



CITATION AND COLLABORATION CHARACTERISTICS IN CIVIL ENGINEERING RESEARCH PROJECTS

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ABSTRACT

Citation analysis focuses on examining the impact and the presumed quality of a particular author, article, journal, institution or a field of study based on level and frequency of citation, among other metrics. The essence of citation analysis most especially in higher institution of learning cannot be overemphasized. The study adopted Bibliometric method. A citation analysis of research projects submitted by graduates of the Department of Civil Engineering, Landmark University, Omu-Aran, Nigeria. The study covered research projects submitted during 2016 to 2018. All the references of the research projects were examined in print form one after the other and the different types of cited materials were recorded according to the year. It was discovered that journal articles accounted for the highest citations, and this was followed by book and others. It was also discovered that most of the documents cited were between 2013-2016, and the average citation counts was high. The study also found that civil engineering students prefer current literature in carrying out their research work. The result also revealed that the students prefer multiple authorship materials than single author for their research project writing. Based on these findings, the paper concluded and recommended that the current practice of hybrid collection in the university library should be sustained, for serious academic research. Library should continue the annual subscription to books, journals (Prints) and electronic databases as they account for the quality of student's projects, it was also recommended that supervisors should intensify effort in mentoring the students so as to have continuous improvement in the quality of projects.

Key words: Citation, Collaboration, Civil Engineering, Landmark University, Research Projects

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1. INTRODUCTION

Civil engineering has been adjudged as significant to the modern day development as its role is required in construction of roads bridges and building that the modern man rely upon for transaction of business, relationship building and international relations. Several new roles are emerging in the field and this has led to generation of several documents from professionals and laymen. It is therefore pertinent to investigate sources of information engaged by undergraduate students who are assumed to have little knowledge of research (Mavroudhis 2017) [9]. Citing the sources where information emanated from, in academic writing is sacrosanct. The authority cited gives credence to authenticity of a particular work. For instance, high citation of statements of a sociologist in a core engineering article may not attract much attention like that of a specialist in such field. This illustration constitutes one of the fundamentals of citation analysis.

Citation analysis focuses on examining the impact and the presumed quality of a particular author, article, journal, institutions or a field of study based on level and frequency of citation, among other metrics. When citation is made, credit is given to the appropriate and specific individuals or organizations responsible for the cited source; subsequent readers are referred to the source; researcher's integrity is demonstrated as unlawful ownership of information is not displayed; an argument is given verifiable support; and respect is shown for previous scholars that have earlier investigated a particular field of interest (Kayongo & Helm2012; Hoffmann & Doucette 2012; Mahajan & Anil 2017) [6, 4, 8].

One other major reason for citation analysis is the myriad sources of information occasioned by internet accessibility by students. A simple search on Google and other search engines may provide several millions of documents without requisite touch of expertise on topics. Some sources are blogs which may be an individual's myopic opinion and unscientific assertions (Breznik & Skrbinje 2017; European Commission 2016) [7, 3]. Similarly, Ilo, Idiegbeyan-ose, Adebayo and Osinulu (2015) [5] stressed that Students are mandated to write theses, dissertation or project works in fulfilment for the awards of bachelor, masters or doctorate degrees. Graduating students at all levels are mandated to carry out researches in their areas of study in partial fulfilment for the award of various degrees.

1.1. Objective of the Study

The general objective of the study is to investigate citation and collaboration characteristics in civil engineering research projects. The specific objectives of the study are:

- To establish year-wise and volume-wise quantitative growth of cited documents
- To know the average citation counts per research project in Civil Engineering
- To investigate various information sources cited
- To investigate the types of cited materials often use in Civil Engineering research projects
- To find out the chronological distribution of cited materials
- To find out the age of cited materials
- To examine the authorship pattern of cited documents in the literature of Civil Engineering

1.2. Research Questions

1. What are the year and volume quantitative growth of the cited documents?
2. What is the average citation counts per research project in Civil Engineering?

3. What are the various information sources cited?
4. What are the types of cited materials often used in Civil Engineering research projects?
5. What is the chronological distribution of the cited materials?
6. What is the age of the cited materials?
7. What are the authorship pattern of the cited documents in Civil Engineering?

2. REVIEW OF RELATED LITERATURE

As gatekeepers of information resources, efforts have been made by scholars in the field of library and information science to investigate some cardinal aspects of resources cited in researches across several disciplines aside civil engineering. This study covers citation counts per research, information sources cited, materials often used in civil engineering research, chronological distribution and age of cited materials, and authorship patterns of cited materials. An analysis of materials cited from the middle of 1600s to 2012 on the growth science growth re-examination by Bornmann and Mutz (2015) [2] focused on the quantity of publications and the references cited. Through their analysis, it was possible to identify three phases of growth. Publications and rate of citation were lagging below 1% till the mid eighteenth century; then between 2% and 3% within the first and the second world wars; and later rose to about 8% to 9% in the year 2012. The citation analysis enabled the ease of calculating the growth within the years under study.

The year-wise study by Abdi, Idris, Alguliye & Aliguliyev (2017) [1] on articles that were published in the journal of Information Processing & Management (IP & M) revealed that 2,913 articles were published in the journal from the year 1980 to 2015. An average of 81 papers could be said to have been published annually within those years. The year that witnessed the highest publication was 2007 while the lowest was 1980. A study by Nasir, Umar, and Khan (2010) [10] found books were the most cited of doctoral theses investigated. Also, single authorship was found to be predominant. A chronological analysis of doctoral theses by 1996-2005 publications were the most cited of journals while the lowest citation were recorded for journals published before 1925. It was however recorded that while citation of books was very high from 1936 to 1945, there was sharp decrease from year 1996 to 2012 in book purchase.

3. METHODOLOGY

The study adopted Bibliometric method. A citation analysis of research projects submitted by graduates of the Department of Civil Engineering, Landmark University, Omu-Aran, Nigeria was conducted. The study covered research projects submitted during 2016 to 2018. All the references of the research projects were examined in print form one after the other and the different types of cited materials were recorded according to the year. The data were manually collected from the references of each research projects. Micro soft excel sheet was used to code and analyzed the data. Data collected included type of document cited, number of authors, difference between the year of publication of cited document and the research project.

4. DATA ANALYSIS AND DISCUSSION

4.1. Distributions of Citations

Table 1 shows yearly submission of research projects in the Department of Civil Engineering from 2016-2018. There were 3,646 citations in 92 research projects. Most of the citations 1,757

(48.19%) were recorded in 2017. The highest number of research projects (40) were submitted in 2017 and the least number of research projects 25 were submitted in 2016. The average citations for each project was 38.68 across the years under consideration. Even though the average citations in 2016 were the least (29.16), average citations in 2017 and 2018 increased significantly and in similar pattern 43.93 and 42.96 respectively. The increase is observably recorded in journals (Table 2).

Table 1 Submission of research projects by year and average number of citations

Year	Research projects	Citations (%)	Average citations
2016	25	729 (19.99)	29.16
2017	40	1,757 (48.19)	43.93
2018	27	1,160 (31.82)	42.96
	92	3,646	38.68

Furthermore, Table 2 reveals the distribution of citations according to various forms of information sources. A total of 3,646 citations were seen in the research projects of Civil Engineering during 2016 to 2018. Journals comprise the highest citations 1,699 (46.60%); followed by book citations 622 (17.06%); Internet/e-resources 409 (11.22%); theses/dissertation 247 (6.77%); conference proceedings 241 (6.61%); reports 234 (6.42%) and others such as working paper, workshop/seminar paper, newspaper e.t.c 194 (5.32). The citations received for theses/dissertation indicate that they are important source to spread scientific information, though they are less in numbers in comparison with journals and books. Also, conference proceedings have been used more by project authors as compared to reports and other materials including workshop/seminar papers, newspapers, standards, manuals, patents, and reviews. The use of journals across showed an increase from 2016 to 2017 and decline widely in 2018. For books there is a continuous decline from 24.00% in 2016, to 15.94% in 2017 and 14.40% in 2018. However, the use of internet/e-resources and conference proceedings increased continuously from 9.19% to 15.17% and 3.29% to 13.71% respectively.

Table 2 Distribution of citations according to information sources

Information source	2016 (%)	2017 (%)	2018 (%)	No. of citation	% of citations
Book	175 (24.00)	280 (15.94)	167 (14.40)	622	17.06
Journal	253 (34.71)	1,034 (58.85)	412 (35.52)	1,699	46.60
Internet/E-resources	67 (9.19)	166 (9.45)	176 (15.17)	409	11.22
Conference proceedings	24 (3.29)	58 (3.30)	159 (13.71)	241	6.61
Reports	36 (4.94)	44 (2.50)	154 (13.28)	234	6.42
Thesis/dissertation	112 (15.36)	66 (3.76)	69 (5.95)	247	6.77
Others	62 (8.50)	109 (6.20)	23 (1.98)	194	5.32
Total	729 (100)	1,757 (100)	1,160	3,646	100

4.2. Chronological Distribution of Citations

Table 3 indicates that the highest number which is about one quarter (24.6%) of the total citation are documents published during 2013-2016. This is followed by publications before 2001 (23.7%), 22.6% during 2009-2012, 16.8% during 2005-2008 and 10.7% during 2001-2004. However, documents published in 2017 and 2018 are the least cited (1.6%). It appears that Civil Engineering students do not have access to the most current literature in their field.

Table 3 Chronological distribution of cited materials

Year	Citations	Percentage
2000 and Below	864	23.7
2001-2004	389	10.7
2005-2008	611	16.8
2009-2012	824	22.6
2013-2016	898	24.6
2017 and Above	60	1.6
Total	3646	100

4.3. Age of Cited Documents

The age of the cited documents was determined by calculating the difference between the submission year of the research project and the cited documents. As shown in Table 4, 23.6% of the total citations were derived from materials published between 6 to 10 years. This is followed by last 5 years publications. Twenty-six years and more category has only 8.8% of the total citations. This implies that Civil Engineering students prefer current literature. Therefore, recent developments and studies were largely considered and noticed by Civil Engineering students before conducting their research projects.

Table 4 Age of cited documents

Year	Citations	Percentage
Less or equal to 5	837	23.0
6-10	860	23.6
11-15	596	16.3
16-20	430	11.8
21-25	602	16.5
26 and above	321	8.8
Total	3,646	

Table 5 shows the authorship pattern of the studied research projects. The data indicate that there is continuous decline in the cases of documents cited with either no author or author not given from 2.61% in 2016 to 0.69% in 2018. While total cases of no author during 2016 and 2018 is 1.15%. As shown in Table 5 researchers in Civil Engineering prefer multiple authored materials for writing their research projects (59.11%) to single authored materials (35.19%) and materials with corporate authorship (4.55%). This finding is supported by earlier studies such as Subramanyam (1983) who attests that the degree of collaboration is higher in technical fields like Civil Engineering than humanities. However, there are fluctuations in the authorship pattern across the 3 years under consideration.

Table 5 Year-wise distribution of authorship pattern

Authorship pattern	Citations (%)			
	2016	2017	2018	Total
No author/ author not given	19 (2.61)	15 (0.85)	8 (0.69)	42 (1.15)
Corporate authorship	47 (6.45)	60 (3.41)	59 (5.09)	166 (4.55)
Single author	278 (38.13)	477 (27.15)	528 (45.52)	1,283 (35.19)
Two authors	168 (23.05)	373 (21.23)	268 (23.10)	809 (22.19)

Three authors	114 (15.64)	270 (15.37)	116 (10.00)	500 (13.71)
Four or more authors	103 (14.13)	562 (31.99)	181 (15.60)	846 (23.20)
Total no. of multiple authors	385 (52.81)	1,205 (68.58)	565 (48.71)	2,155 (59.11)
Total citations	729 (100)	1,757 (100)	1,160 (100)	3,646

4.4. Degree of Collaboration

Table 6 shows the degree of collaboration in research projects in Civil Engineering. This was calculated by using Subramanyam's formula. According to Subramanyam (1983) [11], collaboration can be defined as follows:

$$C = \frac{N_m}{N_m + N_s}$$

$$N_m + N_s$$

Where

C = degree of collaboration in a discipline,

N_m = number of multiple-authored research papers in the discipline published during a year,

N_s = number of single-authored research papers in the discipline published during the same year.

Therefore, the degree of collaboration in this study is 0.61. While there is no much difference in the degree of collaboration in 2016 (0.58) and the average in the study (0.61), the degree of collaboration is higher in 2017 (0.72) than in 2016 (0.58) and 2018 (0.52). The visibility and productivity of researcher is determined by the extent of collaboration.

Table 6 Degree of authors' collaboration

Year	Single author (N_s)	Multiple authors (N_m)			Degree of collaboration (C)
		Two authors	Three authors	Four or more authors	
2016	278	168	114	103	0.58
2017	477	373	270	562	0.72
2018	528	268	116	181	0.52
Average					0.61

5. CONCLUSION

Citation analysis focuses on examining the impact and the presumed quality of a particular author, article, journal, institutions or a field of study based on level and frequency of citation, among other metrics. When citation is made, credit is given to the appropriate and specific individuals or organizations responsible for the cited source; subsequent readers are referred to the source; researcher's integrity is demonstrated as unlawful ownership of information is not displayed; an argument is given verifiable support; and respect is shown for previous scholars that have earlier investigated a particular field of interest (Kayongo and Helm, 2012; Hoffmann and Doucette, 2012).

The study adopted Bibliometric method. A citation analysis of research projects submitted by graduates of the Department of Civil Engineering, Landmark University, Omu-Aran, Nigeria was conducted. The study covered research projects submitted during 2016 to 2018. It was discovered that journal articles account for the highest citations, and this is followed by book and others. It was also discovered that most of the documents cited are between 2013-2016, even though these materials are considered recent, there is need for Civil Engineering to

access more recent materials in their field for their research projects. The study also found that these students prefer current literature in carrying out their research work. The result also revealed that the students prefer multiple authorship materials than single authors for their research project writing.

6. RECOMMENDATIONS

1. The current practice of hybrid collection in the university library should be sustained, for serious academic research
2. Library should continue the annual subscription for print books, journals and electronic databases as they account for the quality of student's projects.
3. The supervisor should intensifier effort in mentoring the students so as improve the quality of the Civil Engineering projects
4. The students should be discouraged from citing materials without authorship
5. The university library should intensifier the user education programme so as to increase the usage of the materials (prints and electronic) in the library

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