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Recent Trends In Startup – A Scientometric Analysis (2020-2024)

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Abstract: Startups have become central to innovation, economic growth, and technological progress in the global economy. In 2016, Prime Minister launched Start-up India mission so that India becomes the next big start-up Nation. The dimensions of Scientometric analysis include quantitative study for evaluating scientific literature that serves as an effective tool for exploring the development, trends, and impact of research on startup. This study results a notable research gap by analyzing scholarly works on this topic from the Web of Science database, covering the period from 2020 to 2024. Over this five-year period, an overall of 4,443 startup-related publications were indexed in the Web of Science database. Notably, the research output in the startup sector doubled, rising from 684 publications in 2020 to 1,231 in 2024. Although the topic of startup success is gaining increasing attention from researchers, comprehensive analyses remain confined to few people. By examining annual publication trends, research growth using time series analysis, key sources (journals), influential authors, documents, keyword frequency, and geographical distribution, this study offers valuable insights into the evolving landscape of startup research. This article provides insight knowledge for the researchers and newcomers to become familiar with this field of study as it examines the salient features and evolution in the field of innovation studies.

Index Terms - Startups, Scientometric, entrepreneur, innovation, technology.

I. INTRODUCTION

In the Hustle-bustle of the world, the start-up touched the highest position and this has become the aim and future plan of youngsters and entrepreneurs. It helps them to earn money in their known way. Start-ups are essentially of two kinds. One that starts something at the root level, something that no one has thought about and is often ground breaking. Very complex to create such start-ups, but once established often sees extraordinary growth. The second kind of Start-ups that we see around us is primarily the ones that are modified startup handled by others. The study of startups through scientometric analysis is particularly valuable, as it highlights hidden patterns in academic research, evaluates the impact of scholarly work on entrepreneurial practices, and informs strategic decision-making for stakeholders. As startups continue to reshape industries and economies, understanding the academic discourse that surrounds them is essential to fostering innovation, strengthening entrepreneurial ecosystems, and promoting sustainable development.

II. OBJECTIVES:

The major objectives are mentioned below:

1. To study the year-wise distribution of publications startup.
2. To examine growth of research output of startup with regular intervals.
3. To analyze the author wise research publications in startup research.
4. To identify the Document type and Journal wise distribution of publications in startup.
5. To identify the country-wise distribution of publications and different language with different key words research output in Startup.
6. To find out the Institution wise research concentration of startup research.

III. DATA COLLECTION:

The necessary data has been downloaded from Web of Science database. It includes the Science Citation Index (SCI) and Social Science Citation Index (SSCI) and Arts & Humanities Citation Index (ACHI) which is available via the Web of Science (WoS). The WoS is the search platform provided by Thomson Reuters (the former Thomson Scientific emerged from the Institute for Scientific Information (ISI) in Philadelphia). The publications in "startups" by the scientists in Science and technology were taken as a source and published from 2020 to 2024 by the scientists are accounted as 4443.

IV. METHODOLOGY:

The methodology applied in this study of scientometric analysis, which is used to study in details the articles and citation analysis in the references at the end of each article published in "startup" from 2020 – 2024 total articles 4443.The articles were recorded and analyzed for making observations. The data have been calculated and represented the tables.

V. ANALYSIS:

5.1. Year-wise distribution of Research output in Startup

Table1: Year-wise distribution of Research output in Startup

S.No	Publication Year	Recs.	Percent	TLCs	TGCs
1	2020	684	15.39	482	15041
2	2021	786	17.69	352	11401
3	2022	828	18.64	251	8657
4	2023	914	20.57	157	5011
5	2024	1231	27.71	113	2210
	TOTAL	**4443**	**100**	**1355**	**42320**

It reveals that a picture in its entity of the published items with "Startup" in the address field, it explain that during the period of 5 years spanned between 2020 and 2024, a totally 4443 publications were published by Startup researchers. The highest number is found to be 1231 for the year 2024 with 113 Local Citation scores and by 2210 Global Citation Scores scaled. It is inferred from the analysis that there is a growth of literature on startup from the year of 2020 in 15.39 % and 27.71% in 2024.

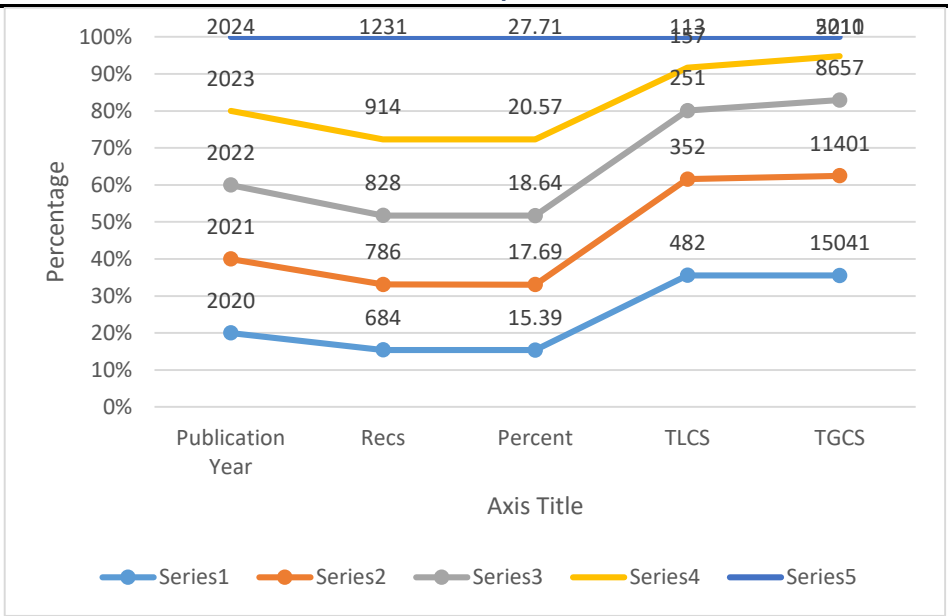

Figure 1: year-wise distribution of research output in startup

5.2. Time series Analysis of research productivity of Startup:

The multivariate analysis technique namely multiple regression has been used by the researcher. The purpose of using this technique is to predict the number of publications for the near future, i.e., 2029 and 2034 & 2020-2024 and using simple linear regression method to projections are made.

The regression equation is: y = a + bx
Where 'y' is the dependent variable (number of publications),
'x' is an independent variable (the reference year),
'a' and b are the constants.

Table2: Time series analysis of research output in startup

S.No	Year	Rec.(Y)	X	X^2	XY
1	2020	684	2	4	1368
2	2021	786	1	1	786
3	2022	828	0	0	0
4	2023	914	-1	1	914
5	2024	1231	-2	2	2462
	TOTAL	**4443**	**0**	**8**	**5530**

Straight line equation is applied to arrive at projection for future growth under Time Series Analysis.
Straight line equation Yc = a + b X

Since, $\sum X = 0$

$a = \frac{\sum Y}{N}$

$a = \frac{4443}{5} = 888.6$

$b = \frac{\sum XY}{\sum X^2}$

$b = \frac{5530}{8}$

b = 691.25

Estimated literature in 2029 is when X = 2029 – 2022

X = 7

Yc = a + b X

Yc = 888.6 + (691.25 X 7)

Yc = 888.6 + 4838.75

Yc = 5727.35

Estimated literature in 2034 is when X = 2034 – 2022

X = 12

Yc = a + b X

Yc = 888.6 + (691.25 X 12)

Yc = 888.6 + 8295

Yc = 9183.6

Using time series analysis and the research findings for the years 2029 and 2034, it has been projected that startup research output is likely to show a rising trend in the coming years. The output is expected to reach 5,727.35 by 2029 and increase to approximately 9,183.6 by 2034 nearly doubling over the five-year period. This suggests a global positive trend in startup research productivity. These projections are based on regularly recorded data and aim to predict future research performance using observed patterns.

5.3. Author-wise distribution of research output of Startup:

Table 3: Author-wise distribution of research output of Startup

S.No	Author	Recs	%	TLCs	TGCs	Rank
1	Liu Y	38	0.86	4	415	1
2	Wang Y	29	0.65	2	733	2
3	Li X	26	0.59	5	226	3
4	Zhang L	25	0.56	5	254	4
5	Zhang H	24	0.54	1	292	5
6	Li J	23	0.52	3	304	6
7	Kim J	22	0.49	4	121	7
8	Wang CL	21	0.47	4	397	8
9	Wang C	20	0.45	14	130	9
10	Li Y	18	0.41	3	191	10

The above table3 reveals that the top ten (5.54 %) prolific authors of startup research output belong to maximum number of research works. It also shows that the Total Global Citations scores were scaled. In the present study the authors are ranked on the basis of their publications. The researcher ranked the top ten authors according to their research output.

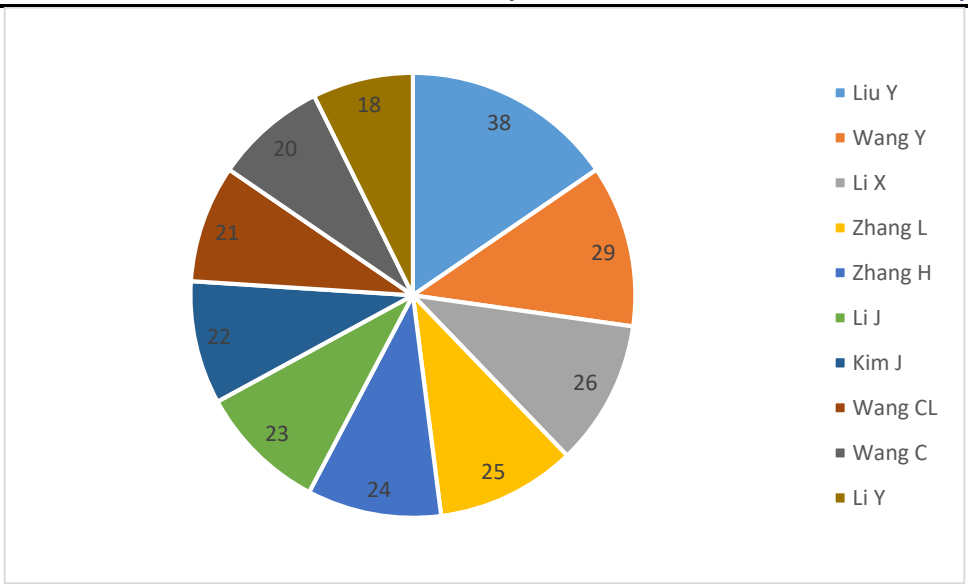

Figure2: Author-wise distribution of research output in startup

Among the 14407 authors,"Liu. Y" has published the maximum number of articles so as 38 (0.86%) with the 4 Total Local Citation scores and 415 Total Global Citations scores. And to this with second rank by Wang.Y has published the maximum articles 29 (0.65 %) calculated with 2 and 733 Total Global Citation scores scaled. It could be found from this analysis Liu.Y and Wang.Y were the most prolific authors among the total of 14407 authors.

5.4. Key Word analysis of publications in the research output of Startup:

The process of constructing indexes through the key word is the basis for keyword searching and research. They are created by analyzing the document either manually or automatically. To make key word extraction, these keywords are relevant and useful in searching the title for research references.

Table 4: Key word analysis of research output in startup

S.No	Word	Recs	Percent	TLCs	TGCs
1	STARTUP	755	16.99	413	5931
2	BASED	461	10.37	92	4266
3	STARTUPS	413	9.29	206	3777
4	PERFORMANCE	317	7.13	69	2936
5	ANALYSIS	303	6.82	35	2490
6	SYSTEM	283	6.36	32	2510
7	HEAT	277	6.23	43	2524
8	USING	223	5.02	38	1532
9	INNOVATION	218	4.91	116	2410
10	MODEL	210	4.73	109	2366

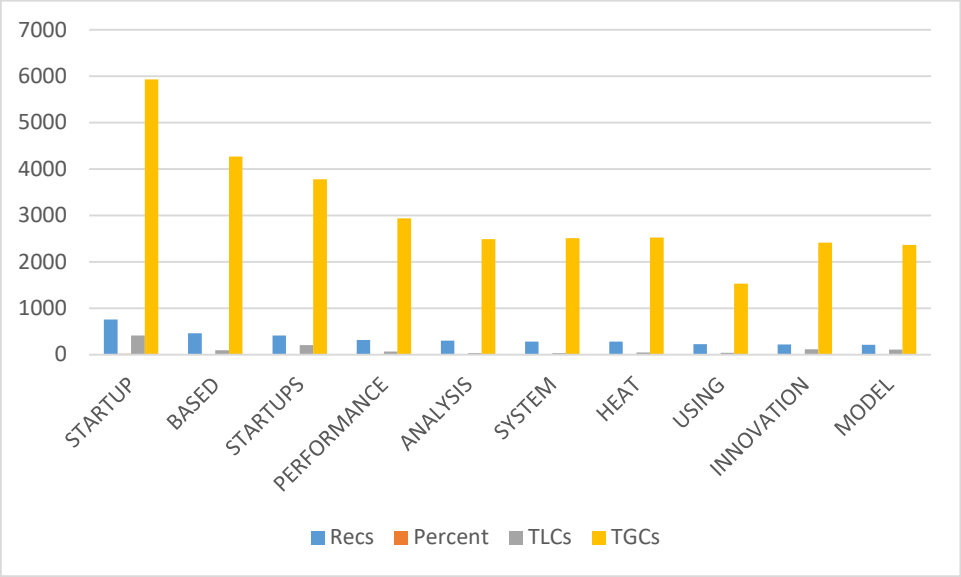

Figure 3: Key word analysis of research output in startup

In the above table Publications convey precisely the thought contents of the papers. The strength of information concentrated on the titles of the papers is more than the rest of this section of the papers. Therefore, if a word occurs more frequently than expected, then it reflects the emphasis given by the authors about the research field of their interest. The important words are called as "Key Word" and it is one of the factors to understand and grasp immediately about the content of the papers, methodologies used and areas of research addressed. The high frequency of keywords used were "STARTUP" which were topped with 755 records with Global Citation Scores of 5931, next to this "BASED" with the highest Global Citation score of 4266 with 461 publications.

5.5. Analysis of Document Type of research output in Startup:

Table5: Document type analysis of research output in startup

S.No	Document Type	Recs.	Percent	TLCs	TGCs
1	Article	4010	90.25	1273	36855
2	Review	169	3.80	69	4170
3	Article; Early Access	154	3.47	0	229
4	Editorial Material	96	2.16	8	241
5	Article; Proceedings Paper	37	0.83	8	680
6	News Item	23	0.52	0	134
7	Meeting Abstract	14	0.32	0	0
8	Book Review	13	0.29	0	2
9	Correction	13	0.29	0	5
10	Article; Retracted Publication	8	0.18	0	26

The above table explained research performance and its publications through careful analysis of the type of publications in which it reached a wider spectrum of audience. It can be useful for deeper insights to make comparisons between the institutions and the subject.

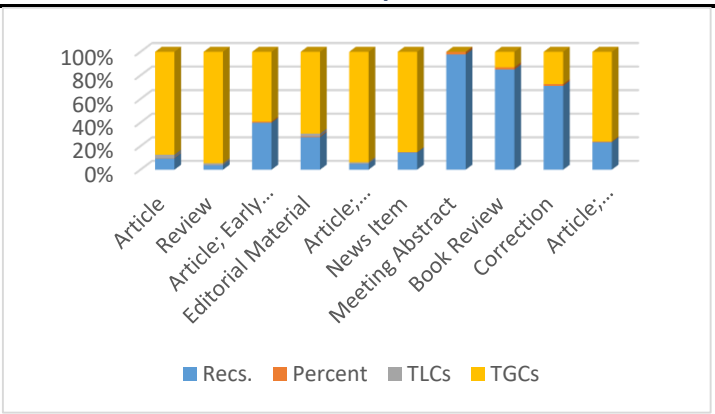

Figure 4: Analysis of document type research output in startup

The above table 5 reveals that the top ten productive document types of startup research output belong to maximum number of research works. The highest number of publications were 4010 (90.25%) in the form of articles with 1273 Local Citation Scores and with 36855 Total Global Citation Scores next to this were 169(3.80 %) in review, with 69 Local Citation Scores and 4170 Global Citation Scores and other publications were in early access articles by 154 (3.47 %) records, with 229 Global Citation Scores. The Inference is that the form of publication preferred by the scholars including faculty from the startup researchers was found to be the Journal articles and the remaining items formed a very low percentage. The Global Citations rate exceeded the local citation rates and the inference is that the visibility of the publications while compared to that of the local citation rates. Hence the journal source of citation of startup occupies a predominant place while compiling other sources of citations.

5.6. Language wise distribution of research output of Startup:

The Global visibility of the research work is much easier in publishing the research work in English than other languages. As far as language of publication is concerned English with 4523 (101.8%) articles top the list. The calculation, the comparison and citation of an article is possible if it is published in English. Most of the prolific authors are publishing the articles in English too.

5.7. Country wise Research Performance of Startup:

It is observed that one hundred six (106) countries globally encouraged publishing research work in Startup. The table 6 shows the top ten countries in the publication productivity of startup. To highlight research and development startup research output in the countries were comparative globally and it will be useful for ranking the countries.

Table 6: country-wise research output in startup

S.No	Country	Recs.	Percent	TLCs	TGCs
1	Peoples R China	1525	34.3	258	14237
2	USA	1058	23.8	518	11407
3	UK	264	5.9	157	3079
4	Germany	253	5.7	106	3451
5	Italy	227	5.1	223	3384
6	India	215	4.8	52	1816
7	South Korea	188	4.2	33	1409
8	France	154	3.5	63	1681
9	Spain	154	3.5	26	1924
10	Canada	150	3.4	58	1353

Among the total publications, 34.3% of the work is being produced by Republic of China with 1525 records claimed 258 Total Local Citations Scores and 14237 Total Global Citations Scores. Next to this, USA has produced 1058 records (23.8 %) with 518 Total Local Citations Scores and 11407 Total Global Citations Scores. It is found from the table that India ranked in the sixth place in this list with 215 records (4.8 %) with 52 Total Local Citations Scores and 1816 Total Global Citations Scores.

5.8. Institution-wise distribution of research output of Startup:

The researcher and authors are encouraged by the affiliating institutions to make those institutions in the list of ranking. Specifically, the most prolific authors are in the most productive institutions and they are the major producers of the research output.

Table 7: Institution-wise research output in startup

S.No	Institutions	Recs.	Percent	TLCs	TGCs
1	Xi An Jiao Tong Univ	105	2.36	24	860
2	Chinese AcadSci	93	2.09	14	857
3	Tsinghua Univ	92	2.07	10	1242
4	Zhejiang Univ	56	1.26	19	682
5	Shanghai Jiao Tong Univ	54	1.22	8	480
6	Univ Chinese AcadSci	54	1.22	11	482
7	BeihangUniv	39	0.87	8	285
8	HuazhongUnivSci&Technol	39	0.87	5	518
9	Tianjin Univ	34	0.76	10	546
10	Univ Penn	34	0.76	25	475

The table mentioned above indicates Institutions wise research productivity of startup. It is noted that Institutions Contributed 4443 of the total research productivity. It is noted that Xi an Jiao Tong University contributed maximum number of research publication of 105 records (2.36%) followed by Chinese academy science with the publication of 93 records (2.09%) ranked in the second place. It is also found that Shanghai Jiao Tong University and University of Chinese Academy of Science published 54 records (1.22%) and is positioned in the same (5&6) place.

5.9. Journal-wise distribution of publication in the research output of startups:

Based on this contribution of number of articles by the authors a startups journal is ranked. Based on the productivity the ranking has been done. Table shows the list of top 10 Journals. The Journal of “SUSTAINABILITY” with 123 (2.8%) articles of the total coverage ranks the top most position with the impact factor of 3.3 followed by journals “APPLIED THERMAL ENGINEERING” with 90 (2.0%) articles. ENERGY is the journal having the highest Impact Factor of 9.0 publishing 41 articles in startups during the period (2020-2024) of study.

Table 8: Journal-wise research output in startup

S.No	Journal	Recs.	Percent	TLCs	TGCs	Impact Factor
1	SUSTAINABILITY	123	2.8	0	1355	3.3
2	APPLIED THERMAL ENGINEERING	90	2.0	0	851	6.1
3	ENERGIES	72	1.6	0	403	3.0
4	SMALL BUSINESS ECONOMICS	56	1.3	76	835	6.5
5	ANNALS OF NUCLEAR ENERGY	54	1.2	0	579	1.9
6	IEEE ACCESS	54	1.2	14	361	3.4
7	IEEE TRANSACTIONS ON POWER ELECTRONICS	46	1.0	31	642	6.6
8	PHYSICS OF FLUIDS	46	1.0	0	214	4.1
9	ENERGY	41	0.9	0	551	9.0
10	INTERNATIONAL JOURNAL OF HYDROGEN ENERGY	41	0.9	29	842	8.1

VI. Conclusion:

At present, start-ups are spreading like a money plant. All youngsters are into it, even women are coming with new innovations and they are also taking the opportunity to prove their worthiness. Indian Start-up environment is booming with education, talent, innovation and incubators in association with funding agencies. Now, the present government is also extending its support to the Start-ups. In this study analyzes the research output and publication productivity related to startups from 2020 to 2024 include a total of 4,443 startup-related to publications, were indexed in the "Web of Science database". Notably, the research output in the startup sector doubled, rising from 684 publications in 2020 to 1,231 in 2024. This trend aligns with Derek de Solla Price's observation on the exponential growth of scientific output. Among the contributing researchers, Liu Y stood out as the leading author, with the highest number of publications and a total of 415 global citations during the study period. The journal "ENERGY" emerged as the most prolific publisher of startup-related to research, featuring 41 articles and an impressive Impact Factor of 9.0. The findings reflect a growing entrepreneurship interest in the startup ecosystem. China (People's Republic of China) was identified as the leading global contributor to startup research, whereas India's contribution remained comparatively modest. However, within India, a specific industry emerged as the most preferred for startups, although this was not explicitly named in the current analysis. It identifies significant research gaps and highlights emerging areas of interest, providing a foundation for future research directions and informed decision-making.

Furthermore, the results underscore the potential for enhanced collaboration and partnerships among researchers and institutions to advance the field. Given the upward trajectory, it is expected that research and development in this domain will continue to be prominently featured in high-impact entrepreneurship sources. The findings of the study provide a better understanding of the different innovation systems approaches and research areas scholars are actively pursuing which can be used to influence future studies of startups, partnerships and publications.

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