Scientometric Trends and Mapping of Technology Roadmap Research Output: A Global Perspective

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Abstract

The study describes Scientometric Tends and Mapping of Technology Roadmap Research Output: A Global Perspective indexed in the Web of Science database. "Technology Roadmap" as a search term in the all field tag obtained 13125 records and the period of coverage from 1990 to 2021. The highest number of 1560 (11.89%) publications in the year 2021. RGR has shown a decreased trend, which means the rate is low in terms of proportion, and on the other hand, the Doubling Time (DT) has been increased during the same period. The journal articles are in the first position contributing 12020 publications with 91.58 percentages. It is identified from the above analysis that most of the scientists prefer English as the communication language (13108, with 99.87%) and TCS is 289686 for exploring their academic research activities. The most productive journal is Monthly Notices Of The Royal Astronomical Society with 492 (3.75%) papers dealing with Technology Roadmap research as first rank (TCS is 881, TGS is 13157). China is the most predominant contry

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Keywords
Scientometrics; Technology Roadmap; Bradford Law; Relative Growth

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1 Introduction

The scientometric analysis of the research has become one of the widely used methods to assess the research performance of the individual researchers, departments, faculties, universities, countries, and journals in recent years. However, there has not been an extensive scientometric evaluation on technology roadmap research.Scientometrics deals with the quantitative features and characteristics of science and scientific research. It is a newly emerging field that investigates quantitative aspects of science and is often used with the same meaning as the bibliometrics. Now it is generally used as a generic term for a variety of research approaches within the study of science. The science and scientific communication are so interrelated that one influences the other for the generation of information. Among scientists it is widely accepted that scientific research performed in academic and governmental research institutions are the driving force behind high technology and economic growth. It is the fact that research plays an important role in contribution to the economic growth of a nation. This research study focused on. scientometric tends and mapping of technology roadmap research output on worldwide.

2. Review of Literature

Zhou, L., Zhang, L., Zhao, Y., Zheng, R., & Song, K. (2020). The study was found as a new and rapidly developing distributed technology,blockchain has shown substantial impact on the fields of cryptocurrency and e-commerce and thus has attracted the interests of governments, enterprises, and research institutions. As such, it is important to understand the state of blockchain research in order for those institutions to plan their research effectively. Koondhar, M. A., Shahbaz, M., Memon, K. A., Ozturk, I., & Kong, R. (2021), the research was explored that Environmental Kuznets curve (EKC) is a statistical tool to examine the cointegration and causality nexus between economic growth and carbon emissions. Although a large number of researchers have analyzed the EKC by applying different statistical models, some review work has been summarized to draw a pictorial view of extending studies in this research field. However, still, the macroscopic overview needs to be considered. Shao, H., Yu, Q., Bo, X., &Duan, Z. (2013), the analysis was identified over the past half-century, the incidence of tumours has increased, resulting in cancer becoming one of the most lethal diseases in humans. In the present study, we elucidated the status of oncology research from 2001 to 2010.

Studies published in 30 representative oncology journals were retrieved from the Web of Science (2001-2010) to compose our dataset. Knowledge domain visualisation, co-citation analysis and social network analysis methods were used. Chang, Y. H., Chang, C. Y., & Tseng, Y. H. (2010) have found that used scientometric methods to conduct an automatic content analysis on the development trends of science education research from the published articles in the four journals of International Journal of Science Education, Journal of Research in Science Teaching, Research in Science Education, andScience Education from 1990 to 2007.

3. Objectives of the Study

- To identify and map yearly-wise research papers in Technology Roadmap.
- To know the most prolific journals on Technology Roadmap research
- To measure the Relative Growth Rate on Technology Roadmap research
- To Know the top country and continent-wise research publicationsv in this research domain
- To test the Braford Law of journal distribution in Technology Roadmap research publications

4. Methodology

Data was downloaded from Web of Science for 'Technology Roadmap with all the terms in MeSH (Medical Subject Heading) with limits as 'humans', '33 years during1989 to 2021'. . A total of 11500 ecords were obtained from Web of Science database for this study. This study covers the measured most prolific authors, values of h, g and m indexes for authors impact, Degree of Collaboration for authors also been discussed. An aggregate of 13125 records was downloaded and analyzed by using the R-Programming (Biblioshiny), VoS Viewer, HistCite and MS-Excel as per the objects of the study.

5. Result and Discussions

Table 1: Details of Sample data

SI. NO	Detail about the Sample	Observed values
1	Duration	1990-2021
2	Period of Time	32 Years
3	Total Records	13125
4	Total Number of Authors	110250
5	Unique Authors	53208
6	Total Number of Journals	3496
7	Document Types	18
8	Languages	10
9	Words	20085
10	Countries	150
11	Institutions	11410
12	Institutions with subdivisions	31026
13	Total Cited Reference	490740
14	Total Global Citation	289757

Table 1 explains the sample details of Technology Roadmap research publications obtained from the Web of Science database. The time span for the present study is from 1990 to 2021. In the present study, 13125 records were collected from the database, it has110250 contributing authors, 3496 total number of journals, 18 types of documents,10 types of languages, 150 countries from various continents and 11410 institutions respectively.

Table 2: Year wise distribution of Technology Roadmap Research Output

S. No	Year	Records	Percentage	LCS	GCS
1	1990	3	0.02	0	26
2	1991	11	0.08	2	131
3	1992	12	0.09	2	290
4	1993	17	0.13	0	1086
5	1994	22	0.17	3	1349
6	1995	25	0.19	1	445
7	1996	21	0.16	1	238
8	1997	27	0.21	0	1520
9	1998	23	0.18	5	861
10	1999	46	0.35	4	343
11	2000	52	0.40	7	1761
12	2001	53	0.40	6	1278
13	2002	64	0.49	26	2710
14	2003	61	0.46	8	2040
15	2004	67	0.51	41	3487
16	2005	95	0.72	23	3792
17	2006	106	0.81	31	5136
18	2007	105	0.80	63	4929
19	2008	204	1.55	135	10239
20	2009	420	3.20	226	16390
21	2010	472	3.60	307	16211
22	2011	542	4.13	309	21759
23	2012	539	4.11	233	17446
24	2013	576	4.39	329	23996
25	2014	633	4.82	269	18217
26	2015	799	6.09	340	18677
27	2016	1213	9.24	341	37233
28	2017	1134	8.64	362	24107
29	2018	1301	9.91	269	23039

30	2019	1396	10.64	182	14669
31	2020	1526	11.63	81	10823
32	2021	1560	11.89	27	1896
Total		**13125**	**100.00**	**3633**	**286124**

Table 4.2 explains present study 1990 to 2021 scientists published 13125 articles worldwide on Technology Roadmap. Analysis of the data shows that the annual research output in the Technology Roadmap research was increased throughout the period of study, with highest number of 1560 (11.89%) publications in the year 2021, 1526 (11.63%) records was published in 2020, 1396 (10.64%) communications in 2019 and the least was in the year 1990 with 3 (0.03%) records. A steady growth in number of publications has been gradually increased from 2018 to 2021.

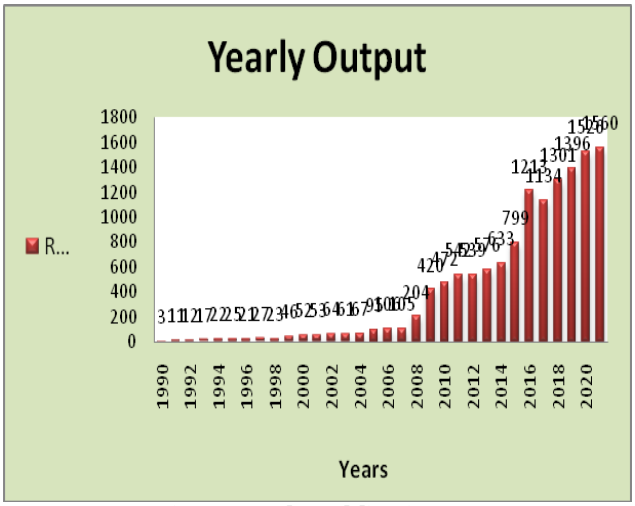


Fig. 1: Yearly-Publications

Table 3: Growth Ratio by Year-wise Analysis of Technology Roadmap Research

S. No	Year	Records	Growth Ratio
1	1990	3	-
2	1991	11	3.67
3	1992	12	1.09
4	1993	17	1.42
5	1994	22	1.29
6	1995	25	1.14
7	1996	21	0.84
8	1997	27	1.29
9	1998	23	0.85
10	1999	46	2.00
11	2000	52	1.13
12	2001	53	1.02
13	2002	64	1.21
14	2003	61	0.95
15	2004	67	1.10
16	2005	95	1.42
17	2006	106	1.12
18	2007	105	0.99
19	2008	204	1.94
20	2009	420	2.06
21	2010	472	1.12
22	2011	542	1.15
23	2012	539	0.99
24	2013	576	1.07
25	2014	633	1.10
26	2015	799	1.26
27	2016	1213	1.52
28	2017	1134	0.93
29	2018	1301	1.15
30	2019	1396	1.07
31	2020	1526	1.09
32	2021	1560	1.02
Total		**13125**	-

Table 3 indicates that the annual growth ratio wise research output in the Technology Roadmap, with highest number of growth ratio is 3.67 in the year 1991, 2.06 in 2009 with second rank, 2.00 in the year 1999 with third place, 1.94 growth ratio value in the year2008 with fourth rank and 1.52 in the year 2016 with fifth rank respectively. The least growth ratio value is 0.84 in the year 1996.

Table 4: Relative Growth Rate and Doubling Time of Research output

S. No	Year	Arti cles	Cum-ulative	W1	W2	RGR	DT
1	1990	3	3	0	1.10	1.10	0.63
2	1991	11	14	1.10	2.64	1.54	0.45
3	1992	12	26	2.64	3.26	0.62	1.12
4	1993	17	43	3.26	3.76	0.50	1.38
5	1994	22	65	3.76	4.17	0.41	1.68
6	1995	25	90	4.17	4.50	0.33	2.13

7	1996	21	111	4.50	4.71	0.21	3.30
8	1997	27	138	4.71	4.93	0.22	3.18
9	1998	23	161	4.93	5.08	0.15	4.50
10	1999	46	207	5.08	5.33	0.25	2.76
11	2000	52	259	5.33	5.56	0.22	3.09
12	2001	53	312	5.56	5.74	0.19	3.72
13	2002	64	376	5.74	5.93	0.19	3.71
14	2003	61	437	5.93	6.08	0.15	4.61
15	2004	67	504	6.08	6.22	0.14	4.86
16	2005	95	599	6.22	6.40	0.17	4.01
17	2006	106	705	6.40	6.56	0.16	4.25
18	2007	105	810	6.56	6.70	0.14	4.99
19	2008	204	1014	6.70	6.92	0.22	3.09
20	2009	420	1434	6.92	7.27	0.35	2.00
21	2010	472	1906	7.27	7.55	0.28	2.44
22	2011	542	2448	7.55	7.80	0.25	2.77
23	2012	539	2987	7.80	8.00	0.20	3.48
24	2013	576	3563	8.00	8.18	0.18	3.93
25	2014	633	4196	8.18	8.34	0.16	4.24
26	2015	799	4995	8.34	8.52	0.17	3.98
27	2016	1213	6208	8.52	8.73	0.22	3.19
28	2017	1134	7342	8.73	8.90	0.17	4.13
29	2018	1301	8643	8.90	9.06	0.16	4.25
30	2019	1396	10039	9.06	9.21	0.15	4.63
31	2020	1526	11565	9.21	9.36	0.14	4.90
32	2021	1560	13125	9.36	9.48	0.13	5.48
Total		**13125**	**84325**	**196.52**	**206.00**	**9.48**	**106.86**

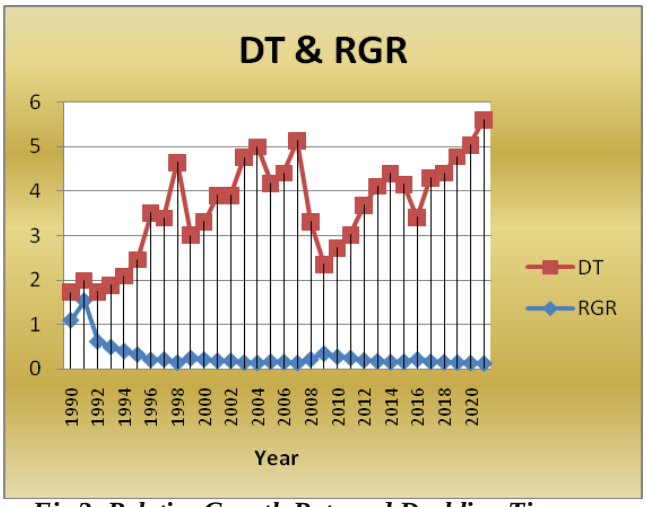


Fig.2: Relative Growth Rate and Doubling Time

The growth rate of Technology Roadmap research literature is intended by using Relative Growth rates (RGR) and Doubling time (DT) for the publications. The particulars of this model already discussed in the previous chapter. Table 4 indicates the RGR and DT time of total research output on Technology Roadmap research. The RGR value for the year 1990 is 1.19 and the value for the final year 2021 is 0.13.The result shows that the value was gradually decreased over the years. The Doubling Time (DT) shows an increasing trend, from the year 1990 with 0.63 values and the final year 2021 is 5.48. RGR has shown a decreased trend, which means the rate is low in terms of proportion, and on the other hand, the Doubling Time (DT) has been increased during the same period.

Table 5: Top Prolific Authors on Technology Roadmap Researcg Output

S. No	Author	Recs	Rank	LCS	GCS
1	Wang Y	131	1	23	1861
2	Zhang Y	131	1	23	2758
3	Li Y	126	2	44	2431
4	Liu Y	104	3	37	3589
5	Wang J	101	4	36	3943
6	Li J	96	5	33	1547
7	Zhang J	93	6	15	1788
8	Scott D	91	7	118	12720
9	Wang L	87	8	18	3025
10	Zhang L	83	9	21	4630
11	Liu J	75	10	20	1798
12	Li L	71	11	21	1327
13	Chen L	69	12	6	1017
14	Dickinson C	67	13	124	8961
15	Li H	67	13	14	1090
16	Bond JR	63	14	21	12079
17	Remazeilles M	62	15	43	11923
18	Zhang H	62	16	18	1214
19	Calabrese E	61	17	19	11674
20	de Zotti G	61	17	3	11611

The table 5 identifies that the most prolific author is Wang Y with 131 records dealing with Technology Roadmap research ranked as first place, LCS 23, GCS 1861 and Zhang Y also ranked as first position. Li Y has produced 126 articles, LCS 44, GCS 2431 ranked as second place. Liu Y has published 104 records, LCS 37, GCS is 3589 with third rank. Wang J has produced 101 articles with fourth place, Lcs 36, GCS 3943. the remaining authors are contributing 96 and below in Technology Roadmap research out of top 20 contributors.

Table 6: Brodford's Law of Journals Scattering in Technology Roadmap Research

S. No	Source	Rank	Freq	cumFreq	Zone
1	MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY	1	519	519	Zone 1
2	ASTROPHYSICAL JOURNAL	2	307	826	Zone 1
3	ASTRONOMY & ASTROPHYSICS	3	212	1038	Zone 1
4	REMOTE SENSING	4	198	1236	Zone 1
5	SENSORS	5	147	1383	Zone 1
6	SCIENTIFIC REPORTS	6	99	1482	Zone 1
7	HUMAN BRAIN MAPPING	7	98	1580	Zone 1
8	ISPRS INTERNATIONAL JOURNAL OF GEO-INFORMATION	8	87	1667	Zone 1
9	PHYSICAL REVIEW D	9	65	1732	Zone 1
10	IEEE ACCESS	10	64	1796	Zone 1
11	SUSTAINABILITY	11	62	1858	Zone 1
12	ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES	12	57	1915	Zone 1
13	EXPERT SYSTEMS WITH APPLICATIONS	13	57	1972	Zone 1
14	SCIENCE OF THE TOTAL ENVIRONMENT	14	54	2026	Zone 1
15	IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY	15	53	2079	Zone 1
16	BMC GENOMICS	16	52	2131	Zone 1
17	ISPRS JOURNAL OF PHOTOGRAMMETRY AND REMOTE SENSING	17	51	2182	Zone 1
18	APPLIED SCIENCES-BASEL	18	49	2231	Zone 1
19	INTERNATIONAL JOURNAL OF REMOTE SENSING	19	49	2280	Zone 1
20	INTERNATIONAL JOURNAL OF ADVANCED MANUFACTURING TECHNOLOGY	20	47	2327	Zone 1
21	JOURNAL OF CLEANER PRODUCTION	21	47	2374	Zone 1
22	JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS	22	45	2419	Zone 1
23	NATURE COMMUNICATIONS	23	45	2464	Zone 1
24	IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS	24	43	2507	Zone 1
25	ECOLOGICAL INDICATORS	25	42	2549	Zone 1
26	JOURNAL OF HIGH ENERGY PHYSICS	26	42	2591	Zone 1
27	ICARUS	27	41	2632	Zone 1
28	JOURNAL OF MAGNETIC RESONANCE IMAGING	28	41	2673	Zone 1
29	NATURAL HAZARDS	29	41	2714	Zone 1
30	THEORETICAL AND APPLIED GENETICS	30	41	2755	Zone 1
31	JOURNAL OF APPLIED REMOTE SENSING	31	40	2795	Zone 1
32	PHOTOGRAMMETRIC ENGINEERING AND REMOTE SENSING	32	39	2834	Zone 1
33	ASTROPHYSICAL JOURNAL LETTERS	33	38	2872	Zone 1
34	PLOS ONE	34	37	2909	Zone 1
35	COMPUTERS & GEOSCIENCES	35	36	2945	Zone 1
36	COMPUTERS AND ELECTRONICS IN AGRICULTURE	36	36	2981	Zone 1
37	MEASUREMENT SCIENCE AND TECHNOLOGY	37	36	3017	Zone 1
38	MOLECULAR BREEDING	38	36	3053	Zone 1
39	MULTIMEDIA TOOLS AND APPLICATIONS	39	36	3089	Zone 1
40	SENSORS AND MATERIALS	40	34	3123	Zone 1
41	EUPHYTICA	41	33	3156	Zone 1
42	OPTICS EXPRESS	42	33	3189	Zone 1
43	ENVIRONMENTAL EARTH SCIENCES	43	32	3221	Zone 1
44	NEUROCOMPUTING	44	32	3253	Zone 1

45	TRANSPORTATION RESEARCH RECORD	45	32	3285	Zone 1
46	ENVIRONMENTAL SCIENCE & TECHNOLOGY	46	31	3316	Zone 1
47	INTERNATIONAL JOURNAL OF APPLIED EARTH OBSERVATION AND GEOINFORMATION	47	31	3347	Zone 1
48	BRITISH JOURNAL OF EDUCATIONAL TECHNOLOGY	48	30	3377	Zone 1
49	OPTICAL ENGINEERING	49	30	3407	Zone 1
50	ADVANCES IN SPACE RESEARCH	50	29	3436	Zone 1
51	COMPUTERS & EDUCATION	51	29	3465	Zone 1
52	MATHEMATICAL PROBLEMS IN ENGINEERING	52	29	3494	Zone 1
53	NUCLEIC ACIDS RESEARCH	53	29	3523	Zone 1
54	ASTRONOMICAL JOURNAL	54	28	3551	Zone 1
55	INTERNATIONAL JOURNAL OF CLINICAL AND EXPERIMENTAL MEDICINE	55	27	3578	Zone 1
56	INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH	56	27	3605	Zone 1
57	EXPERIMENTAL AND THERAPEUTIC MEDICINE	57	25	3630	Zone 1
58	G3-GENES GENOMES GENETICS	58	25	3655	Zone 1
59	JOURNAL OF ALLOYS AND COMPOUNDS	59	25	3680	Zone 1
60	JOURNAL OF ASIAN EARTH SCIENCES	60	25	3705	Zone 1
61	NEUROIMAGE	61	24	3729	Zone 1
62	REMOTE SENSING OF ENVIRONMENT	62	24	3753	Zone 1
63	TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE	63	23	3776	Zone 1
64	ZOOTAXA	64	23	3799	Zone 1
65	BMC PLANT BIOLOGY	65	22	3821	Zone 1
66	CATENA	66	22	3843	Zone 1
67	JOURNAL OF ATMOSPHERIC AND OCEANIC TECHNOLOGY	67	22	3865	Zone 1
68	RSC ADVANCES	68	22	3887	Zone 1
69	TECTONOPHYSICS	69	22	3909	Zone 1
70	JOURNAL OF THE INDIAN SOCIETY OF REMOTE SENSING	70	21	3930	Zone 1
71	MEDICINE	71	21	3951	Zone 1
72	ARABIAN JOURNAL OF GEOSCIENCES	72	20	3971	Zone 1
73	INTERNATIONAL JOURNAL OF MOLECULAR SCIENCES	73	20	3991	Zone 1
74	JOURNAL OF BIOLOGICAL CHEMISTRY	74	20	4011	Zone 1
75	PHYSICAL REVIEW LETTERS	75	20	4031	Zone 1
76	BMC BIOINFORMATICS	76	19	4050	Zone 1
77	GEOPHYSICAL JOURNAL INTERNATIONAL	77	19	4069	Zone 1
78	BIOCHEMICAL AND BIOPHYSICAL RESEARCH COMMUNICATIONS	78	18	4087	Zone 1
79	INFRARED PHYSICS & TECHNOLOGY	79	18	4105	Zone 1
80	JOURNAL OF GEOPHYSICAL RESEARCH-SPACE PHYSICS	80	18	4123	Zone 1
81	JOURNAL OF HYDROLOGY	81	18	4141	Zone 1
82	NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH SECTION B-BEAM INTERACTIONS WITH MATERIALS AND ATOMS	82	18	4159	Zone 1
83	PHYSICAL REVIEW B	83	18	4177	Zone 1
84	PUBLICATIONS OF THE ASTRONOMICAL SOCIETY OF JAPAN	84	18	4195	Zone 1
85	SCIENCE	85	18	4213	Zone 1
86	ADVANCES IN MECHANICAL ENGINEERING	86	17	4230	Zone 1
87	BULLETIN OF THE SEISMOLOGICAL SOCIETY OF AMERICA	87	17	4247	Zone 1
88	COLD REGIONS SCIENCE AND TECHNOLOGY	88	17	4264	Zone 1
89	ENGINEERING GEOLOGY	89	17	4281	Zone 1
90	ENVIRONMENTAL MONITORING AND ASSESSMENT	90	17	4298	Zone 1

91	EUROPEAN RADIOLOGY	91	17	4315	Zone 1
92	**GPS SOLUTIONS**	**92**	**17**	**4332**	**Zone 1**
93	MOLECULAR BIOLOGY REPORTS	93	17	4349	Zone 2
94	MOLECULAR MEDICINE REPORTS	94	17	4366	Zone 2
95	TUNNELLING AND UNDERGROUND SPACE TECHNOLOGY	95	17	4383	Zone 2
96	ANALYTICAL CHEMISTRY	96	16	4399	Zone 2
97	ENERGIES	97	16	4415	Zone 2
98	GENE	98	16	4431	Zone 2
99	GEOMATICS NATURAL HAZARDS & RISK	99	16	4447	Zone 2
100	INFORMATION SCIENCES	100	16	4463	Zone 2

Table 6 noted that the highest number of paper communicated to journals technology roadmap research. This analysis information 3500 journals to have published 13125 articles. The bold letters states the values of three zones based on Bradford's law of scattering. It is completed from the analysis that first twenty five journals are nuclear or core journals.

Table 7: Journal-wise Analysis

S. No	Journal	Records	Percentage	LCS	GCS
1	Monthly Notices Of The Royal Astronomical Society	492	3.75	881	13157
2	Astrophysical Journal	301	2.29	59	6216
3	Astronomy & Astrophysics	208	1.58	41	15906
4	Remote Sensing	193	1.47	54	3738
5	Sensors	135	1.03	31	1690
6	Human Brain Mapping	96	0.73	47	2231
7	Scientific Reports	95	0.72	0	1574
8	Isprs International Journal Of Geo-Information	86	0.66	3	617
9	Ieee Access	62	0.47	10	343
10	Physical Review D	62	0.47	0	1512
11	Sustainability	61	0.46	3	466
12	Astrophysical Journal Supplement Series	56	0.43	18	2014
13	Expert Systems With Applications	54	0.41	28	1162
14	Science Of The Total Environment	52	0.40	32	1233
15	Bmc Genomics	51	0.39	0	1655
16	Isprs Journal Of Photogrammetry And Remote Sensing	49	0.37	56	1555
17	Ieee Transactions On Vehicular Technology	48	0.37	30	1540
18	International Journal Of Advanced Manufacturing Technology	47	0.36	14	792
19	Applied Sciences-Basel	46	0.35	0	163
20	Journal Of Cleaner Production	46	0.35	8	1164

Table 7 indicates that the most productive journal is Monthly Notices Of The Royal Astronomical Society with 492 (3.75%) papers dealing with Technology Roadmap research as first rank (TCS is 881, TGS is 13157). Astrophysical Journal appears on rank 2 with 301 (2.29%, TCS is59, TGS is 6216) articles, Astronomy & Astrophysics has produced 208(1.58% TCS is 41, TGS is 15906) communications with third positions, Remote Sensing has contributed in fourth place with 193 (1.47% TCS is 54, TGS is 3738) papers out of top 20 most contributed journals in Technology Roadmap research.

Table 8: Country wise Technology Roadmap Publication Growth

S. No	Country	Articles	SCP	MCP	MCP_Ratio
1	CHINA	6668	4934	1734	0.26
2	USA	1569	884	685	0.437
3	UNITED KINGDOM	1417	644	773	0.546
4	INDIA	597	422	175	0.293
5	CANADA	300	143	157	0.523
6	AUSTRALIA	278	119	159	0.572
7	JAPAN	243	100	143	0.588
8	KOREA	205	139	66	0.322
9	GERMANY	139	33	106	0.763
10	THAILAND	137	84	53	0.387
11	ITALY	104	35	69	0.663
12	IRELAND	103	57	46	0.447
13	SINGAPORE	102	52	50	0.49

14	FRANCE	95	21	74	0.779
15	SPAIN	78	30	48	0.615
16	PORTUGAL	76	32	44	0.579
17	NETHERLANDS	75	26	49	0.653
18	SOUTH AFRICA	56	21	35	0.625
19	IRAN	53	24	29	0.547
20	BRAZIL	48	16	32	0.667

Table 8shows that a total of 150 countries have contributed their publications in the field of Technology Roadmap research from 1990 to 2021. China is the most predominant contry with 6668 records and SCP is 4934, MCP is 1734, MCP ratio is 0.26. The USA appeared in the second rank with 1569 records and SCP is 884, MCP is 685, MCP ratio is 0.437. The UK has occupied the third position with 1417 records and SCP is 644, MCP is 273, MCP ratio is 0.546. India has appeared as the fourth rank with 597 records and SCP is 422, MCP is 175, MCP ratio is 0.293. Canada has appeared at the fifth place with 300 records and SCP is 143, MCP is 157, MCP ratio is 0.523 out of the top 92 countries in the Technology Roadmap domain.

Table 9: Continent wise Technology Roadmap Publication Growth

S. No	Continent	No of Record	SCP	MCP	Rank
1	Asia	8311	5906	2405	1
2	Africa	112	41	71	5
3	North and Central America	1591	893	698	3
4	South America	38	7	31	6
5	Europe	2741	1180	1561	2
6	Oceania	278	119	159	4
	Unknown	54	-	-	-
	Total	**13125**	**8146**	**4925**	**-**

Table 9 shows that a total of 6 continents have contributed their publications in the field of Technology Roadmap research from 1990 to 2021. Asia is the most predominant country with 8311 records and SCP is 5906, MCP is 2405.. Europe appeared in the second rank with 2741 records and SCP is 1180, MCP is 1561. North and Central America appeared in the third rank with 1591 records and SCP is 893, MCP is 698. Oceania is appeared as fourth rank with 278 records and SCP is 119, MCP is 159 out of six continents in Technology Roadmap research output over the period of time. Unknown record is 54.

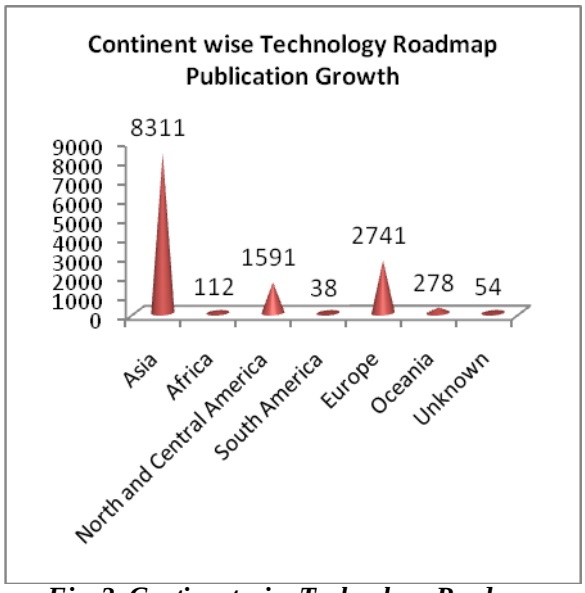


Fig. 3: Continent wise Technology Roadmap Publication Growth

6. Conclusion

The research study examines 13125 articles worldwide on Technology Roadmap during the period of time. The highest number of 1560 (11.89%) publications in the year 2021. RGR has shown a decreased trend, which means the rate is low in terms of proportion, and on the other hand, the Doubling Time (DT) has been increased during the same period. The journal articles are in the first position contributing 12020 publications with 91.58 percentages. It is identified from the above analysis that most of the scientists prefer English as the communication language (13108, with 99.87%) and TCS is 289686 for exploring their academic research activities. The Bradford multiplier between the number of references in zone 1 and zone 2 is 34.00 while it is 33.00 between zone 2 and zone 3. The average multiplier is 3.75. The most productive journal is Monthly Notices Of The Royal Astronomical Society with 492 (3.75%) papers dealing with Technology Roadmap research as first rank (TCS is 881, TGS is 13157). China is the most predominant country with 6668 records and SCP is 4934, MCP is 1734, MCP ratio is 0.26. Asia is the most predominant country with 8311 records and SCP is 5906, MCP is 2405..

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