

SCIENTOMETRIC ANALYSIS WITH SPECIAL REFERENCE TO MOBILE TECHNOLOGY PUBLICATIONS FOR THE YEAR 2003 - 2013

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Abstract *The purpose of this study is to explore the scientometric analysis of mobile technology publication output using Scopus database for period of 11 years between 2003 and 2013. For this study analysis of 51,258 research articles obtained from the mobile technology output of Scopus database, and it was found that the year 2012 was the most productive year with 6,606 articles (12.89%) published. The relative growth rates (RGR) has decreased from 2003 (0.98) to 2013 (0.13) in the span of 10 years. The Doubling Time (DT) has been gradually increased from 0.71 in 2003 to 5.15 in 2013. The highest numbers of articles (17.83%) were contributed by the authors from USA. China has got second rank to contribute in this field with 14.28% followed by South Korea 6.12% of articles and UK 6.11% of articles respectively. The most prolific author is Pujolle, G, who contributed 40 articles (0.078%), followed by Mori, K with 37 papers (0.072%). The maximum number of articles have been published in English Language (96.38%), followed by Chinese 2.04% articles, German 0.62% articles and 0.26% in Russian.*

Keyword: *Mobile Technology, Scientometric Analysis, Author Productivity, RGR, DT, Scopus Database*

INTRODUCTION

Mobile technology and its increasing use throughout the globe has nearly become a twentieth century social development and as per the estimation by numerous skilled agencies among few years we tend to area unit about to expertise a complete sweep by the dominance of this hand-held device. The utilization of mobile phones has reached associate degree unexampled height within the last decade and with the continued innovations and development in numerous technological fronts yet as interactive area of recent use and applications, mobile technology looks to rule the social, skilled yet as personal area for time to return. The recent trends in mobile technology area unit indicative of additional encompassing rise and dominance of it all told human endeavors. The widespread use and development of mobile applications as a social development have compete an enormous role in increasing the use of applications for business and other transactions like banking and insurance and therefore the trend of using mobile for these crucial purposes is already showing up and becoming popular.

The word Scientometrics was coined by Pritchard in 1969. This is a descriptive which deals with various features of science and technology literature output. Thus, A.F.J. Van Raan defined the scientometric research is devoted to quantitative analysis of science and technology. It aims at the advancement of knowledge and the development of science and technology and also in relation to social and political questions [1]. Sengupta explained the term scientometric as

the organization, classification and quantitative evaluation of publication patterns of all macro and micro communications along with their authorship by mathematical and statistical calculations [2]. Basically the scientometric analysis focus on the measurement of magnitude of the growth of literature along with various dimension.

REVIEW OF LITERATURE

According to Davarpanah and Aslekia₈ conducted quantitative study in the field of library and information science (LIS) in which total of 894 contributions published in 56 LIS journals indexed in SSCI during the years of 2000–2004 were analyzed. A total of 1361 authors had contributed publications during the five years. The overwhelming majority (89.93%) of them wrote one paper. The average number of authors per paper is 1.52. All the studied papers were published in English. The sum of research output of the authors form USA and UK reaches 70% of the total productivity. Ramakrishnan and Ramesh Babu₉ analyzed the literature output in the field of hepatitis from three bibliographic databases, namely MEDLINE, CINAHL and IPA, and found that collaboration in authorship pattern is prevalent, averaging 0.85.

Using the PubMed database, Falagas, Papastamataki, and Bliziotis₁₀ collected information for the period of 1995–2003 in the field of parasitology. Research productivity was evaluated based on a methodology and used in other bibliometric studies. The research productivity was

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evaluated in relation to gross domestic product of each region and in relation to gross national income per capita and population of each region. Asha₁₁ examined the articles and citations in Demography India from 1972-2001 and identified core areas of demographic studies, including article contributions by country and geographic areas, authorship patterns and collaboration, most cited journals, bibliographic forms of cited documents, average age of citations, and rate of citations per article. Arya₁₂, et al. studied the collaboration in research and authorship trend in the area of veterinary sciences all over the world with special reference to India. The study was based on the data collected from ‘CABI abstracts’ for the period of 2006-2010. The findings of the study revealed that the average degree of collaboration was found 0.84 and subject analysis showed a good research in the area of animal nutrition and veterinary physiology.

Ravichandran₁₃ conducted study of bibliometric analysis on research publications in the field of Biodiversity during the period 1975-2010. It was analyzed 1, 57,557 articles of Scopus database and examined year wise distribution of articles, country wise distribution, languages distribution and bibliographic form of articles, authorship pattern, country wise authorship pattern, high productive Indian Institutes etc. inferences and findings were shown with relevant data analysis. Dutt₁₄ investigated and analyzed 1317 papers published in the first fifty volumes of the international journal of Scientometrics during 1978 to 2001. It was found that the U.S.A share of papers is constantly declining while that of the Netherlands, India, France and Japan is on the rise. The research output is highly scattered as indicated by the average number of papers per institution.

Velmurugan₁₅ studied to investigate the bibliometric analysis of 203 articles appearing in Annals of Library and Information Studies journal selected six years for a period between 2007 and 2012. It was found that the most of the contributions are by two authored i.e., 88 (43.35 %). The degree of collaboration ranges from 0.57 to 0.82 and the average degree of collaboration is 0.64. The total average number of authors per paper is 1.87 and the average productivity per author is 0.53. Ram₁₆ identified data in the PubMed database for the period of 1996-2010 to study the growth of research on Artemisia, including research distribution by country, type of publications, journal authorship patterns, and Indian publication activity on Artemisia.

OBJECTIVES FOR THE STUDY

The objectives of the study are as follows:

- To depict the growth of the literature
- To find the scattering of literature based on publication types

- To examine the growth rate and doubling time of mobile technology literature output
- To identify the most productive authors and dominating countries on mobile technology literature
- To find out the highly productive affiliated institutions
- To present language wise proportionation of the literature
- To quantify the publications as per the Scopus subject fields
- To quantify the contents of the papers through the keywords

METHODOLOGY AND LIMITATIONS

The Scopus database was used for retrieving data on mobile technology during 2003-2013, using search terms namely ‘mobile technology’ in ‘topic’ field. A total of 51258 publications received and these publications were transferred to spread sheet application. The bibliographic fields were analysed by normal count procedure for continents, countries, domains, authorships, and subjects.

DATA ANALYSIS AND FINDINGS

Source Wise Distribution

Table 1. Source Wise Distribution

S. No.	Source Type	No. of Publications	Percentage
1	Conference Paper	29670	57.88
2	Journal Article	16043	31.30
3	Review	2319	4.52
4	Conference Review	1345	2.63
5	Short Survey	542	1.06
6	Article in Press	345	0.67
7	Note	299	0.58
8	Book Chapter	235	0.46
9	Editorial	190	0.37
10	Book	169	0.33
11	Letter	60	0.12
12	Business Article	29	0.06
13	Erratum	7	0.01
14	Abstract Report	5	0.01
Total		51,258	100.00

Table No. 1 and Chart No. 1, it represents the forms of publications in which among 144567 publications, the majority of 65.16 percent contributes conference articles, followed 33.46 percent Journal articles and only 0.25

Chart.1. Source wise Distribution

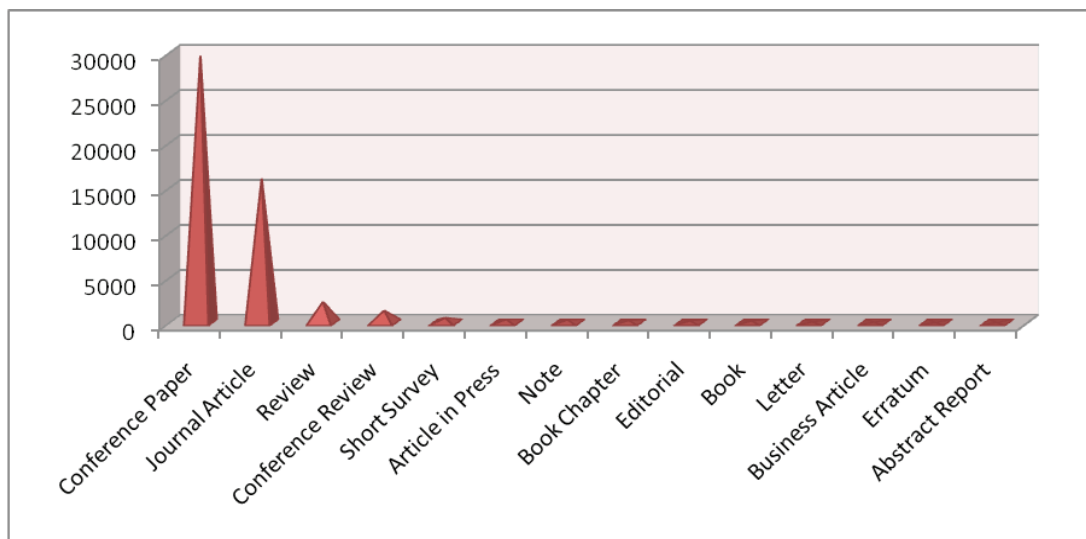
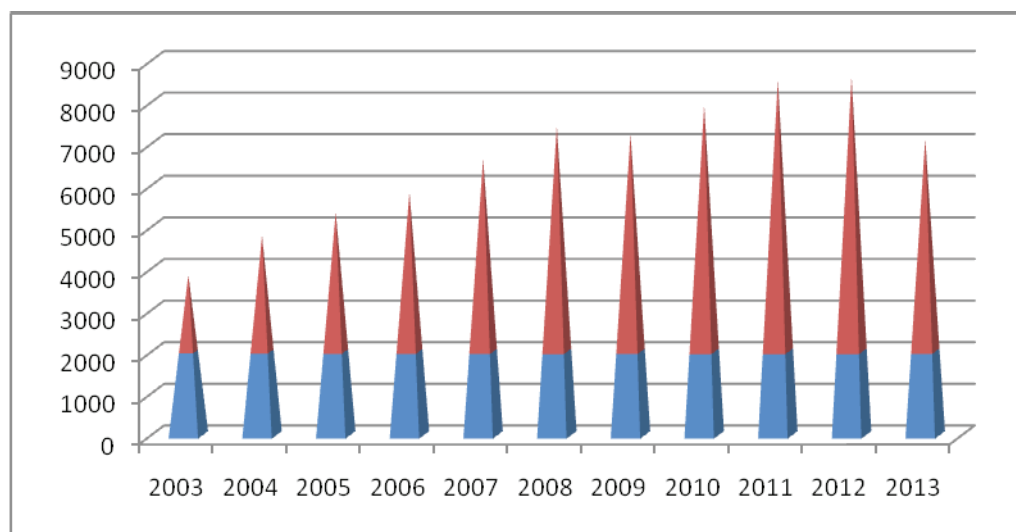


Chart. 2. Year wise Distribution of Publications



percent of articles were in press and altogether these forms of publications contributed 98 percent of the total publication for the period of analysis.

Year Wise Distribution

Table 2. Year Wise Distribution of Publications

S. No.	Year	No. of Publications	Percentage
1	2003	1845	4.00
2	2004	2788	5.44
3	2005	3354	6.54

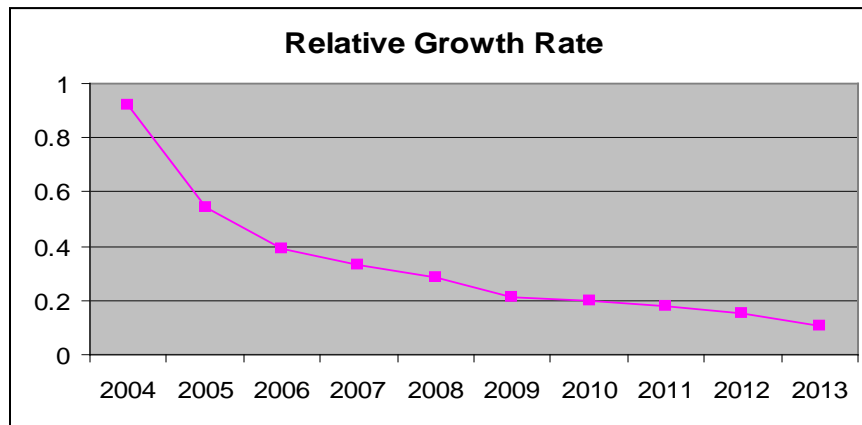
4	2006	3829	7.47
5	2007	4643	9.06
6	2008	5419	10.57
7	2009	5232	10.21
8	2010	5912	11.53
9	2011	6525	12.73
10	2012	6606	12.89
11	2013	5105	9.96

Table No. 2 and Chart No. 2 represents the year wise distribution of publications and the result is also indicate that the exponential growth of the literature over the period.

Table 3. Relative Growth Rate (RGR) and Doubling Time (DT) of Publications

Year	No. of Publications	Cumulative Total of Publications	Loge W1	Loge W2	RGR	DT
2003	1845	1845		7.52023		
2004	2788	4633	7.52023	8.44095	0.92072	0.75267
2005	3354	79871	8.44095	8.98557	0.54462	1.27244
2006	3829	11816	8.98557	9.37820	0.39163	1.76952
2007	4643	16459	9.37820	9.70862	0.33142	2.09100
2008	5419	21878	9.70862	9.99323	0.28461	2.43491
2009	5232	27110	9.99323	10.20765	0.21442	3.23197
2010	5912	33022	10.20765	10.40492	0.19727	3.51295
2011	6525	39547	10.40492	10.58524	0.18032	3.84316
2012	6606	46153	10.58524	10.73971	0.15447	4.48630
2013	5105	51258	10.73971	10.84462	0.10491	6.60566

Chart No. 3 Relative Growth Rate (RGR)



Relative Growth Rate (RGR) and Doubling Time (DT)

The Relative Growth Rate (RGR) is the increase in number of articles or pages per unit of time. This definition derived from the definition of relative growth rates in the study of growth analysis in the filed of mobile technology. The mean relative growth rate (R) over the specific period of interval can be calculated from the following equation.

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Relative Growth Rate (RGR)
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$$1-2^R = \frac{\text{Log}_e W_2 - \text{Log}_e W_1}{T_2-T_1}$$

Whereas

1-2^R - mean relative growth rate over the specific period of interval

Log_e W₁ - log of initial number of articles

Log_e W₂ - log of final number of articles after a specific period of interval

T₂-T₁- the unit difference between the initial time and the final time

The year can be taken here as the unit of time. The RGR for articles is hereby calculated.

Therefore

Table 4. Distribution of Most Prolific Authors

S. No.	Country	No. of Articles	%age	S. No.	Country	No. of Articles	%age
1	Pujolle, G.	40	0.078	9	Cano, J.C	30	0.058
2	Mori, K	37	0.072	10	Schmidt, A	28	0.055
3	Magedanz, T	36	0.070	11	Lu, X	28	0.055
4	Hwang, G. J	34	0.066	12	Rodriguez, J	27	0.053
5	O’Shea, D	34	0.066	13	Taaffee, J	26	0.051
6	Manzoni, P	33	0.064	14	Demestichas, P	26	0.051
7	Sargento, S	31	0.060	15	Pierre, S	25	0.049
8	Adachi, F	31	0.060	16	Milrad, M	25	0.049

$1-2^R$ ($aa^{-1} year^{-1}$) can represent the mean relative growth rate per unit of articles per unit of year over a specific period of interval.

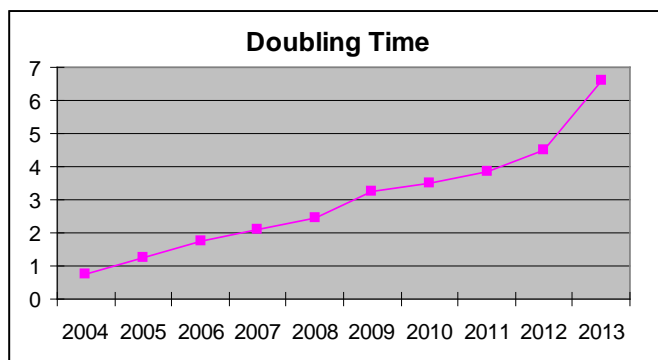
Table No. 3 presents the Relative Growth Rates (RGR) has decreased from 2003 (0.92) to 2013 (0.10) in the span of 11 years. The doubling time (DT) has increased when calculated year wise. The Doubling Time increases from 0.75 in 2003 to 6.61 in 2013.

Doubling Time (DT)

There exists a direct equivalence between the relative growth rate and the doubling time. If the number of articles or pages of a subject doubles during a given period then the difference between the logarithms of numbers at the beginning and end of this period must be logarithm of the number 2. If natural logarithm is used this difference has a value of 0.693. Thus the corresponding doubling time for each specific period of interval and for both articles and pages can be calculated by the formula.

$$\text{Doubling Time (DT)} = \frac{0.693}{\text{RGR}}$$

Chart 4. Doubling Time



Therefore,

$$\text{Doubling time for articles } Dt(a) = 0.693 / 1-2^{\bar{R}} \text{ (aa}^{-1} \text{ year}^{-1}\text{)}$$

Distribution of Most Prolific Authors

Table No.4 indicates that the rank list the authors who have contributed more than 25 articles or more are taken into account to avoid a long list. The list contains the name of 9 authors with more than 30 articles each. It reveals that Pujolle, G is the most productive author contributing 40 articles followed by Mori, K with 37 articles and Magedanz, T with 36 articles respectively.

5.5 Distribution of Author Affiliations

Table 5. Institutional Distribution of Authors

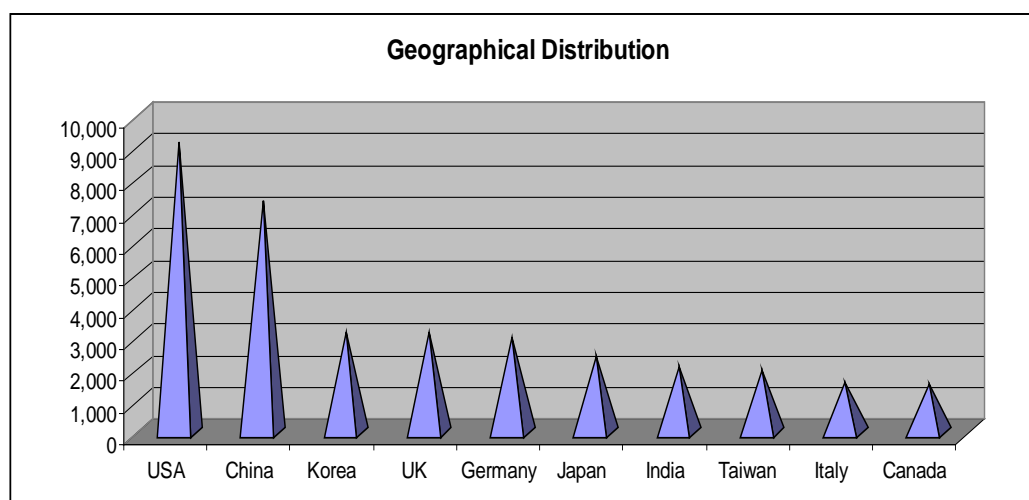
S. No.	Author Affiliation	No. of Publications
1	Beijing University of Posts and Telecommunications	559
2	Nokia	384
3	Electronics and telecommunica-tions Research Institute	379
4	IEEE	326
5	Tsinghua University	257
6	Samsung Electronics	228
7	Sungkyunkwan University	221
8	Korea Advanced Institute of Sci-ence & Technology	212
9	National Taiwan University	204
10	Georgia Institute of Technology	204

Table No. 5 shows that the most prolific institutions. Findings revealed that Institute of Electrical and Electronics Engineering (IEEE) with 1248 articles is the most productive institutions in the field of mobile technology literature.

Table 6. Geographical Distribution of Publications

S. No.	Country	No. of Articles	Percentage
1	USA	9,141	17.83
2	China	7,320	14.28
3	South Korea	3,137	6.12
4	United Kingdom	3,133	6.11
5	Germany	2,967	5.79
6	Japan	2,368	4.62
7	India	2,030	3.96
8	Taiwan	1,969	3.84
9	Italy	1,554	3.03
10	Canada	1,517	2.96

Chart No. 5 Geographical Distribution



Country Wise Distribution of Publications

An attempt has been made to study the country wise distribution of publications in which a list of top 10 countries which contributed majority of articles to the research is given in Table No.6. It is revealed that 17.83% of the total articles were contributed by the authors from USA. China has got second rank to contribute in this field with 14.28% followed by South Korea 6.12% of articles and United Kingdom 6.11% of articles respectively.

Language Wise Distributions

Table No. 7 shows that the maximum number of articles have been published in English Language (96.38%), followed by Chinese 2.04% articles, German 0.62% articles, 0.26% and 0.23% in Russian and Spanish.

High Productivity Subject Areas

Table No.8 and Chart No. 6 depicts that the highest number of articles contributed on Computer Science during this study period and followed by Engineering constituted second rank and followed by Social Sciences. The fourth highest articles belonged to the subject Mathematics.

Keyword Analysis

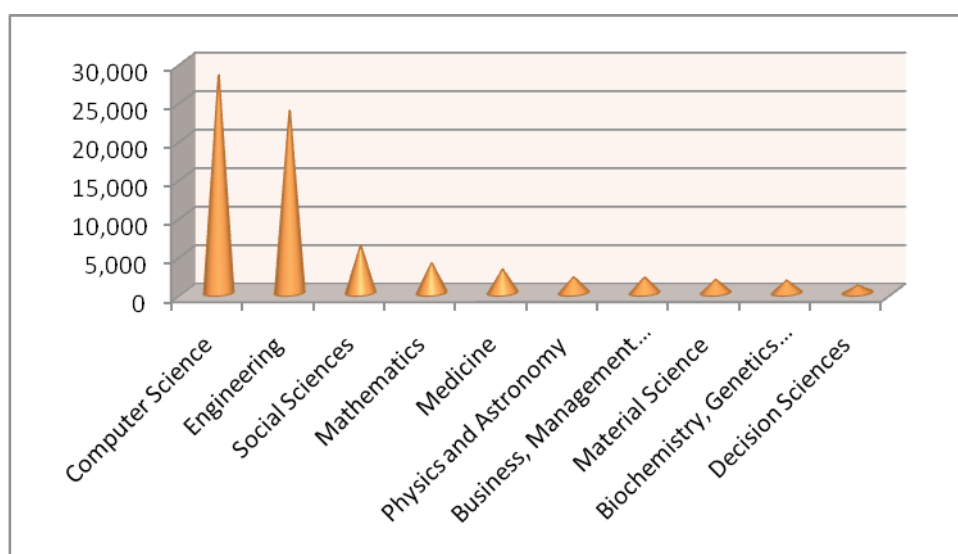
Keywords are one of the best Scientometric indicators to understand and grasp instantaneously the thought content of the publications and to find out the growth of the subject field. By Analysing the keywords appeared either in the title or assigned by the indexer or the author himself will facilitate knowing in which direction the knowledge goes. The high frequency keywords will enable us to understand what are all the aspects that have been studied.

Table 7. Language wise distributions

S. No.	Language	No. of Articles	%age	S. No.	Language	No. of Articles	%age
1	English	49,400	96.38	11	Turkish	22	0.04
2	Chinese	1,047	2.04	12	Croatian	18	0.04
3	German	318	0.62	13	Italian	13	0.03
4	Russian	131	0.26	14	Slovene	13	0.03
5	Spanish	120	0.23	15	Hungarian	11	0.02
6	French	112	0.21	16	Czech	10	0.02
7	Japanese	88	0.17	17	Lithuanian	8	0.02
8	Portuguese	48	0.09	18	Finnish	5	0.01
9	Korean	28	0.05	19	Romanian	5	0.01
10	Polish	25	0.05	20	Serbian	5	0.01

Table No.8 Subject wise Distribution of Articles

S. No.	Subject	No. of Articles	%age
1	Computer Science	28,237	55.09
2	Engineering	23,639	46.12
3	Social Sciences	6,120	11.94
4	Mathematics	3,869	7.55
5	Medicine	3,054	5.96
6	Physics and Astronomy	2,062	4.02
7	Business, Management and Accounting	2,017	3.93
8	Material Science	1,722	3.36
9	Biochemistry, Genetics and Molecular Biology	1,611	3.14
10	Decision Sciences	969	1.89

Chart No. 6 Subject wise Distribution

In this study, keywords appeared in the 'Keywords' field in Engineering Index database of mobile technology

publications were analysed and the keywords are furnished in the table no.9.

Table No. 9 Key Words distribution of articles

S. No.	Keywords	No. of Articles
1	Mobile Telecommunication Systems	7,878
2	Wireless Telecommunication Systems	6,872
3	Information Technology	6,243
4	Mobile Devices	5,619
5	Technology	4,919
6	Wireless Networks	4,876
7	Mobile Computing	4,289
8	Internet	3,866
9	Telecommunication Equipment	3,131

CONCLUSION

We can conclude that the purpose of this study is to analyze the number of contributions and highlight quantitatively the contributions made by the researchers in the field of mobile technology published on Scopus databases during 2003 to 2013. The analysis showed that 51,258 articles were published in the field of mobile technology. The highest number of publication 6,606 was produced in 2012. Authors from USA have contributed maximum number of articles compared to other countries and India stood 7th rank in this study period. The top medium of communication is Conference papers with 29,670 papers (57.88%) followed by Journal articles with 16,043 articles (31.30%). The authors who have published maximum number of articles are also identified. The vast majority of the articles 49,400 were in English language. This may be because the source journals are in English. Therefore, it can be stated that the dominant language of the global publications in mobile technology literature is English. The highest number of articles contributed on Computer Science during this study period and followed by Engineering constituted second rank and followed by Social Sciences. The fourth highest articles belonged to the subject Mathematics.

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