

Citation Analysis of Doctoral Theses in Computer Science & Engineering Submitted to the Department of Computer Science & Engineering, IIT Delhi during 2001-2011: A Study

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Abstract

The present study is based on 2316 citations, appended in the 25 PhD theses of Computer sciences Engineering submitted to Departments Computer Science & Engineering IIT Delhi, Hauz Khas, New Delhi, for the award of doctoral degree during the period 2001-2011. The main purpose of this study was to investigate year wise breakup of theses, year wise distribution of theses, average number of citation per theses, supervision pattern of theses, authorship pattern of the citations, type and form of literature cited, country wise distribution of citation and compiled a rank list of core journals in computer sciences and engineering. The study revealed that conference document were the most preferred sources of information used by the researchers in the field of computer science and engineering accounting for 34.46% of total citations, followed by books with 27.68 % citations.

Keywords: Citation Analysis, Bibliometric, Computer Science, IIT Delhi, Ph D Theses.

INTRODUCTION:

Human beings and Computers:

Computers cannot work on their own. They do what we want them to do; only we give them the right command. It's memory is better than human memory. It cannot forget anything it has saved, so it is also called on artificial intelligence.

Comparison between Human Beings and Computers¹:

S. No.	Human Body	Computer
1.	Human beings are slow in doing calculation	Computers can do complex calculation in seconds
2.	Human beings cannot remember lot of things at one time	Computers can store and remember a large amount of Info. at one time
3.	Human beings can take mistakes	Computer do not make mistakes
4.	Human beings have fallings	Computers do not have feelings
5.	Human beings can think	Computers can not think
6.	Human beings get tired is they work for long hours	Computers never get tired

Citation Analysis:

When one author cites another author, a relationship is established. Citation analysis uses citations in scholarly works to establish that relationship (links). Many different links can be ascertained, such as links between authors, between scholarly works, between journals, between fields, or even between countries. Citations both from and to a certain document may be studied. Citation analysis is one of the important and quite old branches of bibliometric study (Mahapatra, 2000) given by Eugene Garfield. It examines the different frequencies, their patterns and graphs of citations given in articles, review papers, technical communication, theses and books. Citations are used in scholarly works to establish links to other works and researchers, which forms a part of primary scientific communication in a geographical proximity (Binwal, Chandel, & Saraf, 1990). Citation Analysis is used as research evaluation tool mostly used in library and information science.

One very common use of citation analysis is to determine the impact of a single author on a given field by counting the number of times the author has been cited by others. Citation index, such as Institute for Scientific Information's Web of Science, allow users to search forward in time from a known article to more recent publications which cite the known item. Information scientists also use citation analysis to quantitatively assess the core journal. The first citation analysis was a study by P.L.K. Gross and E.M. Gross published in 1927, applied a simple statistical method to the grading of the scientific serials according to their related importance based citation counting from source journals. Citation analysis may be studied from various aspects such as author citations, subject citations and Journal citations etc. This has developed the very important branch at study called citation analysis. Garfield has demonstrated the potential of citations counts and analysis of identifying "stars" or core authors (s), contributor (s), journals and other sources of information.

Definitions:

From Wikipedia (2001)², Citation analysis is a way of measuring the relative importance or impact of an author, on article or a publication by counting the number of times that author article or publication has been cited by other works.

Mahapatra (2000)³, Citation analysis is one of the important and quite old branches of bibliometric study.

About Department Computer Science & Engineering:

The department of computer science and engineering at Indian Institute of Technology, Delhi is renewed for cutting edge research and for importing state of the art education. We attract some of the brightness students and faculty and invite you to join us in the excitement. Courses are offered B. Tech. M. Tech. and Ph.D. in Computer science and Engineering. There are 27 total number s of faculty members in the Department of CSE.

Objectives of study:

The objectives of the present study are:

- ✓ To ascertain the year wise distribution of theses in the field of computer science.
- ✓ To find out the information sources cited by the researchers of computer science.
- ✓ To identify supervision pattern of theses.
- ✓ To find out authorship pattern.
- ✓ To identify most frequently cited journal publisher.
- ✓ To identify the core Journals in the field.

Some Relevant Review of literature:

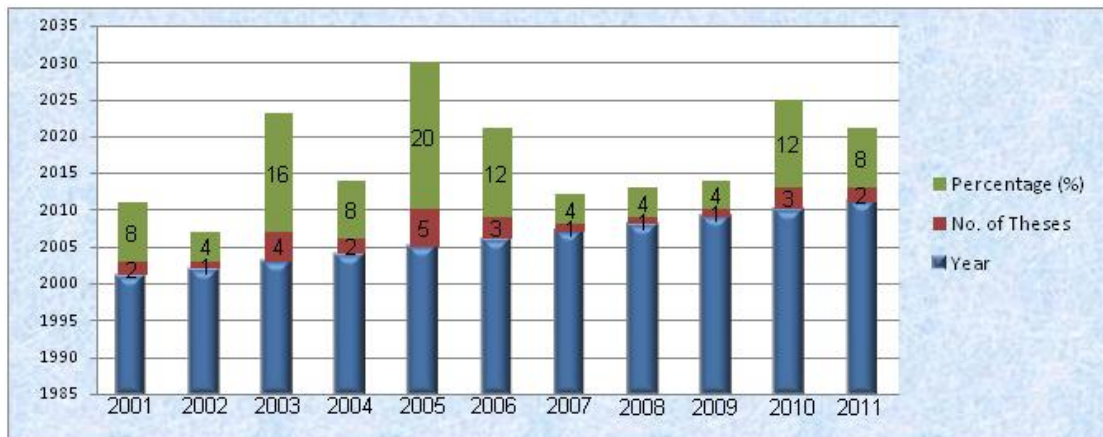
Arun Kumar (2011)⁴, Conducted a study entitled on analysis of the citation pattern of doctoral theses in the field of chemistry in CSJM University Kanpur during (2004-08) investigation analysis of 14136 citations from 66 theses submitted in chemistry. Olatokun & Monkindle (2009)⁵, Studied master's theses in animal science and found that journals were the most used reference materials and that poultry nutrition and agricultural biochemistry and nutrition were most frequent topics. Gao, yu & Luo (2009)⁶, Studied the citations of 56 theses submitted to wuhar University, china in 2005, and these theses were on four different subjects that in library and in for motion science, biology, photogrammetric and remote sensing and stomatology. In the study, Goo analyzed the characteristics of literature cited, language influence and the most frequently cited journals in the pacific field. Cox (2008)⁷, Ascertained that citation analysis would be useful for making device based dental library collection development and facilitate management decision making based on a study that included examining 129 theses of graduate dental students of the Indiana University, USA. Rethlefsen & Wallis (2007)⁸, Performed a citation analysis on public health

citation pattern to determine the publication type sated most often in public health as well as the most heavily cited journal titles.

Analysis of the Study:

Table 1: Year-wise Distribution of Theses

S. No.	Year	No. of Theses	Percentage (%)	Rank
1	2001	2	8	4 th
2	2002	1	4	5 th
3	2003	4	16	2 nd
4	2004	2	8	4 th
5	2005	5	20	1 st
6	2006	3	12	3 rd
7	2007	1	4	5 th
8	2008	1	4	5 th
9	2009	1	4	5 th
10	2010	3	12	3 rd
11	2011	2	8	4 th
Total 10 years		25	100%	



Graph 1:

Table 1: Represents Year wise Distribution of Theses submitted to the Department of Computer Science Engineering, IIT, Delhi during 2001-2011. As is evident from table 1 maximum number of theses (20%) were submitted in the year 2005 followed by 16% in 2003, 12% each in 2006 and 2010. Minimum 4% theses were submitted in the year 2002, 2007, 2008 & 2009 each respectively.

Table 2: Year-wise Distribution of Theses (1966-2011)

S. No.	Year	No. of theses	Percentage (%)	Rank
1	1966-1970	0	0	5 th
2	1971-1980	8	11.71	4 th
3	1981-1990	14	20.61	3 rd
4	1991-2000	21	30.89	2 nd
5	2001-2011	25	36.79	1 st
	Total 10 years	68	100%	

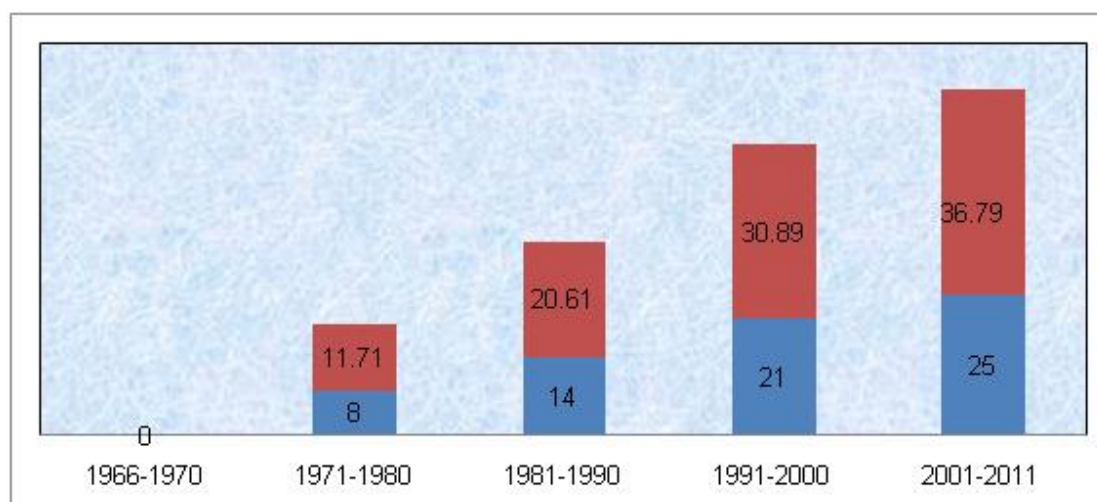
**Graph 2:**

Table 2: Represents Year wise Distribution of Theses submitted to the Department of Computer Science Engineering, IIT, Delhi during 1966-2011. As is clear from table2 maximum Theses 36.79% submitted during year 2001-2011, followed by 30.89% during 1991-2000 and 20.61% during years 1981-1990. It is concluded that as we move from latest to back years, the numbers of theses submitted in decreasing sequence. It is a clear indication that in Computer Science research in recent years is more than previous years.

Table 3: Year-wise Distribution of Theses

S. No.	Year	No. of theses	No. of Citations	Average no. Citations/Theses
1	2001	2	222	111
2	2002	1	111	111
3	2003	4	352	88
4	2004	2	146	73
5	2005	5	514	102.80
6	2006	3	199	66.33
7	2007	1	116	116
8	2008	1	94	94
9	2009	1	115	115
10	2010	3	212	70.66
11	2011	2	235	117.50
Total 10 years		25	2316	

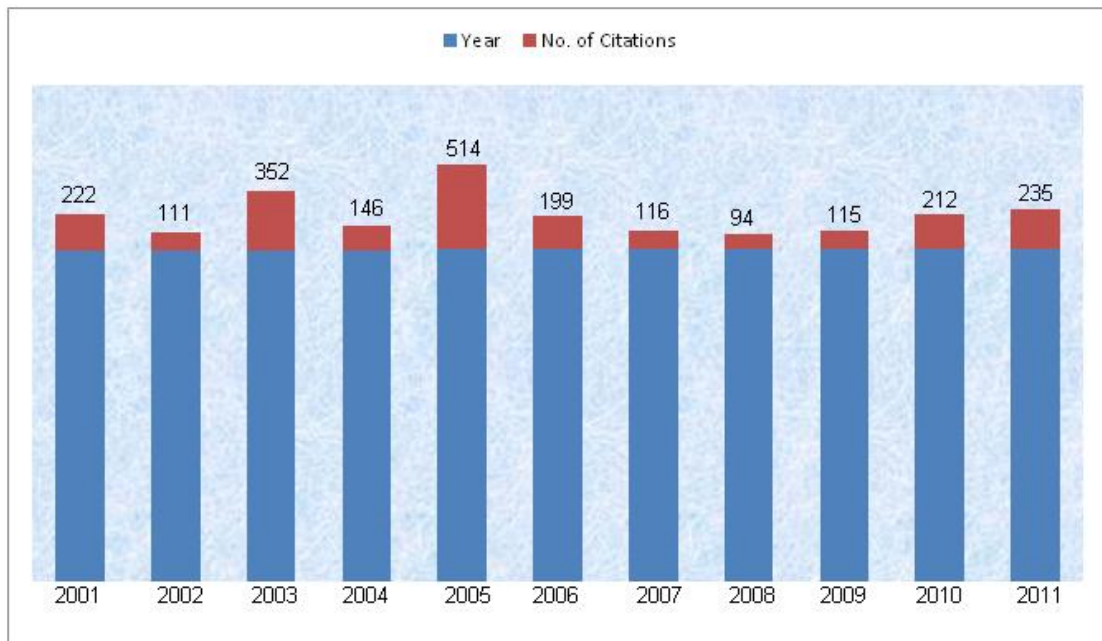
**Graph-3**

Table 3: Represents Year-wise distribution theses submitted Computer Science & Engineering Department IIT Delhi during 2001-2011.

As is clear from table 2 maximum number of citation (117.50) were submitted during year 2011, followed by (116) year 2007, (115) year 2009 and (111) year 2001 – 2002 are equal.

Table 4: Supervision Pattern of Theses

S. No.	Year	No. of Theses	Supervisor	
			Single	Joint
1	2001	2	2	-
2	2002	1	-	1
3	2003	4	4	-
4	2004	2	2	-
5	2005	5	2	3
6	2006	3	3	-
7	2007	1	1	-
8	2008	1	1	-
9	2009	1	-	1
10	2010	3	1	2
11	2011	2	1	1
Total 10 years		25	17	8

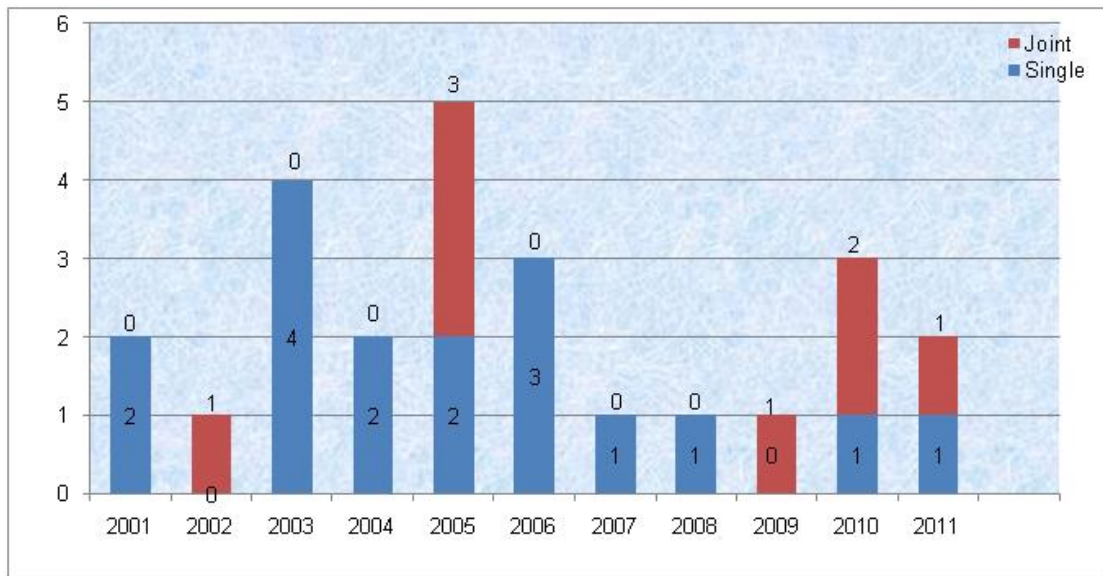
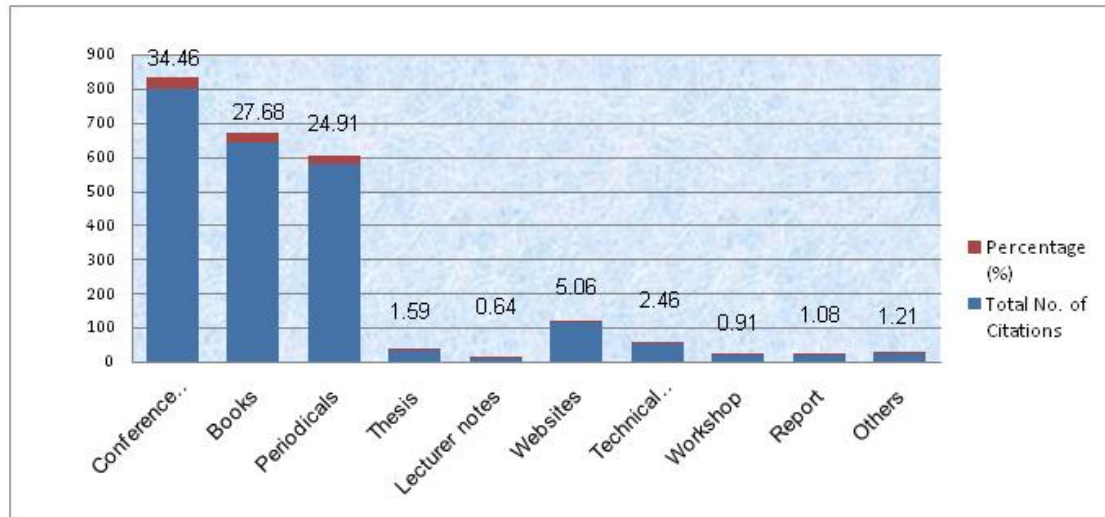
**Graph 4**

Table 4: represents supervision pattern submitted to Computer Science & Engineering Department, IIT Delhi during 2001-2011. It is evident that maximum theses 17 are supervised by single supervisor as compared to 8 theses supervised by joint supervisors. Out of 17 theses supervised by single supervisor, maximum 4 are of the year 2003, followed by 3 of 2006 and 2 each of the year 2004-2005 respectively. Out of total 8 theses supervised by joints supervisors, maximum 3 theses were of the year 2005 were as 2 theses were of the year 2010 and 1 each were of the years 2002, 2009 and 2011.

Table 5: Types of Source Used by the Researchers of Computer Science

S. No.	Type of Source	Total No. of Citations	Percentage (%)
1	Conference Document	798	34.46
2	Books	641	27.68
3	Periodicals	577	24.91
4	Thesis	37	01.59
5	Lecturer notes	15	0.64
6	Websites	117	5.06
7	Technical Reports	57	2.46
8	Workshop	21	0.91
9	Report	25	1.08
10	Others	28	1.21
Total		2316	100%

**Graph 5**

It is surprising to note that maximum citations (34.46%) were of conference proceedings which indicate that Computer Scientists use Conference documents more than Periodicals.

The second highest source used was books (27.68%), followed by periodicals (24.91%), websites (5.06%) and technical report (2.46%). Lecture notes and workshop documents were cited by only (0.64%) and (0.91%) researcher showing very less use of these type of sources by researchers of Computer Science.

Table 6: Authorship Pattern

S. No.	Author	Total no. of Citations	Percentage (%)
1	Single Author	600	25.91
2	Double Authors	757	32.68
3	Three Authors	574	24.78
4	More than Three Authors	385	16.63
	Total	2316	100%

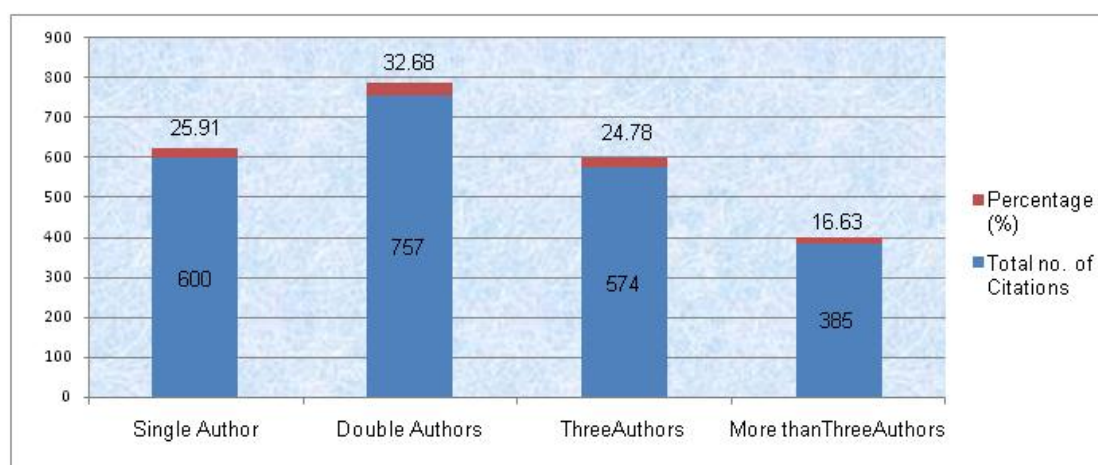
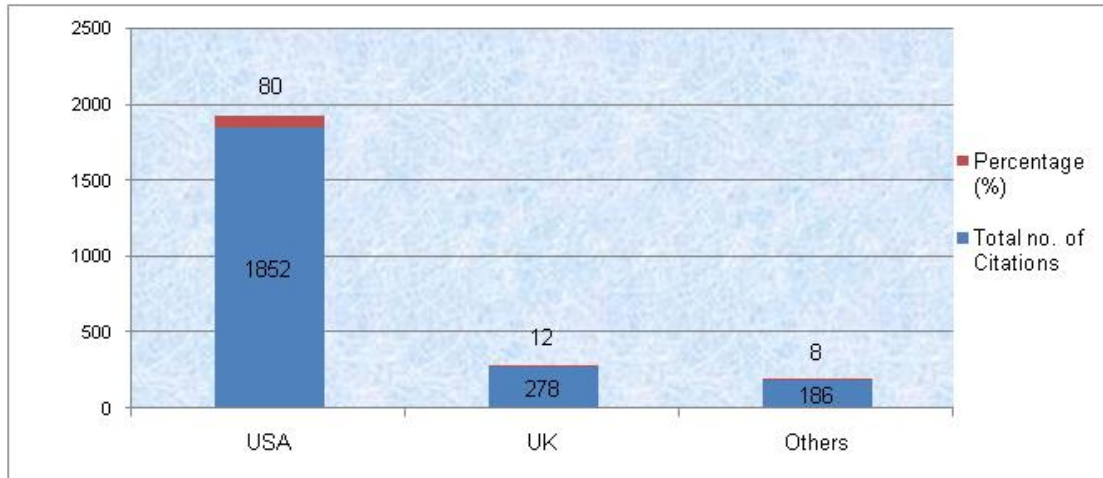
**Chart - 6**

Table 6 Represents Authorship pattern as analyzed from 2316 citations selected for study.

As is evident from table 6 maximum papers were written by double authors (32.68%), followed by 25.91% single authors and 24.78% by three authors. Only 16.63% articles there found to be written by more than three authors. It showed that joint authorship pattern is very common in Computer Science.

Table 7: Country wise distribution of Citations

S. No.	Country	Total no. of Citations	Percentage (%)
1	USA	1852	80
2	UK	278	12
3	Others	186	8
	Total	2316	100

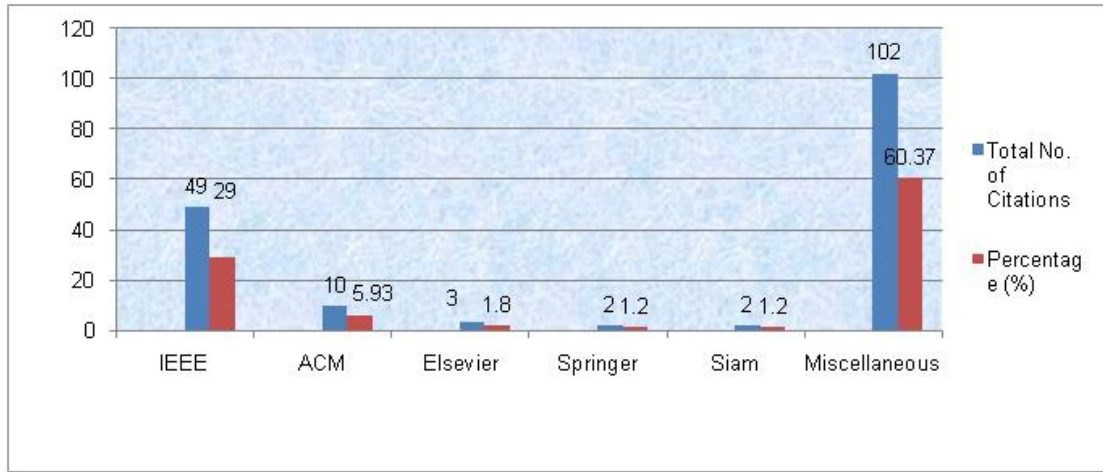


Graph – 7

Table 7: REPRESENTS COUNTRY wise distribution of citations of theses submitted to the department of Computer Science & Engineering, IIT Delhi. It is clear from the table 7 that majority of the documents are found to be published from USA (80%) as against 12% from UK and 8% from author country.

Table 8: Most Cited Journal Publishers

S. No.	Country	Total No. of Citations	Percentage (%)
1	IEEE	49	29.00
2	ACM	10	5.93
3	Elsevier	3	1.80
4	Springer	2	1.20
5	Siam	2	1.20
6	Miscellaneous	102	60.37
Total		169	100



Graph – 8

Table 8 Represents Publishers wise distribution of citations of theses submitted to the Department of Computer Science & Engineering, IIT Delhi. It is clear from the table 8 that majority of the document are found to be published by IEEE publisher (29%) as against 5.93% from ACM Publishers, Elsevier (1.8%) and Springer and SIAM IS each same value (1.20%).

Table 9: Most Cited Journals in the field of Computer Science & Engineering:

S. No.	Journal Name	No. of Citations	Rank
1	IEEE Transaction on pattern analysis and Machine Intelligence	44	1 st
2	Journal of association for computing machinery	38	2 nd
3	IEEE Transaction of image processing	33	3 rd
4	International journal of computer vision	24	4 th
5	IEEE Computer	23	5 th
6	IEEE Transaction on computer	20	6 th
7	IEEE Transaction on circuit system for video technology	16	7 th
8	IEEE Transaction on Networking	15	8 th
9	Journal of visual communication & image representation	13	9 th
10	SIAM Journal of computing	12	10 th
11	IEEE Signal processing	11	11 th
12	Journal of computer and system Sc	10	12 th
13	Communication of the ACM	12	10 th
14	IEEE Transaction on knowledge and data Engineering	12	10 th
15	Journal of applied probability	12	10 th
16	IEEE Transaction on Intelligent Transportation system	9	13 th
17	IEEE CVPR	8	14 th

18	Journal of American society for Info. Sc	7	15 th
19	IEEE ICCV	7	15 th
20	IEEE Transaction on system man and cyber mastics	6	16 th
21	IEEE Transaction on CAD	6	16 th
22	IEEE Transaction on VLSI	5	17 th
23	ACM Transaction on database	5	17 th
24	Image and vision Computing	5	17 th
25	IEEE ACM Transaction on Info. theory	4	18 th
26	IBM Journal of Research and Development	4	18 th
27	IEEE Design and test of computer	4	18 th
28	IEEE multimedia	4	18 th
29	IEEE Transaction on circuit and system	4	18 th
30	Journal of logic and Computation	4	18 th
31	IEEE Transaction on VLSI System	4	18 th
32	Journal of computer vision and image understanding	4	18 th
33	IEEE Journal of solid state circuit	3	19 th
34	IEEE Micro	3	19 th
35	Journal of intelligence Info. System	3	19 th
36	IEEE Transaction on Visualization and Com Graphics	3	19 th
37	Journal of Com. Sc	3	19 th
38	International Journal of Man and MIC studies	3	19 th
39	Journal of parallel and Distributed Computing	3	19 th
40	IEEE Transaction on mobile Computing	3	19 th
41	Logic Journal of IGPL	3	19 th
42	International Journal of Imaging Sc. And technology	3	19 th
43	Journal of Artificial Intelligence Research	3	19 th
44	Computer Vision and Image understanding	3	19 th
45	Computer Graphics forum	3	19 th

Conclusion:

Having examined the theses submitted by Computer Scientists to IIT Delhi during 2001-2011, it was found that maximum numbers of thesis were submitted in the year 2005. When theses submitted from 1966 to 2011 were analysed it was observed that there was an increasing trend in the research of Computer Science & Engineering. More number of theses were submitted in the following years. This clearly shows that Computer Science was gaining importance as a subject and there was more research in this field. Single supervisor was preferred in the research of Computer Science at IIT Delhi which is evidence from analysis. Conference Documents were the most preferred source of information for research in the field of Computer Science which is surprising. The other sources most preferred were periodicals and books. Joint authorship pattern was found to be very common in the field. The research in this field preferred literature published from USA and found it more relevant. Analysis revealed that IEEE publisher was the first choice for Indian Computer Scientists as

compared to other such as (ACM, Elsevier, Springer, etc.). Most cited Journal in the field of Computer Science was IEEE Transaction on pattern analysis and machine Intelligence.

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