International Journal of Multidisciplinary Research and Growth Evaluation.

Bibliometric trends in cross disciplinary research: A web of science perspective

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Article Info

ISSN (online): 2582-7138
Volume: 05
Issue: 05
September-October 2024
Received: 07-07-2024
Accepted: 15-08-2024
Page No: 214-218

Abstract

The aim of this paper is to assess the level of interest in a particular objective through the bibliometric analysis of research methodology. This involves conducting a quantitative research approach, to compile an inventory of publishing activities within the specific field under investigation. The data under scrutiny were downloaded from the Web of Science platform and encompass a range of sources, including scientific works, and articles in specialized journals. The query yielded a total of 10,298 scientific documents that feature the English acronym "cross disciplinary research." This query was carried out on publications spanning the most recent 12 years, up to May 1, 2023.

Keywords: cross disciplinary research, Interdisciplinary, Multidisciplinary, Transdisciplinary, Collaborative research, Convergence research, Integrative research

1. Introduction

Cross-disciplinary research, often referred to as interdisciplinary or multidisciplinary research, represents a dynamic and innovative approach to addressing complex issues and advancing knowledge in various fields. It involves the convergence of multiple academic disciplines and perspectives to tackle multifaceted problems, transcending traditional disciplinary boundaries. As society faces increasingly intricate challenges in areas such as healthcare, sustainability, technology, and social dynamics, cross-disciplinary research has gained prominence as an essential tool for generating novel insights and solutions.

Cross-disciplinary research is a multifaceted concept that encompasses a spectrum of collaborative approaches across different academic domains. It can be defined as "the integration of knowledge, methods, and perspectives from diverse fields to create a holistic understanding of complex problems[1]. This approach encourages researchers to move beyond the confines of their respective disciplines and encourages collaboration with experts from other fields to foster innovation.

The history of cross-disciplinary research dates back to early scientific inquiries, but its formalization and recognition as a legitimate research paradigm gained momentum in the latter half of the 20th century. Pioneering work by scholars like J.D. Bernal and C.P. Snow emphasized the importance of bridging the gap between the sciences and humanities[2,3]. Since then, cross-disciplinary research has continued to evolve and expand into various domains. Interdisciplinarity has traditionally been understood to call for the integration of concepts or theories. However, this form of integration is frequently absent in the young subject of sustainability science. In fact, it is occasionally seen as a barrier to interdisciplinarity.[4]

Cross-disciplinary research offers several advantages, including the potential for groundbreaking discoveries, the ability to address complex societal issues comprehensively, and enhanced creativity through diverse perspectives.

However, it also presents challenges such as communication barriers, integrating disparate methodologies, and establishing common ground among researchers from different backgrounds. The relevance of cross-disciplinary research is evident in its contributions to numerous fields, including medicine, environmental science, and technology development. For example, the emergence of bioinformatics, a fusion of biology and computer science, has revolutionized genomics research.[5] cross-disciplinary research represents a transformative approach to knowledge creation and problem-solving that is gaining increasing importance in today's rapidly changing world. This paper will delve into the intricacies of this research paradigm, shedding light on its evolution, challenges, and potential for shaping the future of academia and society.

Table 1: Main Information

Description	Results
Main Information About Data	
Timespan	2011:2022
Sources (Journals, Books, etc)	10361
Documents	38431
Annual Growth Rate %	7.11
Document Average Age	5.67
Average citations per doc	7.602
References	870975
DOCUMENT CONTENTS	
Keywords Plus (ID)	30535
Author's Keywords (DE)	49967
AUTHORS	
Authors	146366
Authors of single-authored docs	6179
AUTHORS COLLABORATION	
Single-authored docs	6814
Co-Authors per Doc	5.35
International co-authorships %	15.53
DOCUMENT TYPES	
Art exhibit review	1
Article	18966
Article; book chapter	20
Article; data paper	8
Article; early access	260
Article; proceedings paper	295
Article; retracted publication	2
Bibliography	2
Biographical-item	13
Book review	1561
Book review; book chapter	1
Book review; early access	4
Correction	242
Correction; early access	9
Editorial material	3250
Editorial material; book chapter	4
Editorial material; early access	6
Expression of concern	1
Fiction, creative prose	1
Letter	781
Letter; early access	9
Meeting	21
Meeting abstract	7561
News item	132
Proceedings paper	2744
Record review	1
Reprint	7
Retraction	6
Review	2472
Review; book chapter	18
Review; early access	32
Review; retracted publication	1

Research Design

This study employs a bibliometric research approach to analyze cross-disciplinary research from the years 2011 to 2022 using the Web of Science database, as this period represents the last 12 years leading up to the study's inception in 1st May 2023.

Search Strategy

The search query will be designed to capture articles that specifically pertain to cross-disciplinary research. The query may include keywords and phrases such as "cross disciplinary research" (Title) OR Interdisciplinary (Title) OR Multidisciplinary (Title) OR Transdisciplinary (Title) OR "Collaborative research" (Title) OR "Convergence research" (Title) OR "Integrative research" (Title) and 2011 or 2012 or 2013 or 2014 or 2015 or 2016 or 2017 or 2018 or 2019 or 2020 or 2021 or 2022 (Publication Years).

Data Processing

Bibliographic data will be extracted from the Web of Science database, including titles, abstracts, authors, publication dates, source journals, and citation counts. Duplicate entries and irrelevant articles will be removed during the data cleaning process to ensure data accuracy. Articles will be categorized based on their subject areas, publication years, and other relevant attributes.

Data Analysis

Basic descriptive statistics will be used to provide an overview of cross-disciplinary research trends during the specified period. This will include statistics on the **Year wise Productivity,** Source Wise productivity, Country wise Productivity, Most cited journals and
Top productive authors. The table are created using Vosviewer Version 1.6.19, and the images are created using Social Network Visualizer V3.0.4.

Limitations

This study is limited to cross-disciplinary research articles available in the Web of Science database, from 2011 to 2022.

Results

Table 2: Year wise Productivity

Year	Frequency	Total Citation per Art	Total Citation per Year	Citable Years
2011	2,099	14.67	1.13	13
2012	2,165	12.09	1.01	12
2013	2,510	13.08	1.19	11
2014	2,616	11.9	1.19	10
2015	2,806	9.94	1.10	9
2016	3,006	8.97	1.12	8
2017	3,154	8.75	1.25	7
2018	3,449	6.94	1.16	6
2019	3,898	6.05	1.21	5
2020	4,041	5.93	1.48	4
2021	4,220	3.14	1.05	3
2022	4,467	0.91	0.46	2

The table shows that the number of articles published each year increased steadily from 2011 to 2022. The total number of citations received by all articles also increased steadily over this period. The total number of citations received by all

articles published in 2020 was higher than the total number of citations received by all articles published in 2019, even though fewer articles were published in 2020. This suggests that the articles published in 2020 were more highly cited than the articles published in 2019. There are a number of possible explanations for the trends observed in the table. One possibility is that the field is growing rapidly and attracting more researchers. This would lead to an increase in the number of articles published each year. Another possibility is that the quality of research in the field is improving. This would lead to articles receiving more citations on average. Finally, it is also possible that the citation patterns in the field are changing.

Table 3: Source Wise productivity

Journal Name	Rank	count	Citations	Norm. citations	Avg. citations
Journal of Clinical Oncology	1	335	1023	138.84	3.05
Plos One	2	171	3003	328.99	17.56
Journal of Multidisciplinary Healthcare	3	159	2095	283.88	13.18
Journal of the American Geriatrics society	4	159	797	78.48	5.01
Gerontologist	5	144	533	48.13	3.70
Annals of Oncology	6	141	1249	139.94	8.86
Sustainability	7	131	1080	203.84	8.24
Pediatric Blood & Cancer	8	128	198	32.60	1.55
Journal of General Internal Medicine	9	125	119	14.06	0.95
BMJ Open	10	117	1182	182.94	10.10
Annals of Surgical Oncology	11	116	1671	171.42	14.41
International Journal of Radiation Oncology Biology Physics	11	116	236	25.11	2.03
British Journal of Surgery	12	115	632	67.06	5.50
Obesity Surgery	12	115	526	58.50	4.57
Journal of Thoracic Oncology	13	113	4071	310.03	36.03

The provided table offers a comprehensive overview of several academic journals, showcasing their rankings and key metrics. Topping the list is the "Journal of Clinical Oncology" at the first position, having published 335 articles with a total citation count of 1023. This translates to an impressive normalized citation metric of 138.84 and an average of 3.05 citations per article. Following closely is "PLOS ONE" at the second position, with 171 articles that have garnered 3003 citations, resulting in a remarkable normalized citation of 328.99 and an average of 17.56 citations per article. The third-ranked "Journal of Multidisciplinary Healthcare" and others in the list demonstrate varying degrees of scholarly impact, as reflected in their citation counts, normalized citations, and average citations per article. Notably, "Journal of Thoracic Oncology" stands out with a significantly high total citation count of 4071, a normalized citation of 310.03, and an average of 36.03 citations per article. These metrics collectively provide valuable insights into the scholarly influence and impact of each journal within its respective field.

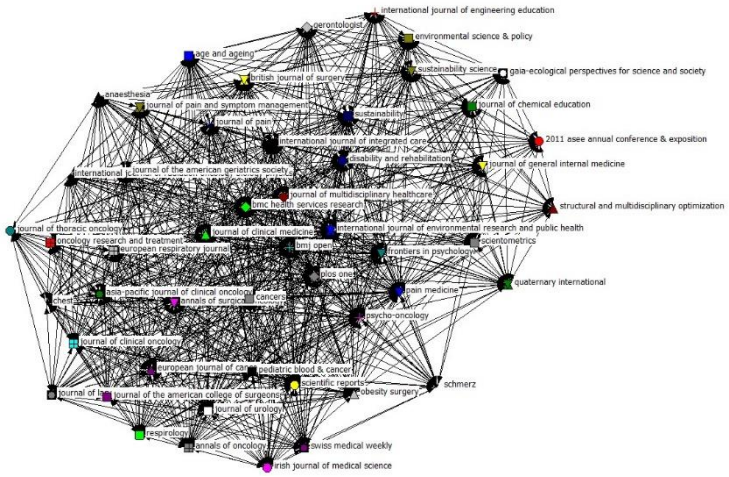

Fig 1

Table 4: Country wise Productivity

Countries	Documents	Citations	Norm. citations	Avg. citations
USA	11965	127721	15893.39	10.67
England	3631	51654	7127.89	14.23
Germany	3514	41771	5534.15	11.89
Italy	2654	33388	4766.94	12.58
Australia	2038	29659	4126.87	14.55
Spain	1980	20329	2854.48	10.27
Canada	1978	28570	3563.37	14.44

Peoples R China	1576	14354	2481.09	9.11
France	1532	23170	3256.48	15.12
Netherlands	1490	33593	4510.08	22.55
Brazil	1019	4887	810.64	4.80
Switzerland	935	16786	2133.89	17.95
Japan	768	7631	1096.55	9.94
Belgium	675	13304	1761.89	19.71
Sweden	656	13652	1994.41	20.81

The table provides a comparative assessment of scientific research productivity and impact across different countries, revealing the United States as a leading contributor with a substantial document count of 11,965 and an impressive 127,721 citations. This results in a notable normalized citation rate of 15,893.39 and an average of 10.67 citations per document. Following closely is England, which, with 3,631 documents and 51,654 citations, boasts a commendable normalized citation rate of 7,127.89 and an average of 14.23 citations per document. Germany, Italy, and Australia also demonstrate significant research output and impact, each contributing distinctive values in terms of document count, citations, normalized citations, and average citations per document. A standout observation is the Netherlands, with a comparatively smaller document count of 1,490 but an exceptionally high average of 22.55 citations per document, indicating a concentrated and influential research output. On the other hand, Brazil displays a lower normalized citation rate, suggesting a moderate average impact despite a smaller document count. These metrics collectively provide valuable insights into the scientific contributions and global influence of each country within the realm of research.

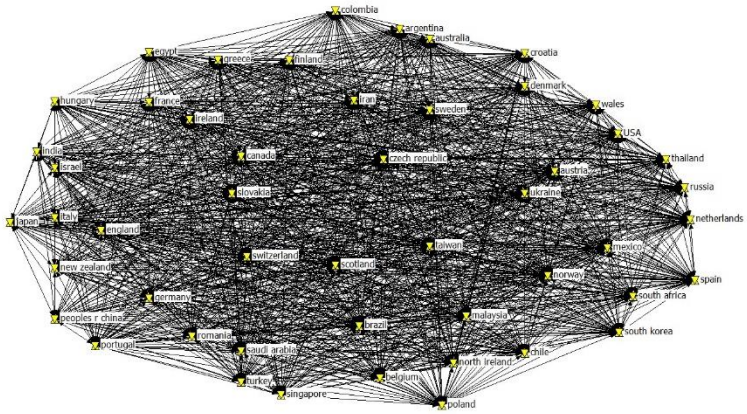

Fig 2

Table 5: Top productive authors

Author	Rank	Documents	Citations
Sevdalis, Nick	1	36	1287
Green, James S. A.	2	30	1143
Osarogiagbon, Raymond U.	3	26	155
Valentini, Vincenzo	4	25	767
Li, Wei	5	25	185
Tagliaferri, Luca	6	22	417
Lamb, Benjamin w.	7	22	909
Peris, Ketty	8	21	1693
Kasper, Bernd	9	19	207
Damaso, Ana R.	10	18	329
Thivel, David	11	18	83
Tock, Lian	12	18	393
Malvehy, Josep	13	17	1742
Ansmann, Lena	14	17	120
Garbe, Claus	15	16	1734

The table provides a ranking of authors based on their research productivity and impact, with key metrics including the number of documents they have authored and the total citations their work has received. Sevdalis, Nick holds the top position with 36 documents and 1,287 citations, demonstrating a significant research output and impact. Following closely is James S. A. Green in the second position with 30 documents and 1,143 citations. Raymond U. Osarogiagbon ranks third with 26 documents and 155 citations. Vincenzo Valentini and Wei Li secure the fourth and fifth positions with 25 documents each, accumulating 767 and 185 citations, respectively. The table showcases a diverse range of authors and their respective contributions to the academic domain, highlighting the varying degrees of research output and impact within this set of ranked authors. It is evident that each author's position is determined by a combination of the quantity and impact of their scholarly work, as measured by the number of documents and total

citations.

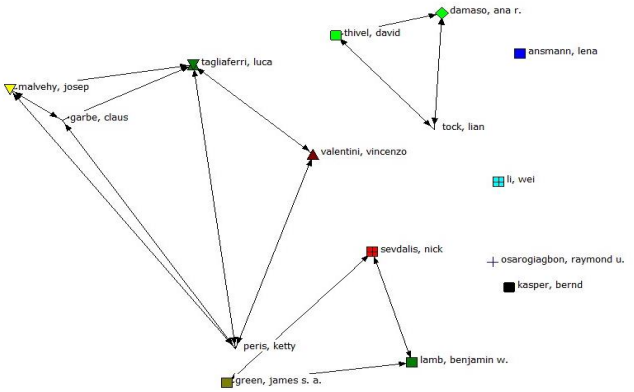

Fig 3

Conclusion

This paper undertook a comprehensive bibliometric analysis of cross-disciplinary research over the past 12 years, examining its evolution, challenges, and global impact. The field of cross-disciplinary research, synonymous with interdisciplinary and multidisciplinary research, has emerged as a dynamic and innovative paradigm for addressing complex challenges across various domains. Our bibliometric analysis, drawing from the extensive Web of Science database, revealed a substantial interest in cross-disciplinary research, with 10,298 scientific documents identified through a targeted query.

The analysis of source-wise productivity showcased several influential journals, with the "Journal of Clinical Oncology" and "PLOS ONE" leading the ranks. These journals exhibited impressive citation metrics, emphasizing their significant impact on the field. The country-wise productivity analysis identified the United States as the leading contributor, followed by England and Germany. Notably, the Netherlands displayed a concentrated and influential research output, as reflected in its high average citations per document.

Furthermore, our examination of top productive authors highlighted individuals making substantial contributions to cross-disciplinary research. Nick Sevdalis emerged as the most prolific author, followed by James S. A. Green and Raymond U. Osarogiagbon. These authors, among others, have played pivotal roles in shaping the scholarly landscape of cross-disciplinary research.

Summary: cross-disciplinary research stands as a transformative approach to knowledge creation and problem-solving. Its increasing importance in today's rapidly changing world is underscored by its contributions to fields such as medicine, environmental science, and technology development. This analysis provides valuable insights into the trends, challenges, and key contributors in cross-disciplinary research, serving as a foundation for future exploration in this dynamic and critical domain.

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