

# Citation Analysis of Ph.D. Theses of Environmental Sciences, G.B. Pant University of Agriculture and Technology, Pantnagar: A Case Study

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## Abstract

*The present investigation is based on the citations given in Ph.D. theses of Environmental Sciences accepted by G.B. Pant University of Agriculture and Technology, Pantnagar. The study generalises the findings and gains an in-depth knowledge of the characteristics of the literature used by the researchers in the field of Environmental Science. Researchers today are faced with increasing pressure to get research work published. Academic departments are expected to meet specific levels of publication output. They are turning more and more to citation analysis for objective parameters of impact assessment. A total of 50 Ph.D. theses in Environmental Science awarded from 2001 to 2016 were analysed, which contain 13,231 bibliographic references. Single authorship pattern was identified as the popular pattern among the authors, as the citations given in the theses.*

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**Keywords:** Citation, Citation analysis, Authorship Patterns, Environmental Science, Agriculture, GBPUAT Pantnagar.

## 1. Introduction

It is more important to publish quality papers in top ranking journals, which provide some new idea, knowledge, innovations, etc. to the academicians and other people. Citation Analysis of the journals provides the information about the quality of the papers and the journals. Basically citation analysis is the study of the impact and assumed quality of an article, an author, or an institution based on the number of times works and/or authors have been cited by other authors. It is the examination of the frequency, patterns, and graphs of citations in documents. The general analysis of collections of documents is known as bibliometrics and citation analysis is a key part of that field. It is a way of measuring the relative importance or impact of an author, an article or a publication by counting the number of times that author, article, or publication has been cited by other works.

Various kinds of tools are available for citation analysis, some of them are subscription-based and others are freely available. Each tool has its strengths and weaknesses and none of them covers the entire universe of scholarly publications. Therefore, it is important to use more than one tool to get a fuller picture of the scholarly impact of an author or a journal. There isn't a single database that keeps tracks of all the journal articles that have cited your work. You may have to check citations to your work in multiple databases to get a sense of a fuller

range of your work's importance. Universities must give future generations education, research and training that will teach them, and through them, others to respect the great harmonies of their natural environment and the life itself.

### **About G.B. Pant University of Agriculture & Technology, Pantnagar**

G.B. Pant University of Agriculture and Technology, Pantnagar is the first agricultural university of India. It was inaugurated by Jawahar Lal Nehru on 17 November 1960 as the Uttar Pradesh Agricultural University (UPAU). Later the name was changed to Govind Ballabh Pant University of Agriculture and Technology in 1972 in memory of the great freedom fighter Govind Ballabh Pant. The University lies in the campus-town of Pantnagar in the district of Udham Singh Nagar in the state of Uttarakhand. The university is regarded as the harbinger of Green Revolution in India. University enrolled about 3,000 students per year. The university runs Vocational / Extramural / Correspondence non-degree courses in areas of societal interest such as religion and culture, and also in its Centre for Advanced Studies where Cinema & TV production prepares films and TV programmes. University has seven colleges namely Agriculture, Veterinary Science, Fisheries, Community Development (Home Science), Basic Sciences and Humanities, Engineering, Agri-Business Management.

The university is offering Master's and Ph.D. programmes in Environmental Science besides mandatory courses in UG and PG curricula of the University. The major thrust areas of research include environmental impact assessment, environmental pollution, biodiversity, environmental stresses and bioremediation of agro-industrial waste. The instrumental facilities for environmental monitoring of air, water & soil samples have been developed. Environmental science is an interdisciplinary academic field that integrates Physical, Biological and Information Sciences (including Ecology, Biology, Physics, Chemistry, Zoology, Mineralogy, Oceanology, Limnology, Soil Science, Geology, Atmospheric Science, and Geodesy) to the study of the environment, and the solution of environmental problems.

## **2. Literature Review**

A literature review is a text of a scholarly paper, which includes the current knowledge including substantive findings, as well as theoretical and methodological contributions to a particular topic. Following studies were helpful in conducting this research work:

Vellaichamy and Jeyshankar (2020) conducted a study on the productivity of the Journal of Ornithology using Scopus database for the time duration of 2000-2015 and filtered the data in Microsoft Excel 2007. As per the analysis it found that 1353 research papers were published during the time period where 2012 recorded highest articles. It was noticed that highest research papers were published in English language and, Wink, M., from Institute of Pharmacy and Molecular Biotechnology was identified as highest paper contributor.

Shukla and Lalengmawia (2018) conducted a study on research output analysis of science and technology faculty members of Mizoram University reveals that majority 75% faculties has published 1-20 papers during the last five years. Majority (87.5%) faculty members preferred Journal articles as a medium of publication followed by 48.75% Conference papers and 21.25% Book chapters.

Tyagi and Krishna (2017) carried a study on Citation Analysis of doctoral theses in Political Science submitted to Chaudhary Charan Singh University from 2010-2014 of the political

science discipline. It was found that the highest numbers of citations (61.1%) were from books, followed by journal articles, newspapers, conference/proceedings, reports etc. Analysis on distribution of country-wise scattering of citations reveals that Indian literature received (51.6%) citations and ranked first, followed by USA and UK with 325 (14.8%) and 172 (7.8%) citations. The analysis of authorship pattern in political science theses reveals that 79.6% of citations were the papers written by single authors, which implies that political sciences are less collaborative as compared to sciences and technology. I was concluded that most citations in thesis under the study belong to the Indian authors 64.8% and remaining 35.2% from foreign.

Sinha and Singha (2016) in their article “Citation Analysis of MLIS Dissertations Submitted to Assam University, Silchar During 2012-2013” attempts to study the citation patterns reflected in the Master’s degree dissertations submitted to the Department of Library and Information Science, Assam University, Silchar during the period 2012 - 2013. From the study it was deduced that journals are the most utilized reference materials in the dissertations which is followed by books and it was also observed that the highest numbers of citations are from single authored papers/publications. The place-wise scattering of citation analysis reveals that about 126 (54.08%) citations are form India and which is followed by U.S.A and U.K.

Borthakur (2015) in her paper “Citation analysis of theses and dissertations in Chemistry submitted to the LNB Library, Dibrugarh University” find that collaborative research is prevailing in the field of chemistry. It was found that journal contributes the highest number of citation. Books and journals are found to be widely used format compared to web/Internet resource and other form of literature. The technique of citation analysis is effective and easier among all other techniques of bibliometrics to know the trend of research in a particular field, to know the preferences of scholar for varied information sources. These studies can help researchers to carry out research in similar field as well as it will also help librarians to plan effective collection development within limited budget constraints.

Kocher and Kelly (2015) in their study "Food Systems Citation Analysis: Trends in an Emerging Interdisciplinary Field" performed research on four journals covering the topic of food systems - a relatively new discipline in academia. Analyses included the types of works cited, the most commonly-cited journals in this discipline, age of materials cited, geographic location of authors, and types of data cited. The data collected aided the librarians who were tasked with supporting this new area of research and will be used to support the research by assisting students and building appropriate collections.

Somashekara and Kumbar (2015) in their research paper “Citation analysis of doctoral theses: an analysis of Physics theses submitted to three universities of Karnataka, India” identified that journal article resource were 5978 (78%) followed by Books 854 (11%). The researcher determines the subject-wise distribution of citations, ranking of Journal source, Bradford law of scattering, Bradford Zones and Journal productivity aspects.

### **3. Objectives**

The present study is focussed on four main objectives:

- To determine the year-wise distribution of theses submitted in the Department of Environment Science.

- To denote the number of studies were carried out in specific subjects of Environment Science.
- To identify the most cited sources of information consulted by the Ph.D. students in Environment Science.
- To identify number of references cited per thesis.
- To know the most used journal in the area of Environment Science.
- To identify the authorship pattern and degree of collaboration in Environment Science research.

#### 4. Research Methodology

Research methodology is a way to systematically solve the research problem, also it act as a science of studying how research is done in a proper systematic layout. A descriptive method was adopted for this current study. All doctoral theses from the Department of Environmental Science of the G.B. Pant University of Agriculture and Technology, Pantnagar (India) from 2001 to 2016 were analysed. Altogether, there were a number of fifty doctoral dissertations found. All citations from each dissertation were included for analysis. Citations from the references in each dissertation were extracted for content analysis. The citations were be broken into four major categories: journals, books, theses and dissertations, and other research materials like- conference papers, web resources, technical reports and standards, government documents, theses and dissertations, patents, personal communications, product literature, software and software manuals, university extension documents, unpublished materials, etc.

Analysis was done with the help of Excel spread-sheet, which includes the author of the dissertation, authorship pattern, journal name, illustration and tables included in thesis, geographical distribution, types of documents such as journal, book, proceeding, series, report, map, newspaper, web site etc. Basically this study is based on my dissertation work submitted to the IGNOU, New Delhi for the partial fulfilment of the requirement for the award of master's degree in the year 2018.

#### 5. Analysis and Interpretations

##### Chronological distribution of dissertations

The university is offering PhD programme in Environmental Sciences and each year few degrees awarded in the discipline. Below table 1 contains the year wise data.

**Table 1: Chronological Distribution of Dissertations**

S.N.	Year	Number	S.N.	Year	Number
1	2001	4	9	2009	2
2	2002	3	10	2010	5
3	2003	0	11	2011	4
4	2004	2	12	2012	4
5	2005	1	13	2013	5
6	2006	1	14	2014	5
7	2007	2	15	2015	6
8	2008	1	16	2016	5
<b>Total = 50</b>					

It is clear from the table 1 that highest 6 theses were submitted in the year 2015 followed by 5 theses equally in years 2010, 2013, 2014 and 2016. Analysis stated that an average of 4 theses awarded each year by the university.

### Distribution of dissertations by subject

There are eight main subjects considered for environmental science discipline. Below table 2 contains the data related to the dissertations by subject.

**Table 2: Distribution of dissertations by subject**

S.N.	Subjects	Numbers
1	Effluents	14 (28.0%)
2	Industries; Uttarakhand	9 (18.0%)
3	Heavy Metals	8(16.0%)
4	Carbon	7 (14.0%)
5	Sequestration; Water Treatment; Phytoremediation; Pulp and Paper Industry; Ecosystems; Microbiology; Bacteria	4 (8.0%)
6	Brassica juncea; Degradation; Distilleries; Eichhornia crassipes; Waste Water; Water Pollution; Water quality	3 (6.0%)
7	Agricultural production; Biomass; Chromium; Consortium; Ecology; Himalayas; Pentachlorophenol; Optimization; Population dynamics; Soil Pollution; Tanneries; Technology Transfer; Vegetation; Water management	3 (6.0%)
8	Air Quality; Aqueous; Biodegradation Biogas; Biosorption; Cadmium Characterization; Climate Change Decolourization; Dendroremediation; Dyes; Electroplating; Forest Management; Immobilization	2 (4.0%)

It was observed from the above table 2 that majority 28.0% of the Ph.D. research work done on the specific discipline “Effluents” of the Environmental Science. Other researches done on major specific disciplines are - 18.0% on Industries, Uttarakhand, 16.0% on Heavy Metals and 14.0% on Carbon.

### Number of tables and illustrations

Tables and illustration were prepared by the submitters as per the requirement of the study. Blow given table 3 contain the data related to the tables and illustration given in the thesis.

**Table 3: Number of tables and illustrations**

S. N.	Author	Table	Illustration	Total
1.	Rajeev Kumar	198	108	<b>306</b>
2.	Poonam Miglani	190	109	<b>299</b>
3.	Shalini	142	105	<b>247</b>
4.	Vikas Singhal	93	153	<b>246</b>
5.	Nidhi Rawat	81	163	<b>244</b>
6.	Mohini Singh	121	117	<b>238</b>
7.	Akanksha Rastogi	116	118	<b>234</b>
8.	Nanda Nautiyal	104	113	<b>217</b>

9.	Megha Verma	131	75	<b>206</b>
10.	Namita Tewari	120	73	<b>193</b>
11.	Deepika Rajwar	74	108	<b>182</b>
12.	Piyush Malviya	114	60	<b>174</b>
13.	Sarita Joshi	39	124	<b>163</b>
14.	Shivani Uniyal	61	99	<b>160</b>
15.	Shalini Shrivastava	67	82	<b>149</b>
16.	Tirthankar Banerjee	27	118	<b>145</b>
17.	Sudipta Ramola	59	81	<b>140</b>
18.	Jaspal Singh Chauhan	71	67	<b>138</b>
19.	Bipin Kumar	37	99	<b>136</b>
20.	Asha Pandey	52	81	<b>133</b>
21.	Meenakshi Sati	66	66	<b>132</b>
22.	Pratibha	77	49	<b>126</b>
23.	Anand Prabha Rawat	57	68	<b>125</b>
24.	Vrinda Negi	50	71	<b>121</b>
25.	Krishna Giri	37	82	<b>119</b>
26.	Siddhartha Shukla	78	41	<b>119</b>
27.	Manish Joshi	66	45	<b>111</b>
28.	Anshul Fuloria	69	41	<b>110</b>
29.	Shobhika	24	83	<b>107</b>
30.	Kavita tariyal	70	32	<b>102</b>
31.	Megha Bora	66	35	<b>101</b>
32.	Anil Kumar Shankhwar	37	62	<b>99</b>
33.	Manisha Saxena	45	51	<b>96</b>
34.	Asha Upadhyaya	56	39	<b>95</b>
35.	Priyanka Agarwal	20	74	<b>94</b>
36.	Bhumija Kaphaliya	33	57	<b>90</b>
37.	Parul Sundha	31	54	<b>85</b>
38.	Shachi Shah	41	44	<b>85</b>
39.	Yogita Chuphal	44	41	<b>85</b>
40.	Shruti Agarwal	50	34	<b>84</b>
41.	Suman Panwar	39	44	<b>83</b>
42.	Tripti Mishra	26	50	<b>76</b>
43.	Rashmi Paliwal	37	34	<b>71</b>
44.	Zeba Khanam	16	55	<b>71</b>
45.	Rama Pal	28	39	<b>67</b>
46.	Ali Seid Mohammad	27	20	<b>47</b>
47.	Utobo	13	23	<b>36</b>
48.	Saumyata Tewari	25	6	<b>31</b>
49.	Pratibha Singh	16	13	<b>29</b>
50.	Sweta Saraswat	23	5	<b>28</b>
<b>Total</b>		<b>3164</b>	<b>3411</b>	<b>6,575</b>

It is evident from the table 3 that highest 306 number of tables and illustrations were given by Mr Rajeev Kumar in his thesis followed by 299 by Poonam Miglani, 247 by Shalini, 246 by Vikas Singhal, and 244 by Nidhi Rawat among the awarded 50 theses during the year 2001 to 2016.

### Major Documents cited in thesis

Many kind of documented cited in the thesis and dissertations. This is based upon the availability of related literature on the specific discipline. Blow given table 4 contain the use of book, journals, theses and dissertations and other research materials.

**Table 4: Major documents cited in thesis**

S.N.	Document	Number	Percentage
1	Books	3282	24.81
2	Journals	7366	55.67
3	Theses and Dissertations	1305	9.86
4	Other research materials	1278	9.66
<b>Total</b>		<b>13231</b>	<b>100.0</b>

It can be seen from the above table 4 that majority 55.67% of the citations from the journals, followed by 24.81% book, 9.86% theses and dissertations, and 9.66% other kind of research materials. This shows the importance of journals for the conducting research work.

### Frequency of top 10 cited journals

Below table 5 contain the data related to the top ten frequently used journals in the awarded PhD theses under the study.

**Table 5: Frequency of top 10 journals cited**

S.N.	Title of Journals	Frequency
1	Bioresource Technology	194
2	Chemosphere	113
3	Atmospheric Environment	99
4	Plant and Soil	93
5	Journal of Hazardous Materials	92
6	Water Research	85
7	Environmental Monitoring and Assessment	83
8	Plant Physiology	83
9	New Phytologist Journal	82
10	Environmental Science & Technology	79

It can be seen from the table 5 that journal Bioresource Technology was highly cited by 194 times, other top used journals are 113 times Chemosphere, 99 times Atmospheric Environment, 93 times Plant and Soil, 92 times Journal of Hazardous Materials, 85 times Water Research, 83 times both Environmental Monitoring and Assessment and Plant Physiology, 82 times New Phytologist Journal and 79 times Environmental Science & Technology.

### Top 10 cited journals by impact factor

Researchers used top class research papers published in journals in their research work. An analysis was done for calculating the impact factor of cited journals and the result is given in below table 6.

**Table 6: Top 10 cited journals by impact factor**

<b>S.N.</b>	<b>Journals</b>	<b>Impact Factor*</b>
1	Nature	40.137
2	Science	37.205
3	Environmental Health Perspectives	9.776
4	Proceedings of the National Academy of Sciences of the United States of America	9.661
5	Global Change Biology	8.502
6	New Phytologist Journal	7.21
7	Environment International	7.088
8	Water Research	6.942
9	Plant Physiology	6.456
10	Environmental Science & Technology	6.198

It can be seen from the above table 6 that the Nature journals has highest Impact Factor 40.137 followed by other journals- Science 37.205, Environmental Health Perspectives 9.776, Proceedings of the National Academy of Sciences of the United States of America 9.661 and 8.502 Global Change Biology. It is concluded that PhD students used the high Impact Factor journals in their research work.

### **Authorship Pattern**

The number of cited authors included in the all thesis was calculated in terms of the authorship patterns as single author, two authors, three authors, four authors and more than four authors. The related data is given in below table 7.

**Table 7: Authorship Pattern**

<b>S. N.</b>	<b>Authors</b>	<b>No.</b>	<b>Percentage</b>
1.	One Author	5939	44.89
2.	Two Author	2475	18.71
3.	Three Author	2145	16.21
4.	Four Author	2083	15.74
5.	More than Five Authors	589	4.45
<b>Total</b>		<b>13231</b>	<b>100.0</b>

It is clear from the analysis of table 7 that majority cited papers are of single author 44.89%, followed by 18.71% two authors, 16.21% three authors, 15.74% four authors and 4.45% more than four authors. It is concluded that majority of the research work done in the area of environmental sciences by the single authors.

### **Most Prolific Author**

Few of the papers were cited by the most of the authors. This shows the most prolific author in terms of the highly received citations. Table 8 shows a list of top ten highly cited authors for their various research contributions in the area.



**Table 8: Most Prolific Authors**

<b>S.N.</b>	<b>Name of Author</b>	<b>Number</b>
1	Rattan Lal	182
2	A.J.M Baker	149
3	K. H. Paustian	125
4	P. Smith	108
5	B. Volesky	101
6	S.P. McGrath	94
7	V. Singh	89
8	M.C. Rillig	81
9	Raskin I.	67
10	C.A. Campbell	49

It is evident from table 8 that Dr Ratan Lal secured top rank among the other authors with the time citations in the Environmental science theses awarded in the university.

## **6. Major findings of the study**

On the basis of the analysis and interpretations followings are the major findings of this present study:

- Majority 28.0% of the Ph.D. research work were done on the specific discipline “Effluents” of Environmental Science.
- Rajeev Kumar Ph.D. Student has given highest 306 tables and illustration in his thesis among the other Environmental Science theses.
- It was noticed that highest 55.67% citations in the theses from the journals.
- Bioresource Technology journal was highly cited by the Ph.D. student of the Environmental Sciences at the G.B. Pant University of Agriculture and Technology, Pantnagar.
- It was found that the journal used by the Ph.D. scholars, Nature was of the top impact factor (40.137) journal among the other used journals.
- Authors were interested in Single authorship pattern, as it was seen in the used research articles majority 44.89% research papers cited were written by single author.
- Dr Ratan Lal was the top prolific author among the others with the highest 182 times cited in the theses awarded by the university.

## **7. Conclusion**

Citation analysis in any research activities has become one of the popular methods to study subject relationship, authorship pattern, impact, publication trends and to identify core journals in a particular subject field or for a particular scientific community. Citations play a vital role in identification and retrieval of earlier works. Librarians are expected to know enough about key subjects in order to assist patrons with their research needs. The exponential growth of scientific literature, interdisciplinary nature of research, and trend towards specialization has posed many problems both to the scientists and librarians.

The present study is an approach to the analysis of information used by the research scholars on the basis of the PhD theses submitted in the Department of Environmental Science at the G.B. Pant University of Agriculture and Technology, Pantnagar (Uttarakhand) from 2001 to 2016 to trace the development of scientific research. The results provided useful insight into the information base of University scientific production in this respective discipline. Authorship is an important facet of scientific research. A detailed analysis of the authorship of citations reveals that research is, now a day a team works rather than a work in isolation. Therefore in a large majority of scientific publications in Environmental Science find more than one names in the author statement. Collaborative authorship is often considered to be indicative of authenticity of the contents of the document. Scientists choose to engage in collaboration for a variety of reasons, such as access to equipment, finance, expert guidance and information support.

As a result, scholars are very interested in reviewing periodical material and the libraries have stressed the need to develop those collections in the respective disciplines. The preference of learned foreign journals as the major medium of science communication is a well established fact. Most probably the lack of indigenous literature on local problems may be the reason that prompts the scholars to depend more on foreign sources for their background study of the topic.

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