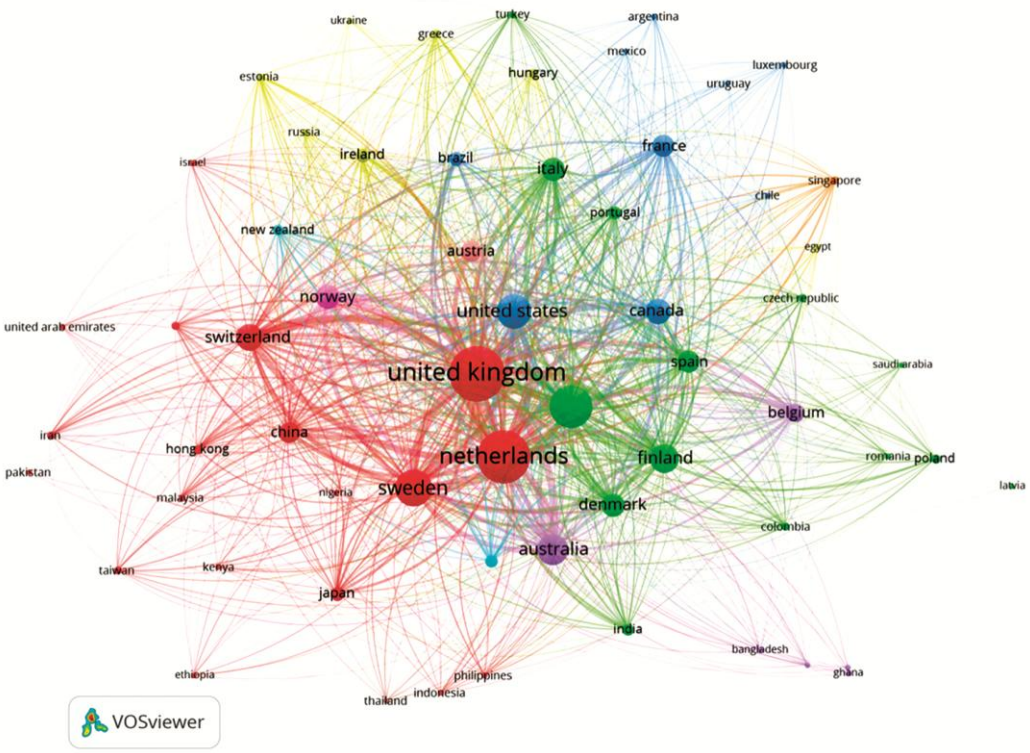

Fig. 4 — Bibliographic coupling of countries

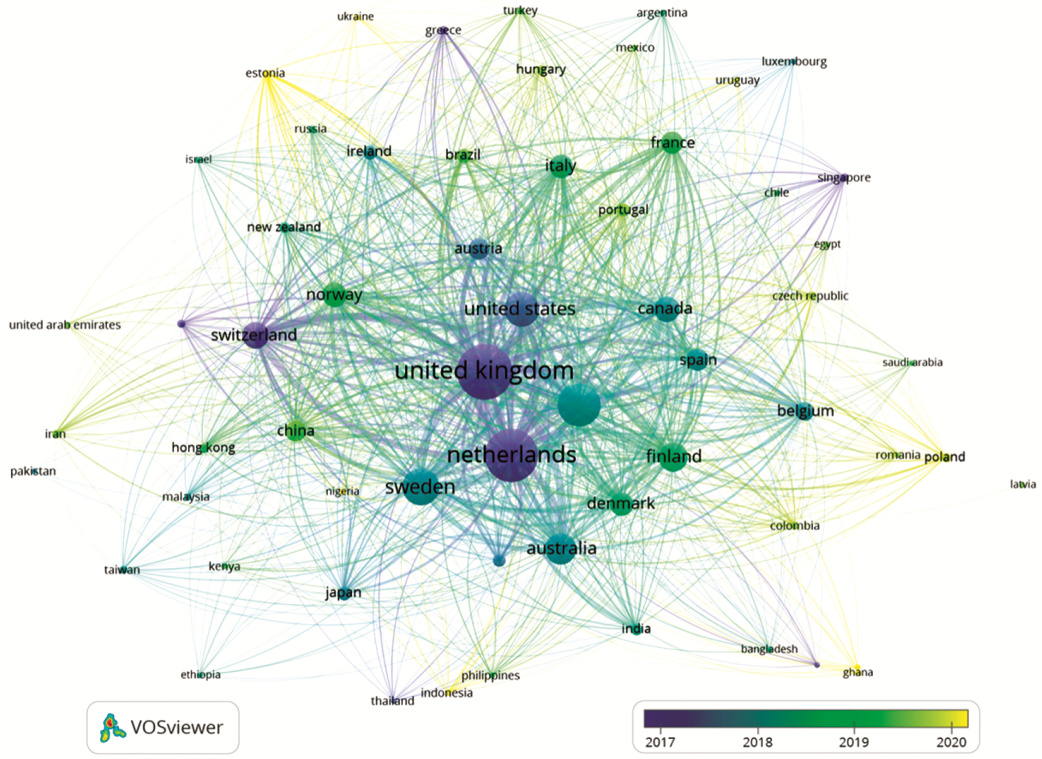

Fig. 5 — Bibliographic coupling of countries on the basis of year

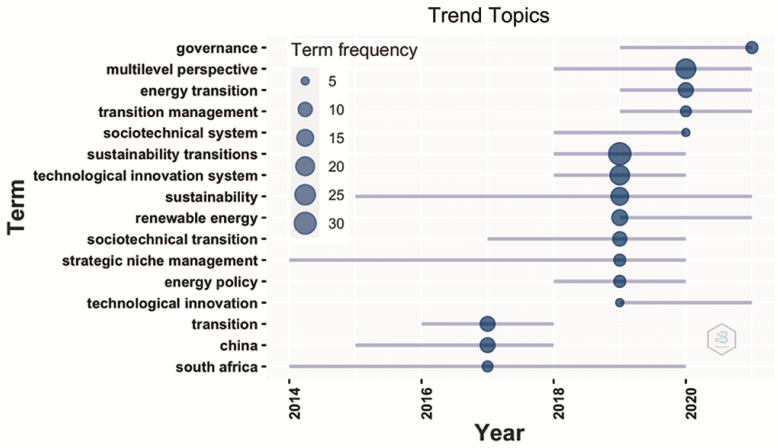

Fig. 6 — Trending topics in the global south

Year (Y) 2016.8, document (N) 596), Netherlands (Y 2015.5, N 552), Switzerland (Y 2016.8, N 137 documents), Germany (Y 2018.8, N 367) and the United States (Y 2017.3, N 244).

However, in the second phase (2019 onwards), many new countries, such as China (Y 2019.2, N 87), Columbia (Y 2019.5, N 15 documents), Poland (Y 2019.7, N 19), Portugal (Y 2019.4, N 37), Iran (Y 2019.4, N 15) and Estonia (Y 2020, N 12) and Indonesia (Y 2020.5, N 6) emerged as a contributor to ST research. It is evident from the coupling analysis of countries that some OECD countries, the United Kingdom, Netherlands, Germany, United States, and Switzerland, have indicated a higher degree of networking.

The analysis also indicates two different phases (see Fig. 5). In phase one (2015 to 2018), OECD nations, including the Netherlands, the United Kingdom, the United States, Germany, and Switzerland, were prominent contributors. From 2019 to 2020, many NON-OECD countries, such as China, Brazil, Portugal, Iran, Estonia, Ukraine, Indonesia, UAE, Ghana and Kenya, emerged as promising contributors to the ST research.

Trending Topics or Hotspots of Global South Countries

The following section presents the trending research themes of global south nations by analysing the global corresponding author's meta-data of the ST research corpus (see Fig. 6). Key terms appearing in the corpus on non-OECD countries were mapped to highlight information about the core contents of the publications and thus allowing for monitoring of the past and present research agendas in those countries. The analysis shows that China and South Africa have been on the rising. ST framework, Strategic Niche Management (SNM) had a low but persistent presence in the last five years. Also, the Technological innovation system has remained the most applied framework of ST. Moreover, energy policy and energy transition are potentially rising research hotspots in future, along with the Multi-level Perspective (MLP) and governance aspects of ST.

Conclusions

The ST research has witnessed consistent growth along with rising concerns about climate change among the global academic community. The publication has shown positive growth from different sources and authors from Global North and Global South. With the increase in publications on ST, a bibliometric study assists researchers and policymakers in understanding the geography of research, collaboration, and trending topics of a given research field. The Global South is nowhere close to Global North. Nevertheless, Global South can be considered as a follower of the research issues and publications themes founded by Global North. From the findings policymakers and academics may learn how Non-OECD countries need to make changes in their approach to collaborative research and funding of research in the ST area. There may be an increasing requirement for collaborative publications and research on Transitions in Global South on issues relevant to Non-OECD countries. To address sustainability issues a greater co-authorship and collaborative research would be essential between OECD and Non-OECD countries in the ST area.

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