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Research Article

A COMPREHENSIVE GLOBAL ANALYSIS OF URBAN SPRAWL RESEARCH PRODUCTIVITY USING BIBLIOMETRIC ANALYSIS TOOLS

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ABSTRACT

There is a wealth of research in Urban sprawl related fields worldwide, but there is no bibliometric analysis telling us about the growth and status of scientific contribution in the fields.

Objective: We aimed to analyze the published literature on Urban sprawl, and provide references for later research.

The related documents on Urban sprawl were searched on Web of Science (WoS). Data have been analyzed using statistical functions and Histcite software ver 8.12.16, Bibliometrix app." (Using R), VOSviewer ver 1.6.6, and SPSS ver 19.

A total of 533 documents on urban sprawl were included in final analysis. With 36.25 Average citations per documents. Among the total 519 (97.37%) articles and 14(2.62%) review papers were published within the survey period 1958 to May 12, 2021. A total of 1354 Authors, and 236 journal sources were contributed according to the information found in the WoS. The analysis revealed that the publication was increased after the year 2000. Journal of Sustainability (NP=29) articles and Land use Policy (NP=26) articles were most Portuguese Journal in the field (the article are mostly published in the prestigious Journals) The USA and China are the most productive countries. China is on top countries in research collaboration based on Multi country production. Salvati L from Italy and Ewing R from the USA are the most active and influence authors. The hot keywords occurrences including 'Growth', 'urbanization', 'cities', 'land-use', 'patterns', 'city', 'expansion', 'model', and 'dynamics' among others.

Our analysis highlights the characteristics of the most active researches in Urban sprawl related works and provides comprehensive insight into the scientific research community in field of urban planning on what has been done in the field and what was remain to be done in the area of Urban sprawl in future.

Keywords: Urban sprawl, Web of Science, VOS viewer, Bibliometric analysis

INTRODUCTION

Urban Sprawl is not simply a development that undercuts the quality of life for suburbanites. It is a hot issue that been raised alarms across the nations presenting in driving challenge to the health policy, environmentalists, land use planners problems[1, 2]. Rapid increase of urban sprawl in many countries worldwide has become a major concern with daily increasing and speeds of bring wealth of publication[3, 4]. The term urban sprawl has been defined as pattern of urban and metropolitan growth, and it has been used to describe low-density automobile-oriented settlement patterns with little comprehensive public planning[1, 3, 4]. Dreaming about the future of cities and consider new visionary schemes for improving the sustainability of urban development [5-7].

On the other hand, the idea of urban sprawl is not always bad but also considered as a part of the economic growth[8, 9], with bringing many negative consequences[10] for residents and the surrounding, such as the air and the water pollution, the increase of the traffic jam and the informal transportation means, agricultural land loss and its impact on rural Livelihoods, decreasing of the collective transport, putting human health in danger by causing different chronic disease, increased flooding, natural habitats loss, destroying the ecosystem and wildlife, by the way, urban sprawl consumes uncountable forests and farmlands, creating a very weak infrastructure and services[2, 11], further affect population health and wildlife [12] and it is considered as a major challenge on the way to sustainable land use[13]. While other research indicates that urban sprawl also influences the green spaces and also traffic[1].

Although there is a wealth of research by scientific community, but there is a need for better understanding of the growth and developments, collaborative endeavor by using bibliometric analysis tools[14]. Bibliometric studies have been widely conducted in various scientific research fields, as well as conducted among the urban metabolism research productivity[15], and Urban smart mobility[16], and other conducted among the cities on and off the map due to the urban globalization research[15]. However, with the increasing demand for comprehensive evidence in Urban Sprawl, it is necessary to examine and review the published studies.

In this study, the annual trends, the journals, authors, countries, institutions and keywords of published studies on Urban Sprawl were analyzed, so to provide insightful basis and reference for the future research direction.

MATERIAL AND METHODS

Search Strategy We searched for “urban Sprawl” on Web of Science on May 12th, 2021; available at (https://apps.webofknowledge.com/) provided by Southeast University. The articles and reviews were included in the retrieved documents which published only in English language and format for further use. Furthermore, the study's ethical approval was not needed because the data used were obtained from a public database and involved no interaction with animals or human subjects.

The journal IF of the year 2019 has been obtained from the InCites Journal Citation Reports (JCR)® Ranking: 2019[17], Moreover, h-index is another indicator, and it is useful to evaluate and characterize the scientific research output of a researcher achievement in any scientific field through assessing the influence of journals, countries, authors, and institutes, according to Hirsh[18].

Bibliometric analysis:

The data analyzed using "Biblioshiny app"—(using R-studio cloud) [19] Histcite software ver 8.12.16[20],and VOSviewer ver 1.6.6 (Van Eck & Waltman, Leiden University, The Netherlands) were used for data mining, mapping, and visualization of the network analyses[21], and SPSS ver 19.

Characteristics of metadata:

A total of 533 documents on urban sprawl were included in the final analysis. Among the total 519 (97.37%) articles and 14(2.62%) review papers were published within the survey period 1958 to May 12th 2021; their attributes are presented in Table 1. Those documents were received Total citations, with H_index 74 and 9.57 Average years from publication. A total of overall document was published in 236 journals, by 1354 authors are contributed 2.54 Authors per Document.

Description	**Results**
Timespan	1958:2021
Sources (Journals, Books, etc)	236
Documents	533
Total citations	19321
H_index	74
Average years from publication	9.57
Average citations per documents	36.25
Average citations per year per doc	3.511
References	19791
Document Types	
Article	519
Review	14
Document contents	
Keywords Plus	1040
Author's Keywords	1336
Authors	
Authors	1354
Author Appearances	1603
Authors of single-authored documents	100
Authors of multi-authored documents	1254

Author's collaboration	
Single-authored documents	109
Documents per Author	0.394
Authors per Document	2.54
Co-Authors per Documents	3.01
Collaboration Index (CI)	2.9

Table 1: Characteristics of metadata data

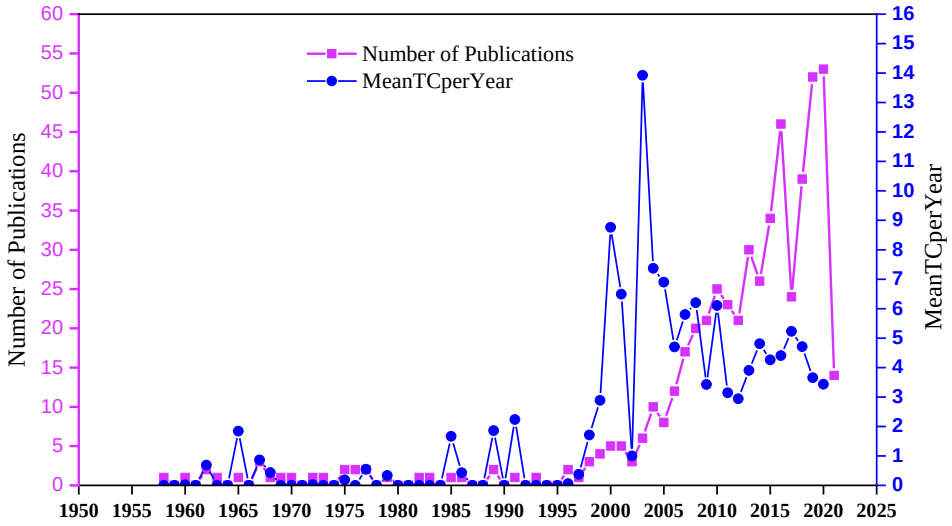

Figure 1: Annual trend and total number of citations of urban sprawl reseach output

Annual growth of the urban sprawl publications:

The characteristics of Metadata as the annual number of documents per year and Average citation score (Figure. 1). The analysis revealed that the publication was increased after the year 2000 with a high number of documents published in the world in the year 2020.

Source (n=236)	h_index	TC	NP	PY_start	IF (2019)
Sustainability	8	170	29	2013	2.57
Land use Policy	19	1128	26	2004	3.68
Landscape and Urban Planning	15	1602	16	2005	5.44
Urban Studies	13	808	15	1998	2.828
Ecological Indicators	11	562	13	2010	4.23
Applied Geography	9	815	12	2003	3.51
Cities	10	471	12	2005	4.80

Journal of the Indian Society of Remote Sensing	4	93	11	2013	0.99
Environment and Planning B-Planning & design	10	439	10	2008	1.53
Habitat International	9	483	9	2010	4.31

Table 2: The top 20 active Journals with highest number of documents published in urban sprawl

Journal type and impact factors:

Total, 236 different journals participated in publishing the retrieved documents in urban sprawl. The top 10 active journals and productive journals with their h_index, Total Citations, Number of Published documents and active year of publications (PY_start) and Journal IF for year 2019 are listed in Table 2. The top productive journal in this field of urban sprawl was Sustainability (n=29, 7.6%, TC= 170), followed by the Land use Policy (n= 26, TC=1128), and Landscape and Urban Planning (n=16, TC=1602).

SCR	Country	NP	TC	ATC	SCP	MCP	MCP_Ratio
1	USA	132	8009	60.67	123	9	0.0682
2	China	92	2446	26.59	67	25	0.2717
3	Italy	30	766	25.53	18	12	0.4000
4	India	27	756	28.00	23	4	0.1481
5	Spain	27	861	31.89	21	6	0.2222
6	Canada	22	857	38.95	10	12	0.5455
7	Germany	22	1006	45.73	12	10	0.4545
8	France	12	362	30.17	6	6	0.5000
9	Belgium	10	473	47.30	4	6	0.6000
10	Switzerland	10	323	32.30	6	4	0.4000

Table 3: Top 10 countries and world regions in urban sprawl research production

SCR, Standard Competition Ranking, NP: Number of Publication; SCP: Single Country Publications; MCP: Multiple Country Publications; TC: Total Citations

Most active countries on urban sprawl research:

The list of these top 10 most productive and influential countries urban sprawl presented in Table 3. The USA ranked the first country with published the most papers among the countries on urban sprawl (NP=132, SCP=123, and MCP=9), followed by China (NP=92, SCP=67, and MCP=25), and Italy (NP=30, SCP=18, and MCP=12) among reported one. Productivity based on the number of citations score per country shown that The USA is the first county based on citation obtained (TC=8009), followed by China (TC=2446), and Germany (TC=1006). The USA, India, France, and Brazil is the most active country in terms of international cooperation, with the largest amount of international collaboration publications (n≥25) articles. China has significant contributors to research based on multiple country publications.

SCR	Author (n=1354)	Institutions	h_index	TC	NP
1	Salvati L	Council Agr Res & Econ CREA, Via Navicella 2-4, I-00184 Rome, Italy	10	472	14
2	Ewing R	Rutgers State Univ, Bloustein Sch Planning &Publ Policy, New Brunswick, NJ 08903 USA	11	1531	12
3	Hamidi S	Coll Architecture & Planning, Dept City & Metropolitan Planning, Salt Lake City, UT 84112 USA	8	409	9
4	Jaeger JAG	Concordia University, Dept Geog Planning &Environm, Montreal, PQ H3G 1M8, Canada	9	549	9
5	Sauri D	University Autonoma Barcelona, Dept Geog, Barcelona 08019, Spain	5	480	6
6	Schwick C	Die GeographenSchwickSpichtig, DiplGeogr, CH-8004 Zurich, Switzerland	6	493	6
7	Serra P	University Autonoma Barcelona, Dept Geog, Barcelona 08019, Spain	4	451	5
8	Song Y	Univ N Carolina, Dept City & Reg Planning, Chapel Hill, NC 27514 USA	5	411	5
9	Brueckner JK	University Illinois, Dept Econ, Urbana, IL 61820 USA	4	759	4
10	Hortas-Rico M	University Complutense Madrid, Barcelona Inst Econ IEB, Madrid 28223, Spain	4	118	4

Table 4: The top 20 authors with the highest number of urban sprawl research

SCR, Standard Competition Ranking,

Authorship analysis:

Since the beginning of urban sprawl research production, many authors have made fundamental contributions to urban sprawl output. a total of (n=1354) authors were identified, with average number of authors per document was of 2.54, were contributed in urban sprawl research productivity. Table 4 sorted the author analysis based on total citation; h_index, g_index, and their affiliation are reported. Salvati L. from Council Agriculture Research & Economic CREA, Via Navicella 2-4, I-00184 Rome, Italy is most productive authors with (14) article, TC (472) citations, h_index (10) score, followed by Ewing R from Rutgers State University, Bluestein School Planning & Public Policy, New Brunswick, NJ 08903 USAwith (12) articles, TC (1531), and h_index (11).

Figure 2: WordCloud of the top 100 keyword Plus that more occurrence urban in sprawl research production

The top 10 occurrence among the top 100 of keywords are 'Growth' (129), 'urbanization'(77), 'cities' (67), 'land-use'(62), 'patterns'(57), 'city' (56), 'expansion'(44), 'model'(42), and 'dynamics' (36) among others (Figure 2).

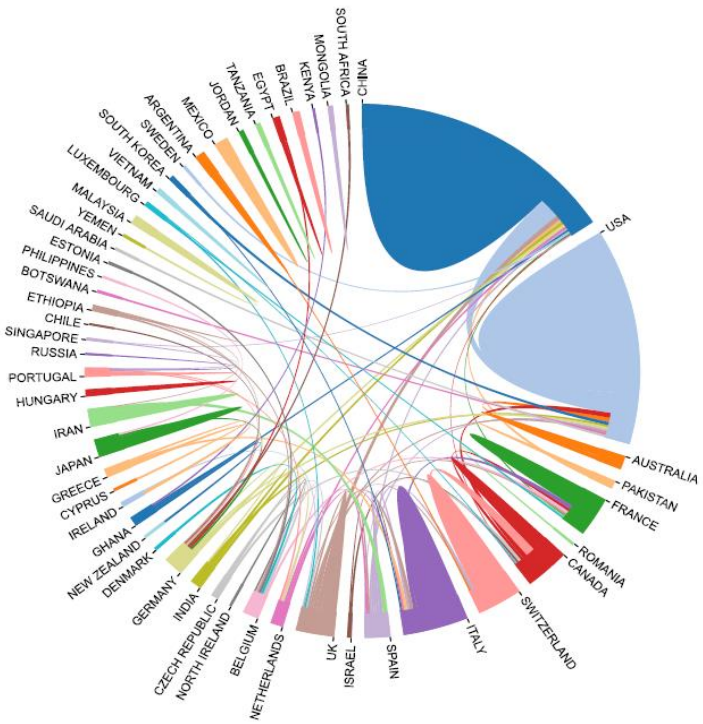

Figure 3: Inter-State relationship analysis between countries contributed in urban sprawl research production

Inter-State relationship analysis:

The scientific collaboration in perspectives of country reported in figure3. The current study show Inter-State collaboration between countries shows that the USA, China and Italy are more collaborated, where less international collaboration are reported between the countries.

SCR	Funding Agencies	NP	(%)
1	National natural science foundation of china	54	9.78
2	United states department of health human services	12	2.17
3	National institutes of health, USA	11	1.99
4	European Commission	10	1.81
5	Chinese Academy of Sciences	9	1.63
6	Fundamental research funds for the central universities	9	1.63
7	National science foundation	7	1.26
8	National science centre Poland	4	0.72
9	NIH national institute of environmental health sciences	4	0.72
10	Social sciences and humanities research council of Canada	4	0.72

Table 5: The 10 top organizations urban sprawl research production

The 10 top organizations & research area urban sprawl research production

Table 5 shows that National natural science foundation of china is the top funding agencies for urban sprawl research production 54(9.78%), followed by United states department of health human services 12(2.17%), and National institutes of health, USA 11(1.99%). Our analysis revealed that Environmental Sciences Ecology are the top research area 293(53.08%), followed by Urban Studies 117(21.19%), and Geography 102(18.47%) as presented in Table 6.

SCR	Research area (n=28)	NP	(%)
1	Environmental Sciences Ecology	293	53.08
2	Urban Studies	117	21.19
3	Geography	102	18.47
4	Public Administration	88	15.94
5	Business Economics	68	12.31
6	Science Technology Other Topics	59	10.7
7	Remote Sensing	39	7.06
8	Physical Geography	33	5.98
9	Engineering	31	5.62
10	Public Environmental Occupational Health	27	4.89
11	Geology	25	4.53
12	Biodiversity Conservation	20	3.62

13	Transportation	18	3.26

Table 6: The 10 top research areas in urban sprawl research area production

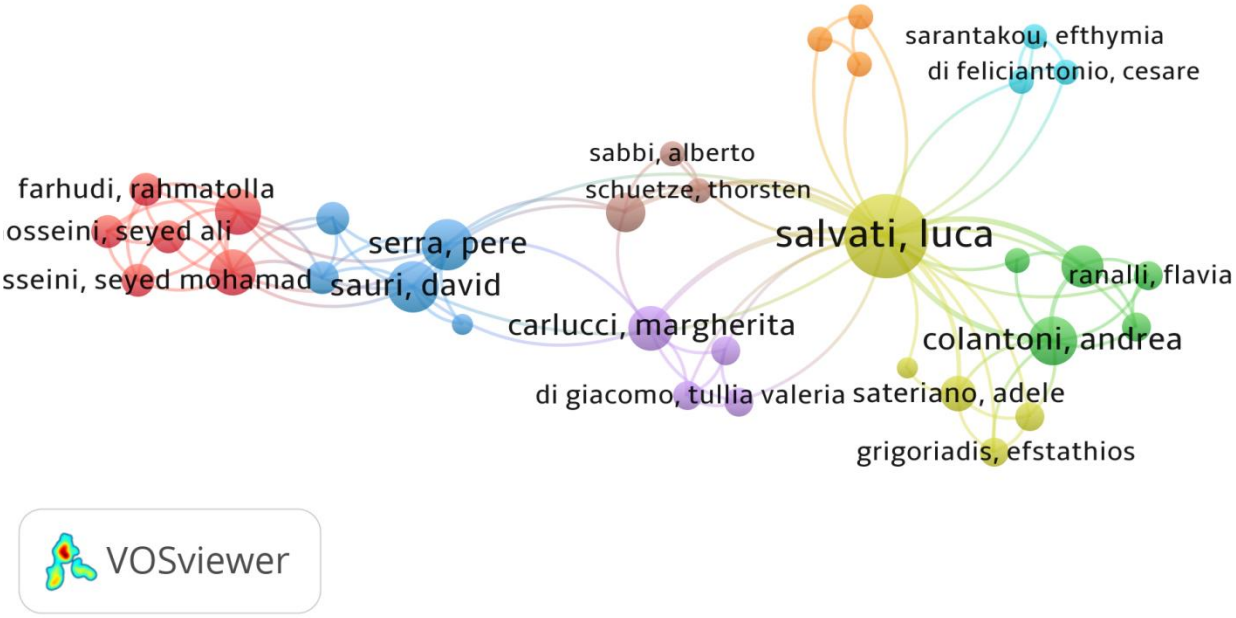

Figure 4: Network visualization between authors in urban sprawl research

We used VOSviewer software to visualize the co-authorship network analysis between the authors. For analysis of authors, a minimum of 1 instance of authorship was required to meet the search criteria, and 1398 authors reached this threshold. As a result, only 34 authors are have appeared in 8 clusters with Link (90) and Total Length Strength (L=24, TLS=32) among others.

DISCUSSION

Our study used bibliometric analysis network for overall published documents on Urban sprawl publication that can identify core research in related field or authors, as well as their relationship, countries collaboration by covering all the publications related to a given topic or specific field as well as conducted previously in a different scientific research field[15, 16, 22]

Journals with the number of publications of more than 9 publications are listed among the top cited journals, which indicates that published urban sprawl scientific research have been published in many relevant journal such as Sustainability, Land use Policy, Landscape and Urban Planning, Urban Studies, Ecological Indicators, and Applied Geography as top five rank journals involved, the publication of studies were relatively more than 10 articles with impact factors over two.

Beyond the most cited research in Urban sprawl, some of the most prominent publications are from the USA, followed by China, and Italy. The findings are similar to previous published documents in smart city which including crowded city, urban growth, urban areas, urban mobility, and urban planning where Italy, United Kingdom, United States, Canada, China, Europe, and Eurasia are the most contributed countries and regions [23]. Also similar to the study published in the United States and China [24]. The analysis highlighted that National natural science foundation of china was the top funding agency in the world for research into urban sprawl as well as similar finding reported by Chen et al., 2014 [24]. However, the leading authorship position coming from the Council Agriculture Research & Economy CREA, Via Navicella 2-4, I-00184 Rome, Italy, followed by Rutgers State University, Bloustein School Planning & Public Policy, New Brunswick, NJ 08903 USA should be acknowledged, as they remain instrumental in facilitating the work and research productivity in field of Urban sprawl related publication.

A total of the publications in Urban sprawl were indexed in 28 research area. The results revealed that the research on urban sprawl covers a wide variety of areas, ranging from "Environmental Sciences Ecology", "Urban Studies", "Geography", "Public Administration", "Business Economics", "Science Technology Other Topics", and "Remote Sensing". It can also be seen that a large number of publications have been produced in the "Environmental Sciences Ecology" areas and "Urban Studies" [24].

In further analysis we used the technique of network for exploring the collaborations and associations between different institutions, countries, and authors and in better understand the linking strengths among the different categories in urban sprawl as well as implemented in many others studies[25, 26] by using VOSviewer as available computer program that we have developed for constructing and viewing bibliometric map[27].

Among all the keywords, only the top 10 keywords are reported which includes 'Growth' 'urbanization', 'cities', 'land-use', 'patterns', 'city', 'expansion', 'model', and 'dynamics' among others which indicated that the focuses of the studies were relatively scattered and wide. Furthermore, these used keywords are considered hotspots research subject with received more and more attention.

Although the study provides a comprehensive analysis of the global Urban sprawl research publication however there are several limitations. The included studies were retrieved from one database only. However, It does not include other databases such as Google Scholar, Scopus, and other non English electronic databases which have met the needs of this study. Another limitation was that the most of the funding is coming from China, we also did not include Chinese studies that have been written in Chinese, which might cause a publication bias to some extent.

CONCLUSION

There is a remarkable global effort towards global Urban sprawl. The study shows the general increasing trend of research in global Urban sprawl, authors, countries and funding agencies are contributed in research Urban sprawl related fields. However, there is a lack of international collaboration in research in

this area where there is a need for an integration of scientific researches and resources as well as scientific collaboration should be strength in global Urban sprawl related research productivity.

There is a need for an integration of scientific researches and resources, the scientific collaborations should be strengthened in global Urban sprawl related to research productivity.

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