

# Formula one (f1) Car: A Scientometric Study

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## ABSTRACT

*Formula one is the most popular game in the fast and furious industry. This game is a combination of speed, mind, calculations, predictive, precisions, management and team spirit. Most preferred document for publication is journal articles. Annual scientific publication, Average citation per year, RoG, CAGR, RGR and DT calculated. Limebeer DJN contributed the highest number of documents. Southwest Jiaotong University (Beta), China; 33 contributed the highest number of research publications and ranked first in publications. China is the most productive country with the highest 323 publications. In Engineering subject highest no 516 papers published. Funding agency "National Natural science foundation of china" highest 20 no contributors. For network analysis Co – authorship analysis of author, Co-occurrence analysis and c0-citation analysis are analyzed.*

**Keyword** Formula one, Formula one car, f1, f1 car, Bibliometric, Scientometrics

## 01 Introduction

Tracing the Formula One automobile racing has found in the European Grand Prix championships of the 1920s and 1930s, this is leads to the foundation of the modern Formula One in 1946 a new agency the “*Fédération Internationale de l’Automobile’s (FIA)*” established and standardization of rules, which was followed by a World Championship of Drivers in 1950. There are two development side by side. 1. Evolution of technical regulation, 2. Started the World championship. Non-championship Formula One races were held for many years, the last held in 1983 due to the rising cost of competition. National championships existed in South Africa and the United Kingdom in the 1960s and 1970s.

### 01.1 History of Formula One car

**Table 1: Timeline of Formula One Car**

SN	Year	Development
01	1901	The first car race to include the words Grand Prix was at Le Mans in France
02	1904	This became the year the FIA (Federation Internationale de l’Automobile) was created, it is basically a governing body for motor car racing
03	1946	Formula One was first defined by the Commission Sportive Internationale (CSI) of the FIA, forerunner of FISA, as the premier single-seater racing category in worldwide motorsport
04	1947	This new "International Formula" was initially known variously as Formula A, Formula I, or Formula 1 with the corresponding "Voiturette" formula being titled Formula B, Formula II, or Formula 2. When the 500c formula was internationally recognised as Formula 3 in 1950 it was never titled as "Formula C" so the three International Formulae were then "officially" titled Formula 1, Formula 2 and Formula 3. The driver championship was created, this is a league. Drivers earn points for wins and places and accumulated throughout the racing year.
05	1949	Motorcycle World Championships was introduced
06	1950	4thh season of the FIA's Formula One motor racing. The first season of the driver championship began and started on May 13th at Silverstone which is the home of the British Grand Prix.
07	1951	5th season of FIA Formula One motor racing
08	1952	6th season of FIA Formula One motor racing. This year they introduced Formula 2

09	1953	7th season of the FIA's Formula One racing. F1 goes international and the first race was at Argentina.
10	1954	8th season of FIA Formula One motor racing.
11	1955	9th season of FIA Formula One motor racing
12	1956	10th season of FIA's Formula One motor racing
13	1957	11th season of FIA Formula One motor racing
<b>British independent specialist teams and the rear-mid engine revolution (1958–1961)</b>		
14	1958	12th season of Formula One motor racing. Several minor rule changes towards safety of the drivers including the banning of racing whilst sharing a car.
15	1959	13th season of FIA Formula One motor racing
16	1960	14th season of the FIA's Formula One motor racing.
17	1961	15th season of Formula One motor racing
<b>Anglophone drivers and 1.5-litre engines (1962–1967)</b>		
18	1962	16th season of FIA Formula One motor racing. Lotus introduced a car design which would later revolutionise every F1 car built from then on.
19	1963	17th season of FIA Formula One motor racing
20	1964	18th season of FIA Formula One motor racing
21	1965	19th season of FIA Formula One racing
22	1966	20th season of FIA Formula One motor racing
23	1967	21st season of FIA Formula One motor racing. The first coloured televised Grand Prix was at the German Grand Prix.
<b>The DFV engine, 12-cylinder engines and the arrival of sponsorship, safety and aerodynamics (1968–1976)</b>		
24	1968	22nd season of the FIA's Formula One motor racing. This is the year Formula 1 went big time, Lotus cars were the first to carry Tobacco brand logos, signifying the arrival of sponsorship.
25	1969	23rd season of the FIA's Formula One motor racing
26	1970	24th season of the FIA's Formula One motor racing
27	1971	25th season of the Fédération Internationale de l'Automobile's Formula One motor racing
28	1972	26th season of the FIA's Formula One motor racing
29	1973	27th season of FIA Formula One motor racing
30	1974	28th season of FIA Formula One motor racing
31	1975	29th season of FIA Formula One motor racing
32	1976	30th season of FIA Formula One motor racing. Formula 1 is branching out with its first race in Asia (Japan) being raced this year.
<b>Ground-effect era (1977–1982)</b>		
33	1977	31st season of the FIA's Formula One motor racing. It's longest Formula One season in the sport's history at the time.
34	1978	32nd season of FIA Formula One motor racing. One of the most influential men in Formula 1 and the world of business was made president of the Formula One Constructors' Association (FOCA) this of course is Bernie Ecclestone.
35	1979	33rd season of FIA Formula One motor racing
36	1980	34th season of FIA Formula One motor racing
37	1981	35th season of FIA Formula One motor racing
38	1982	36th season of FIA Formula One motor racing. This year seen the increase of electronic aids within the car designs, there was also a driver strike after rules were introduced which insisted the driver must have a driver's license.
<b>1.5-litre turbo-charged engines (1983–1988)</b>		
39	1983	37th season of FIA Formula One motor racing
40	1984	38th season of FIA Formula One motor racing
41	1985	39th season of FIA Formula One motor racing
42	1986	40th season of FIA Formula One motor racing
43	1987	41st season of FIA Formula One motor racing

44	1988	42th season of FIA Formula One motor racing
<b>3.5-litre naturally aspirated engines, active suspension and electronic driver aids (1989–1993)</b>		
45	1989	43th season of FIA Formula One motor racing
46	1990	44th season of FIA Formula One motor racing
47	1991	45th season of FIA Formula One motor racing
48	1992	46th season of FIA Formula One motor racing. The introduction of the safety car was first unveiled at the British Grand Prix.
49	1993	47th season of FIA Formula One motor racing
<b>Safety, rules and regulations (1994)</b>		
50	1994	48th season of FIA Formula One motor racing. The famous death of Ayton Senna which occurred during the Imola Grand Prix Race, this was a day after another fatality during qualifying. After these incidents the F1 car bosses and designers became equally as determined to make the cars safer as well as faster, no other driver has lost their life behind an F1 car; a few have come close though.
<b>3-litre engines (1995–1999)</b>		
51	1995	49th season of FIA Formula One motor racing
52	1996	50th season of FIA Formula One motor racing
53	1997	51th season of FIA Formula One motor racing
54	1998	52th season of FIA Formula One motor racing
55	1999	53th season of FIA Formula One motor racing
<b>V10 engine and road car manufacturer team era (2000–2004)</b>		
56	2000	54th season of FIA Formula One motor racing
57	2001	55th season of FIA Formula One motor racing
58	2002	56th season of FIA Formula One motor racing
59	2003	57th season of FIA Formula One motor racing
60	2004	58th season of FIA Formula One motor racing
<b>2.4-litre V8 engines (2005–2008)</b>		
61	2005	59th season of FIA Formula One motor racing
62	2006	60th season of FIA Formula One motor racing
63	2007	61th season of FIA Formula One motor racing
64	2008	62th season of FIA Formula One motor racing
<b>Cost-cutting measures and departure of factory teams (2009–2013)</b>		
65	2009	63rd season of FIA Formula One motor racing.
66	2010	64rd season of FIA Formula One motor racing.
67	2011	65rd season of FIA Formula One motor racing.
68	2012	66rd season of FIA Formula One motor racing.
69	2013	67rd season of FIA Formula One motor racing.
<b>1.6-litre turbocharged V6 hybrid engines (2014–present)</b>		
70	2014	68th season of FIA Formula One motor racing
71	2015	69th season of FIA Formula One motor racing
72	2016	70th season of the FIA Formula One motor racing
73	2017	71st season of Formula One motor racing
74	2018	69th running of the Formula One World Championship
75	2019	70th running of the Formula One World Championship
76	2020	70th anniversary of the first Formula One World Drivers' Championship

Source: [History of Formula One - Wikipedia](#)

## 01.2 Star Player

**Table 2: Drivers by number of World Drivers' Championships won**

SN	Name	Country	Title	Seasons
01	Michael Schumacher	Germany	7	1994, 1995, 2000, 2001, 2002, 2003, 2004
02	Lewis Hamilton	England		2008, 2014, 2015, 2017, 2018, 2019, 2020
03	Juan Manuel Fangio	Argentina	5	1951, 1954, 1955, 1956, 1957
04	Alain Prost	France	4	1985, 1986, 1989, 1993
05	Sebastian Vettel	Germany		2010, 2011, 2012, 2013
06	Jack Brabham	Australia	3	1959, 1960, 1966
07	Jackie Stewart	UK		1969, 1971, 1973

08	Niki Lauda	Austria		1975, 1977, 1984
09	Nelson Piquet	Brazil		1981, 1983, 1987
10	Ayrton Senna	Brazil		1988, 1990, 1991
11	Alberto Ascari	Italy	2	1952, 1953
12	Graham Hill	UK		1962, 1968
13	Jim Clark	UK		1963, 1965
14	Emerson Fittipaldi	Brazil		1972, 1974
15	Mika Häkkinen	Finland		1998, 1999
16	Fernando Alonso	Spain		2005, 2006
17	Giuseppe Farina	Italy	1	1950
18	Mike Hawthorn	UK		1958
19	Phil Hill	USA		1961
20	John Surtees	UK		1964
21	Denny Hulme	New Zealand		1967
22	Jochen Rindt	Austria		1970
23	James Hunt	UK		1976
24	Mario Andretti	USA		1978
25	Jody Scheckter	South Africa		1979
26	Alan Jones	Australia		1980
27	Keke Rosberg	Finland		1982
28	Nigel Mansell	UK		1992
29	Damon Hill	UK		1996
30	Jacques Villeneuve	Canada		1997
31	Kimi Räikkönen	Finland		2007
32	Jenson Button	UK		2009
33	Germany Nico Rosberg	Germany	2016	

Source: [List of Formula One World Drivers' Champions - Wikipedia](#)

### 01.3 By chassis constructor

**Table 3: Constructors by number of World Drivers' Championships won**

SN	Constructor	Titles	Season(s)
1	Ferrari	15	1952, 1953, 1956, 1958, 1961, 1964, 1975, 1977, 1979, 2000, 2001, 2002, 2003, 2004, 2007
2	McLaren	12	1974, 1976, 1984, 1985, 1986, 1988, 1989, 1990, 1991, 1998, 1999, 2008
3	Mercedes	9	1954, 1955, 2014, 2015, 2016, 2017, 2018, 2019, 2020
4	Williams	7	1980, 1982, 1987, 1992, 1993, 1996, 1997
5	Lotus	6	1963, 1965, 1968, 1970, 1972, 1978
6	Brabham	4	1966, 1967, 1981, 1983
7	Red Bull		2010, 2011, 2012, 2013
8	Alfa Romeo	2	1950, 1951
9	Maserati		1954, 1957
10	Cooper		1959, 1960
11	Tyrrell		1971, 1973
12	Benetton		1994, 1995
13	Renault		2005, 2006
14	BRM	1	1962
15	Matra		1969
16	Brawn		2009

Source: [List of Formula One World Drivers' Champions - Wikipedia](#)

### 01.4 By engine manufacturer

**Table 4: Engine manufacturers by World Drivers' Championship win**

SN	Manufacturer	Titles	Season(s)
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01	Ferrari	15	1952, 1953, 1956, 1958, 1961, 1964, 1975, 1977, 1979, 2000, 2001, 2002, 2003, 2004, 2007
02	Ford	13	1968, 1969, 1970, 1971, 1972, 1973, 1974, 1976, 1978, 1980, 1981, 1982, 1994
03	Mercedes		1954, 1955, 1998, 1999, 2008, 2009, 2014, 2015, 2016, 2017, 2018, 2019, 2020
04	Renault	11	1992, 1993, 1995, 1996, 1997, 2005, 2006, 2010, 2011, 2012, 2013
05	Honda	5	1987, 1988, 1989, 1990, 1991
06	Climax	4	1959, 1960, 1963, 1965
07	TAG	3	1984, 1985, 1986
08	Alfa Romeo	2	1950, 1951
09	Maserati		1954, 1957
10	RepcO		1966, 1967
11	BRM	1	1962
12	BMW		1983

Source: [List of Formula One World Drivers' Champions - Wikipedia](#)

### 01.5 By tyre manufacturer

**Table 5: World Drivers' Championship victories by tyre manufacturer**

Rank	Manufacturer	Titles	Seasons
1	Goodyear	24	1966–1967, 1971, 1973–1978, 1980, 1982, 1985–1997
2	Pirelli	16	1950–1954, 1957, 2011–2020
3	Bridgestone	11	1998–2004, 2007–2010
4	Dunlop	8	1959–1965, 1969
5	Michelin	6	1979, 1981, 1983–1984, 2005–2006
6	Firestone	4	1952, 1968, 1970, 1972
7	Continental	2	1954–1955
	Englebert		1956, 1958

Source: [List of Formula One World Drivers' Champions - Wikipedia](#)

### 01.6 By driver nationality

**Table 6: World Drivers' Champions by nationality**

SN	Country	Titles	Drivers	Seasons	By driver (titles)
01	United Kingdom	20	10	1958, 1962–1965, 1968–1969, 1971, 1973, 1976, 1992, 1996, 2008–2009, 2014–2015, 2017–2020	Lewis Hamilton (7)
					Jackie Stewart (3)
					Jim Clark (2)
					Graham Hill (2)
					Jenson Button (1)
					Mike Hawthorn (1)
					Damon Hill (1)
					James Hunt (1)
					Nigel Mansell (1)
					John Surtees (1)
02	Germany	12	3	1994–1995, 2000–2004, 2010–2013, 2016	Michael Schumacher (7)
					Sebastian Vettel (4)
					Nico Rosberg (1)
03	Brazil	8	3	1972, 1974, 1981, 1983, 1987–1988, 1990–1991	Nelson Piquet (3)
					Ayrton Senna (3)
					Emerson Fittipaldi (2)
04	Argentina	5	1	1951, 1954–1957	Juan Manuel Fangio (5)
05	Finland	4	3	1982, 1998–1999, 2007	Mika Häkkinen (2)
					Kimi Räikkönen (1)
					Keke Rosberg (1)



06	Australia	4	2	1959–1960, 1966, 1980	Jack Brabham (3) Alan Jones (1)
07	Austria	4	2	1970, 1975, 1977, 1984	Niki Lauda (3) Jochen Rindt (1)
08	France	4	1	1985–1986, 1989, 1993	Alain Prost (4)
09	Italy	3	2	1950, 1952–1953	Alberto Ascari (2) Giuseppe Farina (1)
10	United States	2	2	1961, 1978	Mario Andretti (1) Phil Hill (1)
11	Spain	2	1	2005–2006	Fernando Alonso (2)
12	New Zealand	1	1	1967	Denny Hulme (1)
13	South Africa	1	1	1979	Jody Scheckter (1)
14	Canada	1	1	1997	Jacques Villeneuve (1)

Source: [List of Formula One World Drivers' Champions - Wikipedia](#)

## 02 Review of Literature

There is no quantitative study related to “formula one car” till now. This paper is first to study related to this topic. Although many studies related to bibliometrics and scientometrics are already done. Few are mentioned here. [Mustafa, Z., et al. \(2020\)](#) study on “Global research trends in Pro-Environmental Behaviour (PEB) studies in the field of computer science from 1976-2019”; [Pinheiro, A., & Govind, M. \(2020\)](#) studies on Emerging global trends in urban agriculture research”; [Danell, B. et al. \(2020\)](#) studies on Fifty Years of Complementary and Alternative Medicine (CAM); [Schilder, I. P. et al. \(2020\)](#) Pathways in the Drug Development for Alzheimer’s Disease (1906-2016); [Martinez, Lopez \(2020\)](#) studies on Research Trends in the International Literature on Natural Language Processing, 2000-2019; [Gasko, N. et al. \(2020\)](#) studies on “A Game Theoretical Analysis of Academic Writing Co-authorship Networks”; [Ciriminna, R et al \(2020\)](#) studies on “Catalysis Research”; [Pisoschi, A et al. \(2020\)](#) studies on “An Analysis of the Influence of Some Incentives on Bibliometric Performances”; [Maurya, Abhay \(2020\)](#) studies on "Scientometric study of Nobel laureate of chemistry department, Massachusetts Institute of Technology (MIT)" and [Maurya, Abhay \(2020\)](#) studies on "Bibliometric analysis of chemistry Nobel laureate George Pearson Smith"

## 03 Methodology

Scopus are used for data retrieve. The study covered a period of 57 years from 1925 to 2021. The following search string is used to download data from the database. Data is downloaded on 11.01.2021 at 09.40 PM.

Searching steps are:

1. Go to Scopus database
2. In Document, type “Formula one car”. [ TITLE-ABS-KEY (formula AND one AND car)]. 764 documents are retrieved.

For Analysis, Excel, R Studio and Vos viewer used.

## 04 Analysis

### 04.1 Main Information About f1 Car

Timespan	1925:2021
Sources (Journals, Books, etc.)	458
Documents	764
Average years from publication	13.6
Average citations per documents	9.475
Average citations per year per doc	0.7076
References	10551
<b>Authors</b>	
Authors	1807

Author Appearances	2096
Authors of single-authored documents	176
Authors of multi-authored documents	1631
<b>Author Collaboration</b>	
Single-authored documents	224
Documents per Author	0.423
Authors per Document	2.37
Co-Authors per Documents	2.74
Collaboration Index	3.02

**04.2 Documents**

According to the study, the highest no scholarly paper medium is journal article 413(54.1%) follow that conference paper 291(38.1%) follow that review 28(3.7%) and so on.

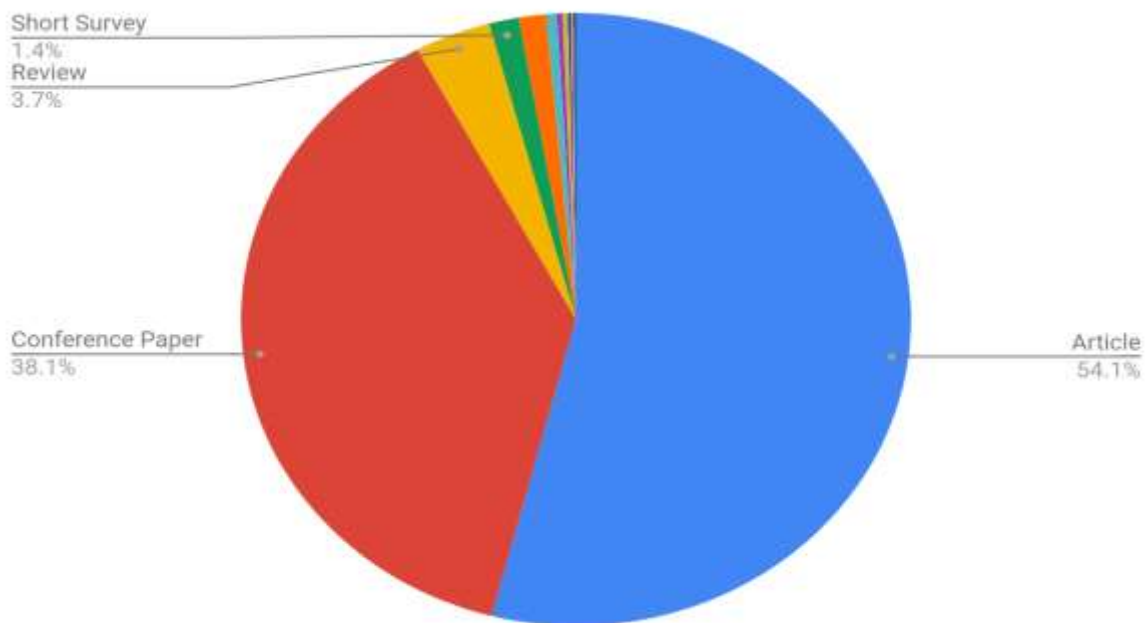
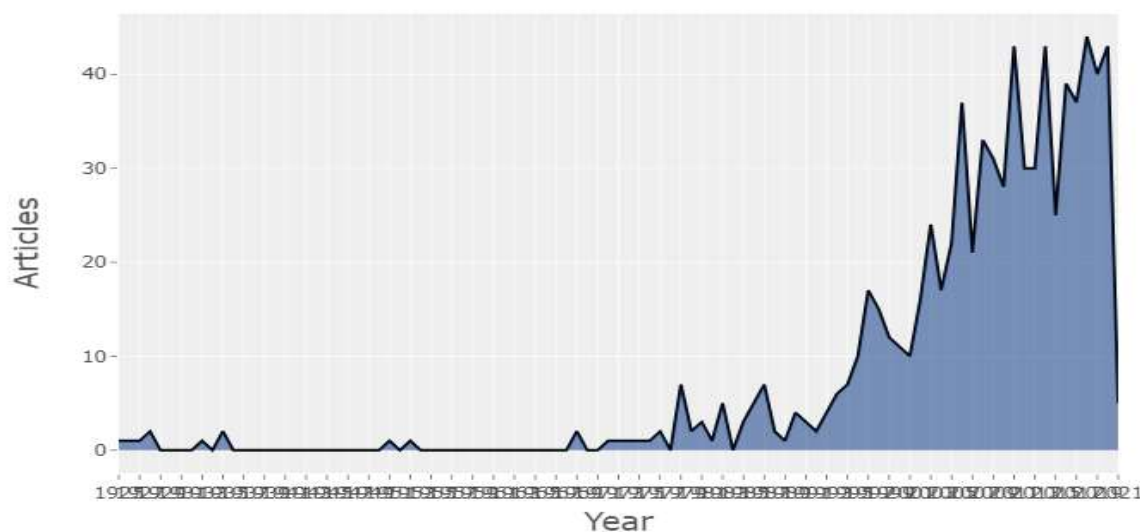


Fig 1: Types of documents

**04.3 Growth of Publications**

**04.3.1 Annual Scientific Production**

## Annual Scientific Production



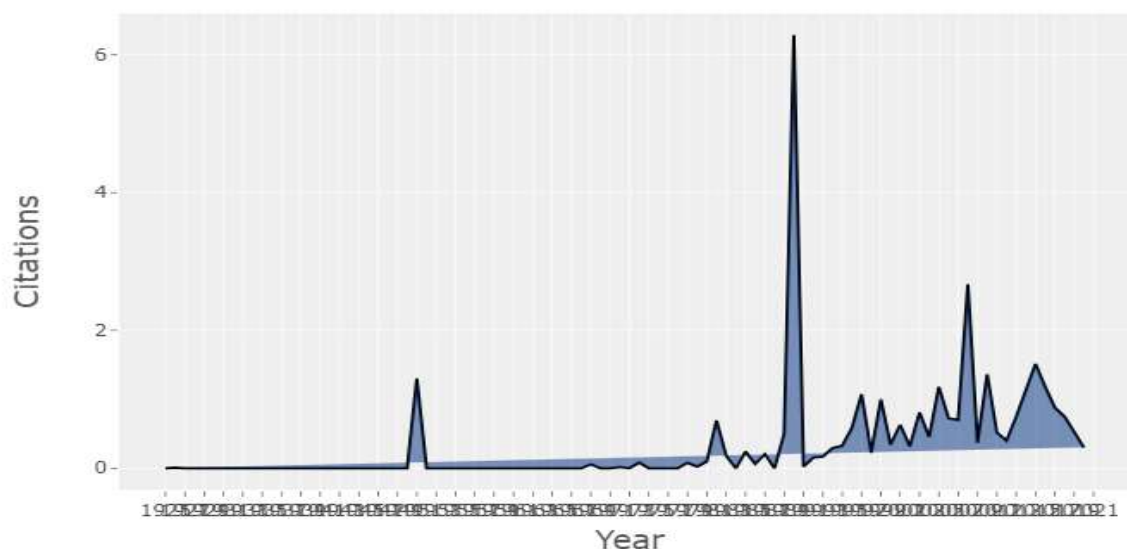
**Fig 1: Annual Scientific Production**

From 2008 – 2020, annual publication productivity shows continuous progress. In 2018, Highest no (48) of paper produce. Followed in 2014 and 2020, 43 papers published and so on.

### 04.4.2 Average citation per year

Paper published in 1925 have highest no (96) citation followed 1926 (95), 1927 (94) and so on.

## Average Article Citations per Year



**Fig 2: Average citation per year**

### 04.4.3 RoG, CAGR, RGR and DT

The Ratio of Growth (RoG), Compound Annual Growth Rate (GAGR), Relative Growth Rate (RGR) and Doubling Time (DT) were calculated for the research output during the period of study and presented in table 7

**Table 7: RoG, CAGR, RGR and DT**

SN	Year	TP	%	Cumm	Cumm %	RoG	CAGR	RGR	DT
1	1925	1	0.13	1	0.13				



2	1926	1	0.13	2	0.26	1	0	0	0
3	1927	1	0.13	3	0.39	1	0	0	0
4	1928	2	0.26	5	0.65	2	-1	1	0.693
5	1933	1	0.13	6	0.78	0.5	0.5	-0.2	-3.465
6	1935	2	0.26	8	1.04	2	-0.148698355	0.5	1.386
7	1951	1	0.13	9	1.17	0.5	0.292893219	-0.0625	-11.088
8	1953	1	0.13	10	1.3	1	0	0	0
9	1969	2	0.26	12	1.57	2	-0.414213562	0.0625	11.088
10	1972	1	0.13	13	1.7	0.5	0.042396719	-0.333333333	-2.079
11	1973	1	0.13	14	1.83	1	0	0	0
12	1974	1	0.13	15	1.96	1	0	0	0
13	1975	1	0.13	16	2.09	1	0	0	0
14	1976	1	0.13	17	2.22	1	0	0	0
15	1977	2	0.26	19	2.48	2	-1	1	0.693
16	1979	7	0.91	26	3.4	3.5	-2.5	2.5	0.2772
17	1980	2	0.26	28	2.8	0.28	0.470849738	-5	-0.1386
18	1981	3	0.39	31	4.05	1.5	-0.5	1	0.693
19	1982	1	0.13	32	4.18	0.33	0.67	-2	-0.3465
20	1983	5	0.65	37	4.84	5	-4	4	0.17325
21	1985	3	0.39	40	5.23	0.6	0.4	-1	-0.693
22	1986	5	0.65	45	5.89	1.66	-0.288409873	2	0.3465
23	1987	7	0.91	52	6.8	1.4	-0.4	2	0.3465
24	1988	2	0.26	54	7.06	0.28	0.72	-5	-0.1386
25	1989	1	0.13	55	7.19	0.5	0.5	-1	-0.693
26	1990	4	0.52	59	7.72	4	-3	3	0.231
27	1991	3	0.39	62	8.11	0.75	0.25	-1	-0.693
28	1992	2	0.26	64	8.37	0.66	0.34	-1	-0.693
29	1993	4	0.52	68	8.9	2	-1	2	0.3465
30	1994	6	0.78	74	9.68	1.5	-0.5	2	0.3465
31	1995	7	0.91	81	10.6	1.16	-0.16	1	0.693
32	1996	10	1.3	91	11.91	1.42	-0.42	3	0.231
33	1997	17	2.22	108	14.13	1.7	-0.7	7	0.099
34	1998	15	1.96	123	16.09	0.88	0.12	-2	-0.3465
35	1999	12	1.57	135	17.67	0.8	0.2	-3	-0.231
36	2000	11	1.43	146	19.1	0.91	0.09	-1	-0.693
37	2001	10	1.3	156	20.41	0.9	0.1	-1	-0.693
38	2002	16	2.09	172	22.51	1.6	-0.6	6	0.1155
39	2003	24	3.14	196	25.65	1.5	-0.5	8	0.086625
40	2004	17	2.22	213	27.87	0.7	0.3	-7	-0.099
41	2005	22	2.87	235	30.75	1.29	-0.29	5	0.1386
42	2006	37	4.84	272	35.6	1.68	-0.68	15	0.0462
43	2007	21	2.74	293	38.35	0.56	0.44	-16	-0.04331
44	2008	33	4.31	326	42.67	1.57	-0.57	12	0.05775
45	2009	31	4.05	357	46.72	0.93	0.07	-2	-0.3465
46	2010	28	3.66	385	50.39	0.9	0.1	-3	-0.231
47	2011	43	5.62	428	56.02	1.53	-0.53	15	0.0462
48	2012	29	3.79	457	59.81	0.67	0.33	-14	-0.0495
49	2013	30	3.92	487	63.74	1.03	-0.03	1	0.693
50	2014	44	5.75	531	69.5	1.46	-0.46	14	0.0495
51	2015	25	3.27	556	72.77	0.56	0.44	-19	-0.03647
52	2016	39	5.1	595	77.87	1.56	-0.56	14	0.0495
53	2017	37	4.84	632	82.72	0.94	0.06	-2	-0.3465
54	2018	44	5.75	676	88.48	1.18	-0.18	7	0.099
55	2019	40	5.23	716	93.71	0.9	0.1	-4	-0.17325
56	2020	43	5.62	759	99.34	1.07	-0.07	3	0.231
57	2021	5	0.65	764	100	0.11	0.89	-38	-0.01824
Total		764		99.77					

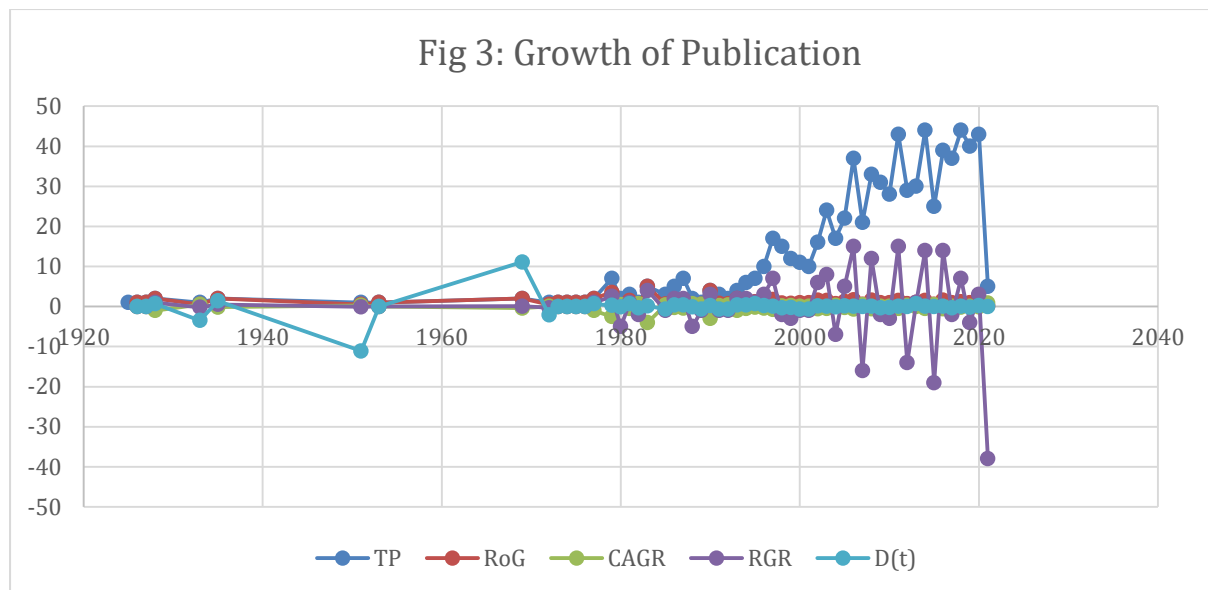
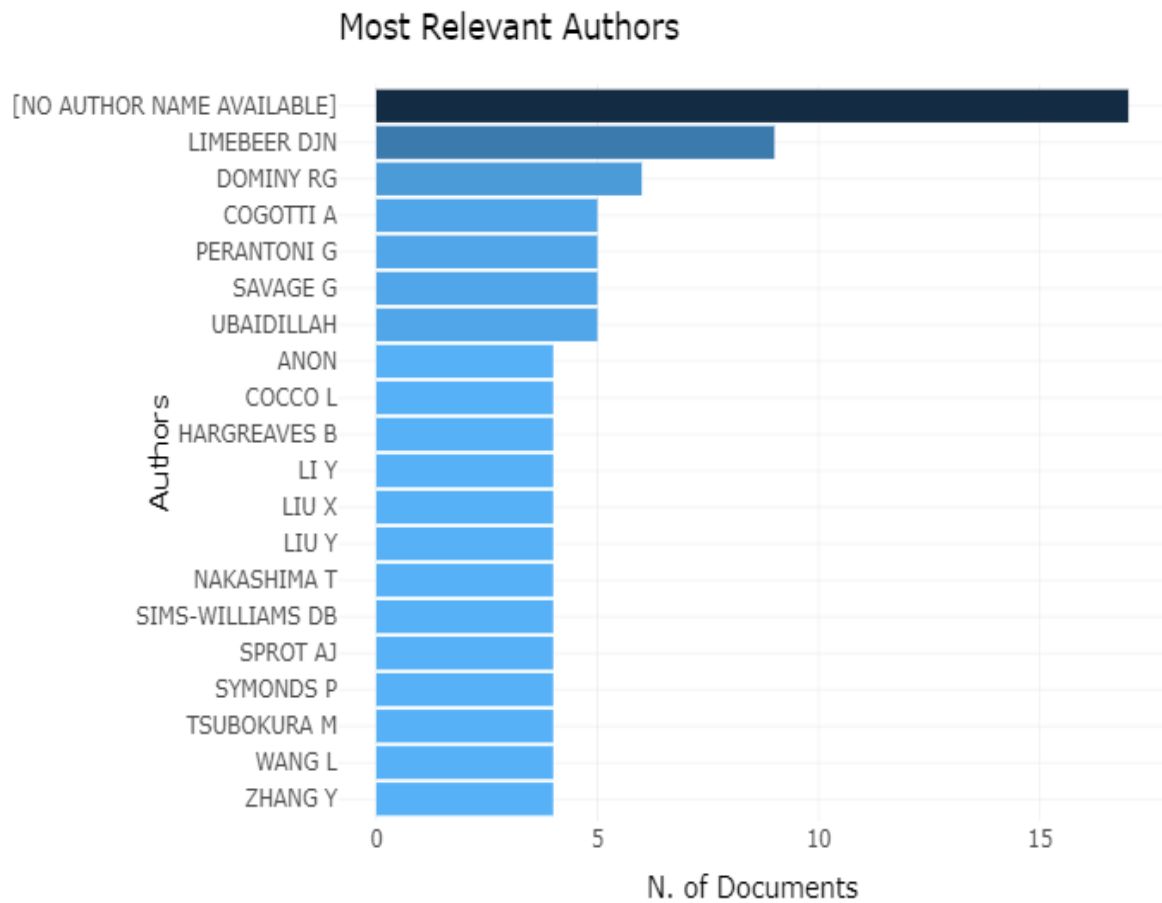


Table 7 shows that 764 articles were published during the period of study 1925- 2021 in the Literature on Formula one car. The highest numbers of articles 44 were contributed in the year 2014 and. It is found that the Ratio of Growth (RoG) is between 0.11 to 5. CAGR is between -4 to 0.89. The Relative Growth Rate (RGR) is between -38 and 15. It is high in the year 2006 with a value of 15 and low in the year 2021 with a value of -38.

**04.5 Prolific Author, Institution and Countries**

**04.5.1 Prolific Author**

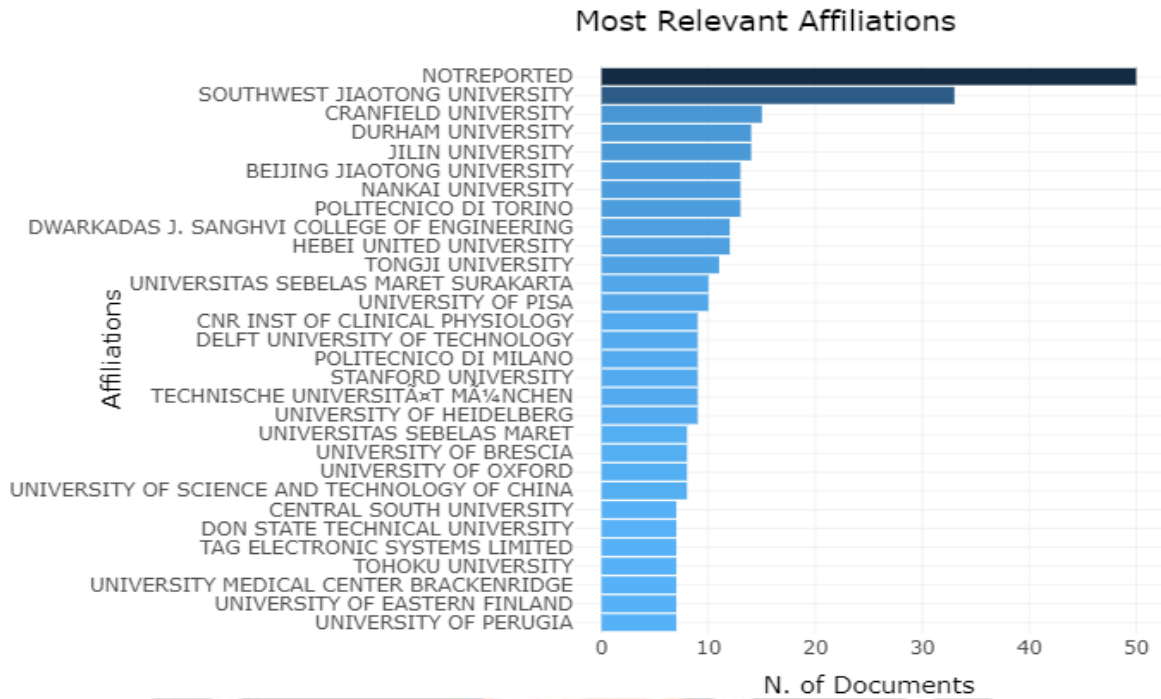
Figure 4 shows ranking of highly productive authors in terms of number of research publications, “Limebeer DJN” contributed most number of documents in the investigated time frame with 9 records, next two authors “Dominy RG” with 6 publication and “Cogottia A” and “Perantoni G” with 5 publication.



**Fig 4: Prolific Author**

**04.5.2 Prolific Institutions**

Figure 5 indicates institution-wise research productivity. It is noted that Southwest Jiaotong University (Beta), China; 33 contributed the highest number of research publications and ranked first in publications followed by Cranfield University, UK; 15 and Durham University, UK; 14.

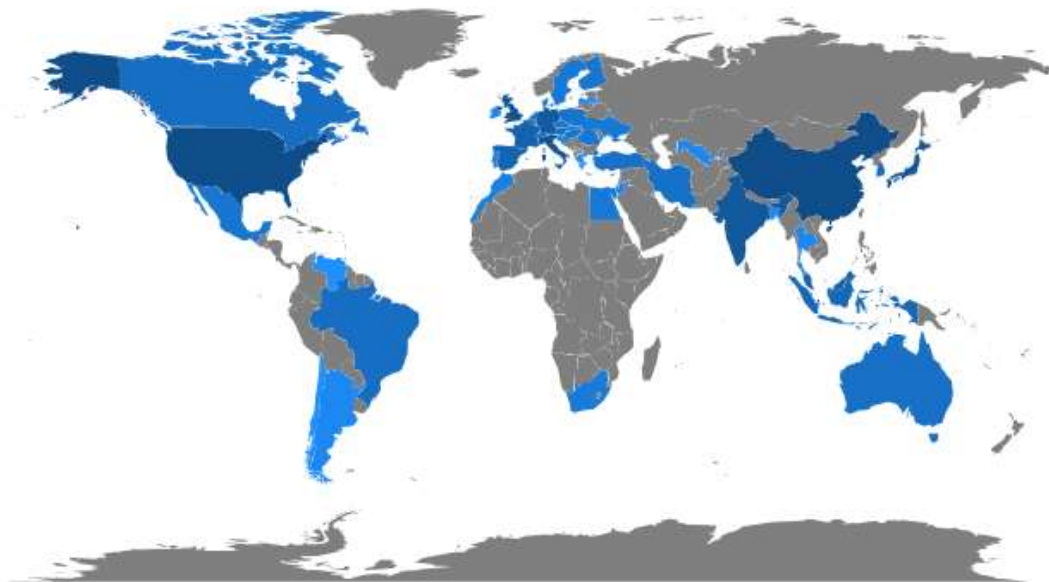


**Fig 5: Prolific Institutions**

**04.5.3 Prolific Country**

From fig 6, China is the most productive country with highest 323 publication after that US 320, UK 183, Italy 168, Japan 135, India 123 and so on.

## Country Scientific Production



**Fig 6: Prolific Country**

**04.6 Subject wise Publication**

From fig 7, In Engineering subject highest no 516 paper published after that Environmental Science 132, Computer Science 114, Physics and Astronomy 83, Mathematics 78, Materials Science 72, Medicine 52 and so on.



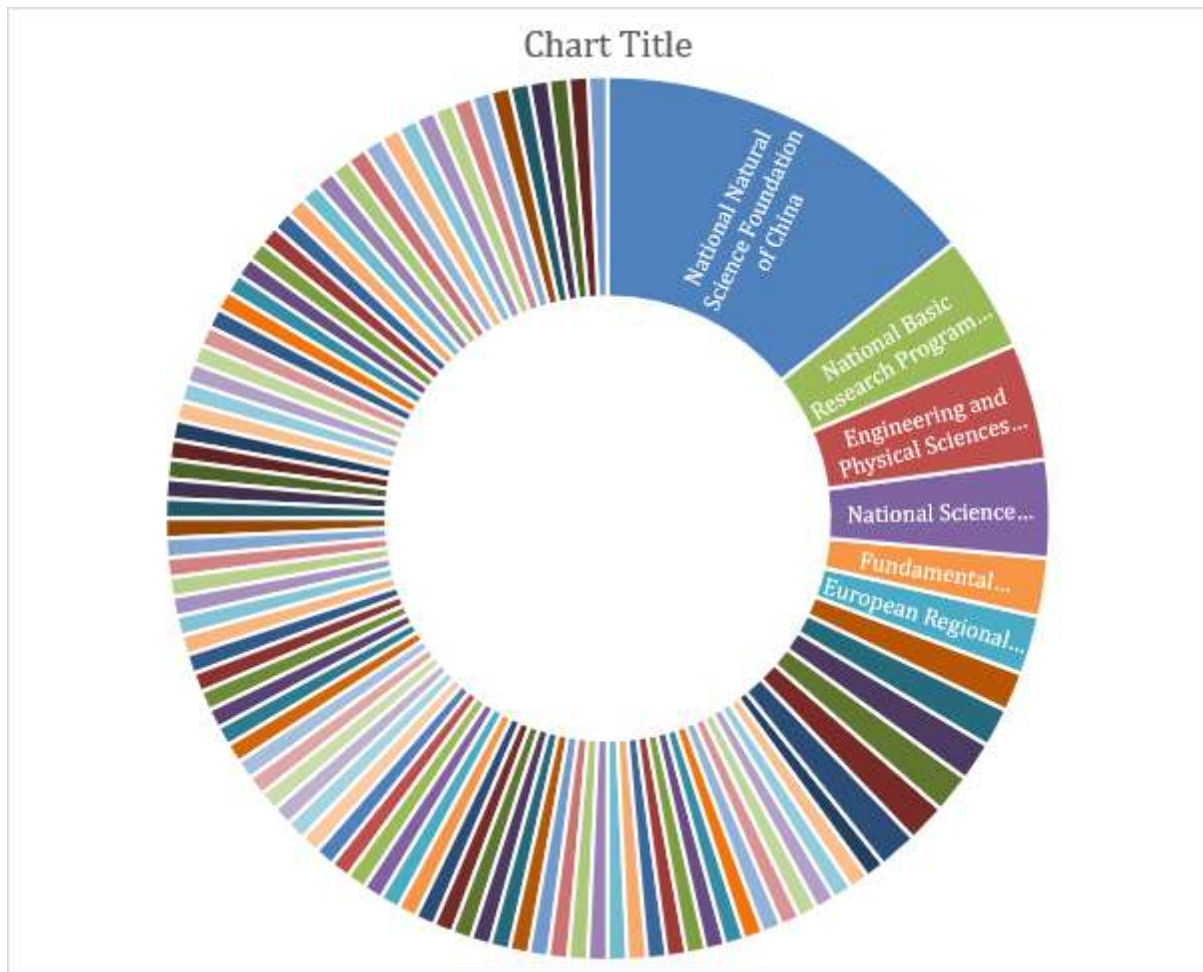
**Fig 7: Subject wise Publication**

**04.7 Funding Agency**

List of highest no of contributed by funding agency are:

National Natural Science Foundation of China	20
Engineering and Physical Sciences Research Council	6
National Basic Research Program of China (973 Program)	6
National Science Foundation	5
European Regional Development Fund	3
Fundamental Research Funds for the Central Universities	3



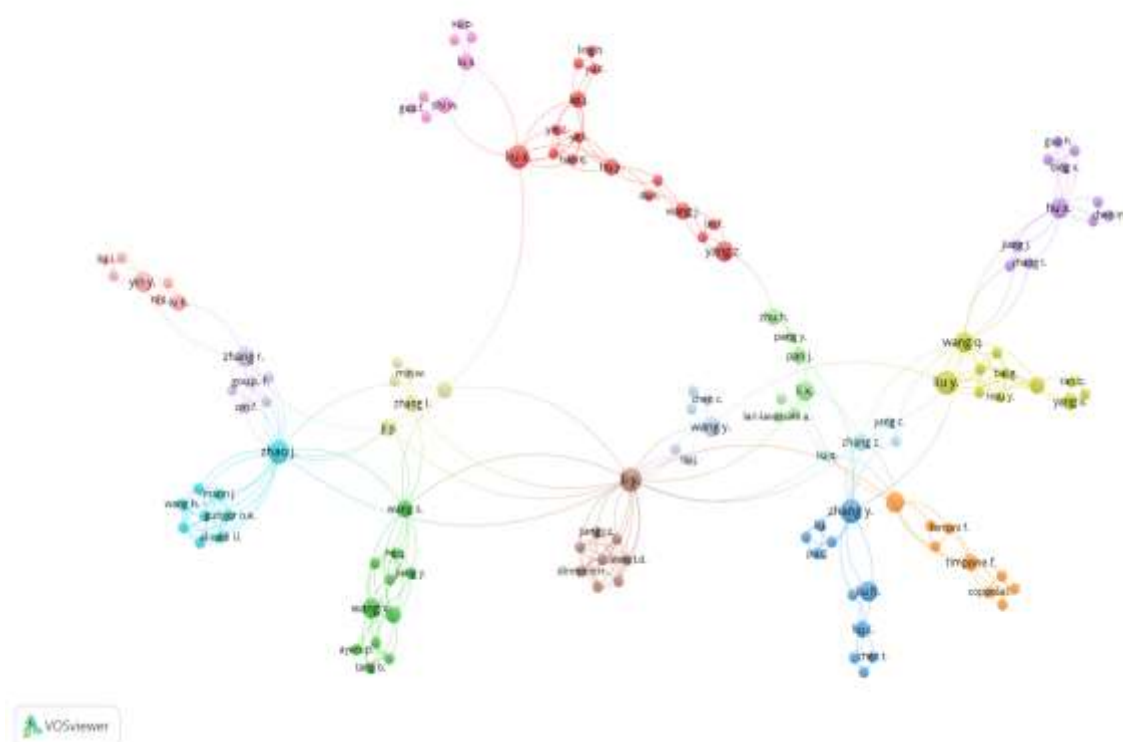


**Fig 8: Funding Agency**

#### 04.8 Network Analysis

##### 04.8.1 Co – authorship analysis of author

Through an analysis of 746 publications of the concerned domain, it was observed that researches conducted on ‘Formula one car’ predominantly have either intra-national or international collaboration. Only 23.59% of the articles have been published by a single author. To identify the pattern of collaboration, we used the network visualization method. Limebeer, D.J.N. produced highest no of document with 9 documents also highest no citation 168 with total 5 links. Second most productive author is “Dominy. R. J.” produced 6 documents with 23 citation and total 14 links. Perantoni, G. third most active author in this fields. He produces 5 documents with 140 citation and total 5 links. Ceccareli, R. is highest no of total 24 links.



**Fig 9: Co – authorship analysis of author**

#### 04.8.2 Co-occurrence analysis

In Vos viewer, for co – occurrence analysis, unit of analysis all keyword selected and counting method full counting method selected. Next step minimum no of occurrence of a keyword 1 selected and of the 6197 keywords, 6197 meet the threshold. For each of 6197 keywords, the total of co-occurrence links with the other keywords will be calculated. The keywords with the greatest total links strength selected. Racing automobile keyword occurred highest no 115 with 719 links Secondly “formula one” keyword occurred 59 times with 312 total links. Third most useful keyword is “Aerodynamics” occurred 55 times with total 370 links. Fourth keyword is “Article” occurred 51 times with total 938 links. Fifth keyword is “Human” occurred 47 times with total 943 links, and so on.

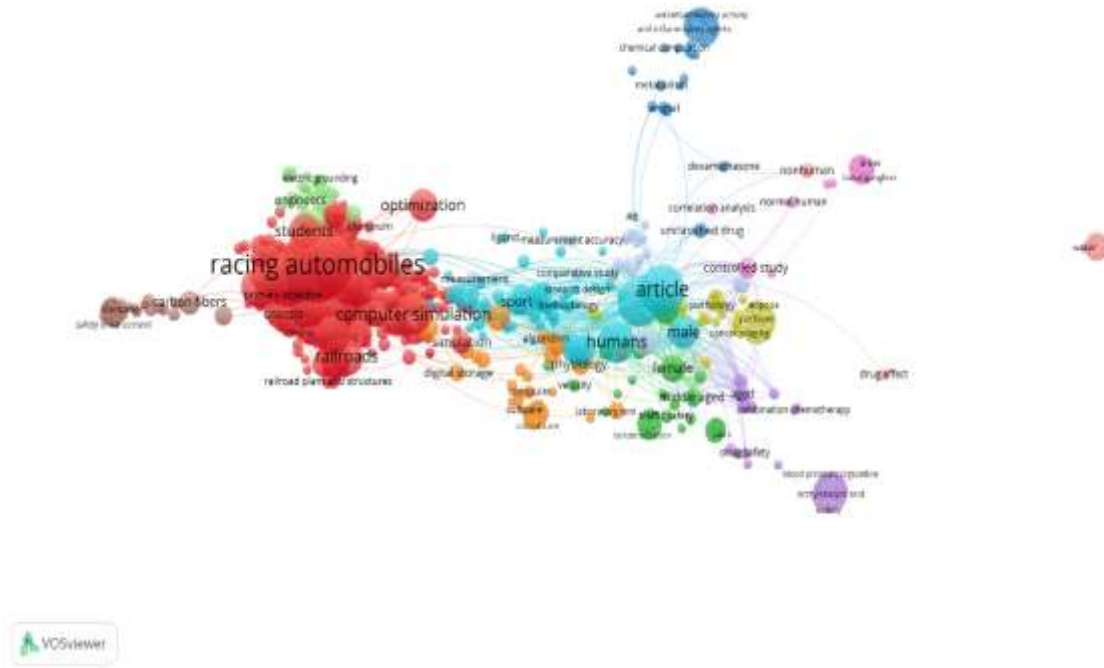


Fig 10: Co-occurrence analysis

04.8.3 c0-citation analysis

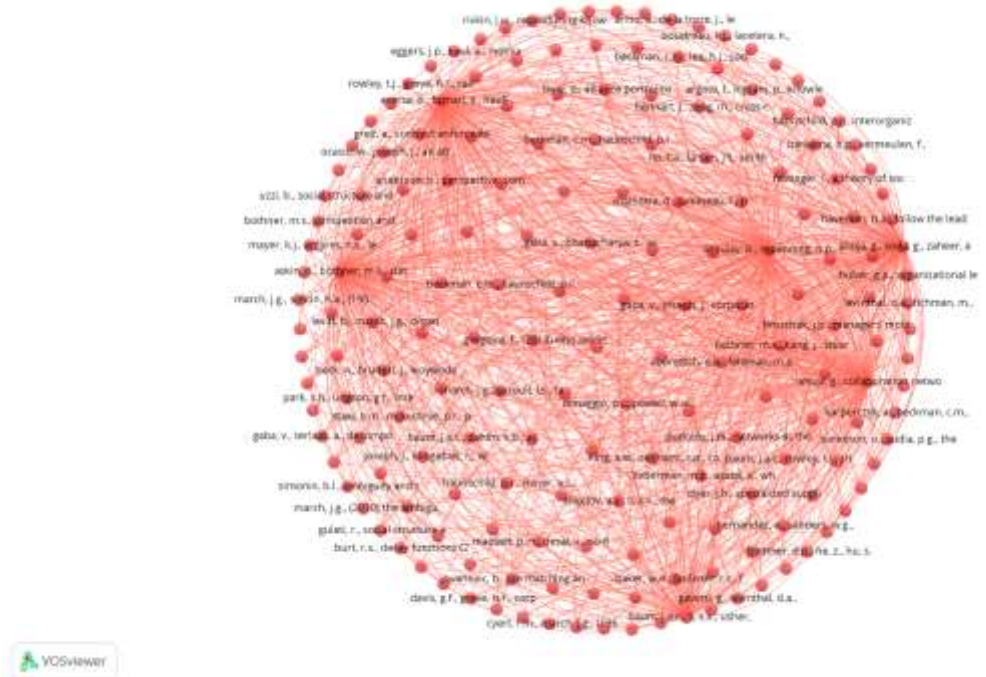


Fig 11: Co-citation analysis

For co-citation analysis, unit of analysis cited reference selected and full counting method used. Minimum no of citation of cite reference is 1. Of the 10450 cite references, 10450 meet the thresholds.

## 06 Conclusion

Most preferred document for publication is journal articles. Annual scientific publication, Average citation per year, RoG, CAGR, RGR and DT calculated. Limebeer DJN contributed the highest number of documents. Southwest Jiaotong University (Beta), China; 33 contributed the highest number of research publications and ranked first in publications. China is the most productive country with the highest 323 publications. In Engineering subject highest no 516 papers published. Funding agency "National Natural science foundation of china" highest 20 no contributors. For network analysis Co – authorship analysis of author, Co-occurrence analysis and c0-citation analysis are analyzed.

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