

# Information Literacy in Global Research Output: A Scientometrics Analysis

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## Abstract

The paper attempts to measure the global research output on information literacy (IL) on the basis of data retrieved from the SCOPUS database from 2000 to 2019. A maximum of 656(8.79%) research publications are contributed in the year 2016 and citations of 2355(3.69%), citations per paper of 3.59, H-index 26. Communication in Computer and Information Science published 383 (15.01 %) papers which is the highest research output and received 639(2.74 %) Citations. The cite core value of 0.7, SJR value of 0.17, SNIP value of 0.367 and H-index is 9. Pinto, M from Purdue University was found to be the most 51(10.83%) productive author, with citations 565(8.12%), CPP 11.08, H-index 14, and 1958 record found in Computer Science with 15247 citations. Even the h-index is also high 52 for this subject discipline. The relative growth rate of publications [R(a)] decreased and increased gradually from 0.09 to 0.87 from 2000 to 2019 and again increased to 4.954 in 2020 the corresponding mean doubling time [Dt(a)] for the period increased from 0.80 to 7.57. Out of 7463 research publications, 2975 research publications are contributed by single authors and the remaining 4488 research publications are multi-author contributions, and the average degree of collaboration is 0.60. The average CC is 0.33, the average CI is 2.04, and the average MCC is 2.05. In the present study, 5125 (68.67 %) documents have been seen in the form of Articles, and the results revealed that most of the papers 3418 (53.31%) resulted from the USA which received 34505 citations. Purdue University in the United States has published a maximum of 92(9.46%) documents and received almost 569 citations.

**Keywords:** Scientometrics; Information literacy; Degree of collaboration, Authorship pattern, Collaborative index, Collaborative co-efficient, Modified collaborative co-efficient

## Introduction

The concept of information literacy (IL) has gained very popular acclaim in Librarianship. The American Association of School Librarians (AASL) defined information literate as one who accesses information efficiently and effectively, critically evaluates the information, and uses it accurately and creatively<sup>1</sup>. It seems to be a buzzword in this decade for library professionals and

even today its different aspects are being studied theoretically and practically. Information literacy instruction, models of IL, the content of IL, method of instructions, its connection with lifelong learning, IL assessment, critical thinking and specific role of library professionals and other teaching communities are some of the points which can be mentioned as a few facets that have often been discussed. In reality, IL is existent in almost every sector with different taxonomy<sup>2</sup>.

The relevance of IL in corporate sector is due to the knowledge based economy and necessity of apt decision making<sup>3</sup>. A study<sup>4</sup> for has shown how entrepreneurship and innovative product design in health care resulted in improved performance when received training on IL. Another study<sup>5</sup> in banking sector illustrated how the IL level of bankers in Ogun state in Nigeria influenced their service pattern in a positive way. Although library people are ahead in trumpeting it, it is not a domain solely belonging to them. It is a term that has been accepted by all the disciplines. As such, to achieve the goals of IL is widespread agenda for all of them. On this backdrop, an emergence of literature is bound to be there from every subject discipline. Hence it would be interesting to study the global research output on IL. The present study is initiative in that direction.

### **Scientometrics**

Nelson, J. (2003)<sup>6</sup>, DOE (1980)<sup>7</sup>, Barnett, A. A. (1978)<sup>8</sup>. Solar power is a renewable resource that is available everywhere in the world. Solar energy is widely available throughout the world and can contribute to reduced dependence on energy imports. Solar cells, popularly known as Photovoltaic (PV) cells, are electrical devices that help us to convert solar energy into direct current

Verma, S. S. (2016)<sup>9</sup>. Solar cells are devices in which sunlight releases electric charges. Hu, C, Richard M. White, R.M, (1983)<sup>10</sup>. Solar cells are a promising and potentially important technology and are the future of sustainable energy for human civilization. Solar cells need to absorb a range of energy (Ranabhat, Kiran. et al., 2016)<sup>11</sup>. The temperature of solar cells was derived based on the calculation of heat generation and a given global heat transfer coefficient. Bach, U. et al. (1998)<sup>12</sup>. Power generated from sustainable and environmentally benign solar cell technologies is one of the key aspects in the development of clean renewable energy. Rokas Kondrotas Chao Chen Jiang Tang, (2018)<sup>13</sup>. Solar energy photovoltaic technology has developed rapidly for the past years and researchers over the world have been working hard on improving the efficiency and reducing the cost of photovoltaic devices. Wang, Ao Xuan, Yimin (2018)<sup>14</sup>, Krebs et al., (2009)<sup>15</sup>. The International Energy Agency hopes to make solar cells the largest source of electricity in the world by 2050. Several scientometric studies have reported analysis of solar energy literature, but fewer only available on solar cell research. Therefore, the present study aims to find the status of solar cells' research performance.

### **Literature review**

**Kolhe, Shankar Reddy (2005)**<sup>16</sup> analyzed the research output on information literacy retrieved from the Web of Science (WoS) during 2005 to 2014. A consecutive growth was observed from 2005 to 2014 in terms of publishing output on IL. The articles published in 2005 have got the maximum number of citations. Literature published on IL was classified under 35 subject

categories recognized by ISI. Most of the 751 articles (49.9 %) were published in the field of Library and Information Science. In all 1,502 article were contributed by 2,694 author. Pinto, M from University of Granada, Spain with 23 article ranked as the most prolific author. Among the most productive institutions in the world, the prominent four were from USA, and two were from Australia. In spite of this, University of Granada, Spain contributed (28) most articles on IL. The Journal of Academic Librarianship was the most prominent (97) journal to publish a variety of articles on IL. Most cited top ten articles had 60 or more citations.

**Bhardwaj, Raj Kumar (2017)**<sup>17</sup> evaluated the literature on information literacy in social sciences and humanities retrieved from the SCOPUS database during 2001-2012. In all, 1990 documents from 79 countries were selected for the study. There was great hike in publication output during 2007-2012 as 1512 paper (76 %) were contributed in this period. There were 160 journal that published literature on IL in Humanities and Social Sciences. The 19 most productive journals produced 915 papers (46 %) and got 5369 (53.6 %) citations. Reference Service Review (124, 6.2 %), Journal of Academic Librarianship (76, 3.8 %) and College and Research Libraries (70, 3.5 %) were identified as the most productive journals. English and Spanish languages constituted 96.7 percent of overall published literature. The developed countries like USA (1035, 52 %), UK (154, 7.7), Canada (102, 5.0 %) were ahead in publishing research on IL. The top 15 countries unanimously produced 84.8 per cent literature.

**Nazim, Mohd. & Ahmad, Moin (2007)**<sup>18</sup> studied 607 articles from 158 journal retrieved from LISA Plus by making a search on 'information literacy'. The results revealed that beginning of 21st century saw an increase on publication on information literacy. By applying Bradford's law of scattering, it was found that 'Reference Service Review' and 'College and Research Libraries' were found to be leading journals in terms of publication on information literacy. Single authors produced 63.15 % articles. Single authorship dominated the authorship pattern. Radar, H. B (15) was found to be the most prolific author followed by Breivik, P. and Grassian, E producing 6 articles each. The literature on information literature was found in 18 language. However, maximum 536 Document (88.30 %) were published in English language. In all 32 countries which produced literature on information literacy, USA (311) stood first. Following USA were UK (75) and Germany (51).

**Singh, Punit Kumar and Singh Ajay (00)**<sup>19</sup> carried out co-occurrence network analysis of the publication on information literacy based on the 27 subject areas given in the Scopus. In all search string brought 3859 records, nonetheless 3853 suitable records were used for analysis of this study. Most publications were seen in the field of Social Sciences (2917). Next to it were Computer Science (1042) and Arts and Humanities (299). Remaining 1115 publications were shared by other 23 subject categories. Social Sciences, Computer Science and Engineering have an uppermost tendency of centralities which was called as leader in the network. Most of these subjects were also found on the central position of network. The utmost co-occurrence was seen with Social Sciences as the most leading subject areas.

**Aharony, Noa (000)**<sup>20</sup> revived the publications on IL in Web of Science by using the technique of bibliometric and content analysis. The study revealed that the largest part of publication i.e. 106 (54.06 %) came from USA, followed by England (200; 10.15 %) and Australia (125; 6.34

%). Majority of documents 96.29 per cent were published in English language. A maximum articles (31.82 %) in overall research output were concerned with IL in Library and Information Science. In dataset considered for the study, most of the source titles (4.16 %) were from the Journal of Academic Librarianship. The main themes in information literacy were miscellaneous (largest category), medicine and education. Even though above studies are related to the present one, it differs in respect of time duration and to some extent treatment.

**Ravichandran and Vivekanandhan (2021)**<sup>21</sup> examine the Scientometric analysis of wastewater management research publications during 2010-2019 from the Scopus database. The study identified that a maximum of 2842(14.31%) research publications with 19857 citations are contributed in the year 2019. Ngo, H.H contributed a maximum of 101(0.51%) research publications, maximum of 19355 articles were contributed by joint authors and the average degree of collaboration was 0.97. Maximum of 2102(10.58%) research publications are contributed in Bioresource technology, ministry of education, china with 863(22.32%) research publication and China has contributed maximum of 5919(29.80%) research publications.

**Adesina and Opesade (2018)**<sup>22</sup> have analyzed sickle cell anemia research publications on Nigeria from the pubmed database during 2006-2016 with 326 publications. Most prolific publications are contributed by the Nigerian Journal of Clinical Practice with 15(5.8%) articles. University of Nigeria teaching Hospital had contributed the highest number of (132) 10% publications. Average degree of collaboration was 0.93 and the majority of authors had contributed from Nigeria.

**Alagu and Thanuskodi (2019)**<sup>23</sup> examined the digital literacy publications indexed in web the of science database between 1992 and 2011 with 512 publications. The highest number of 126 research publications has been published in the year 2011. The most productive country is the USA with 169 articles, most of the 429 publications articles and the average degree of collaboration was 0.602.

**Ravichandran and Vivekanandhan (2021)**<sup>24</sup> analyzed the wireless sensor network research output in India during 2010-2019 from the Scopus database with 11775. This study identified that, the maximum number of 2058(17.48%) publications are contributed in the year 2019 and the compound annual growth rate was 5.44. This study identified that the relative growth rate was decreasing trend and doubling time was increasing trend. The average degree of collaboration was 0.96 and CAI was decreasing trend for more than three authors from 1<sup>st</sup> block year (106.71) to 2<sup>nd</sup> block year (97.39).

## **Objectives**

- To measure the global year-wise research output on information literacy
- To find out the most preferred journals used for the publications
- To find out the most prolific authors and subjects in IL research
- To analyze RGR and authorship pattern of research output
- To study the degree of collaboration and the type of documents
- To ascertain the country-wise distribution of research output
- To identify the most prolific institutions contributing to promoting IL research.

## Methodology

The data have been collected from the Scopus database, the study period was from (2000-2019). In the search string was used, “Information Literacy ” in the Title search box, the field was used, and the period field was selected from 2000 to 2019. A total of 7463 records were retrieved from the Scopus database. (TITLE-ABS-KEY ("Information Literacy") AND PUBYEAR > 1999 AND PUBYEAR < 2020). The data downloaded MS excel sheet and the data was collected on 29.10.2020.

## DATA ANALYSIS AND ELUCIDATION

### Global Research Output on Information Literacy

**Table 1 Global Research Output on Information Literacy**

S.No	Year	Publications	%	Total Citations	%	CPP	h-index
1	2000	58	0.78	765	1.20	13.19	10
2	2001	80	1.07	1532	2.40	19.15	14
3	2002	116	1.55	2461	3.86	21.22	18
4	2003	127	1.70	3453	5.42	27.19	23
5	2004	152	2.04	3895	6.11	25.63	27
6	2005	212	2.84	4668	7.32	22.02	26
7	2006	223	2.99	3776	5.92	16.93	25
8	2007	261	3.50	4539	7.12	17.39	32
9	2008	290	3.89	6248	9.80	21.54	36
10	2009	346	4.64	4603	7.22	13.30	35
11	2010	397	5.32	3790	5.95	9.55	31
12	2011	451	6.04	3207	5.03	7.11	28
13	2012	444	5.95	4030	6.32	9.08	32
14	2013	576	7.72	3407	5.35	5.91	30
15	2014	575	7.70	3189	5.00	5.55	29
16	2015	610	8.17	2532	3.97	4.15	25
17	2016	656	8.79	2355	3.69	3.59	26
18	2017	597	8.00	1925	3.02	3.22	27
19	2018	639	8.56	1742	2.73	2.73	20
20	2019	653	8.75	1618	2.54	2.48	19
	Total	7463	100.00	63735	100.00		

Table1 shows that year-wise distribution of research publications for information literacy research during the study period of 2000-2019. From this study, it is identified that a maximum of 656(8.79%) research publications are contributed the year 2016, followed by publications of 653(8.75%) research publications, third place is 639(8.56%) research publications. the 212 document published in 2005 were citations for a maximum (4668) times followed by 4603 and 4539 documents in 2009 and 2007 respectively. H-index was also high (36) for 2008 and 2009 (35). The average rate of citation per paper was 12.55%.

### Journals Used for the Publication

S. No	Journals Titles	Publications	%	citations	%	h-index	Cites core 2017	SJR2017	SINP2017
1	Communications In Computer And Information Science	383	15.01	639	2.74	9	0.7	0.17	0.367
2	Reference Services Review	320	12.54	3729	15.97	29	1.6	0.697	1.286
3	Journal Of Academic Librarianship	205	8.04	4156	17.80	35	3.8	1.224	1.677
4	Communications In Information Literacy	162	6.35	1160	4.97	16	2.3	1.657	1.687
5	College And Undergraduate Libraries	149	5.84	958	4.10	15	0.9	0.489	0.533
6	Library Philosophy And Practice	130	5.10	360	1.54	10	0.4	0.24	0.623
7	Journal Of Information Literacy	111	4.35	420	1.80	10	1.7	0.495	1.245
8	Portal	108	4.23	1801	7.71	22	2.5	1.182	1.975
9	ASEE Annual Conference And Exposition Conference Proceedings	96	3.76	255	1.09	8	-	-	-
10	Evidence Based Library And Information Practice	95	3.72	297	1.27	8	0.7	0.364	0.327
11	College And Research Libraries	92	3.61	2256	9.66	28	3.5	1.776	2.095
12	Journal Of Library Administration	92	3.61	1162	4.98	18	1.5	0.701	1.097
13	Journal Of Library And Information Services In Distance Learning	91	3.57	503	2.15	13	1.1	0.576	0.91
14	Journal Of Documentation	80	3.14	2314	9.91	25	2.5	0.89	1.515
15	Library Review	80	3.14	712	3.05	14	-	-	-
16	College And Research Libraries News	78	3.06	322	1.38	10	0.8	0.426	0.665
17	Journal Of Librarianship And Information Science	73	2.86	1162	4.98	18	2.6	0.711	1.674
18	International Information And Library Review	69	2.70	225	0.96	8	0.9	0.262	0.782
19	Public Services Quarterly	69	2.70	324	1.39	9	0.6	0.296	0.322
20	Health Information And Libraries Journal	68	2.67	597	2.56	14	2.6	0.521	0.906
		2551	100.00	23352	100.00				



**Table 2 Journals Used for the Publication**

Table 2 throws light on the most common source titles used by the authors interested in publishing on Information Literacy research. The list consisted of 20 journal titles and one conference proceeding. The top twenty most productive titles published 2551(100%) papers which have been citations 639 (2.74 %) times. The remaining source titles published 2455 (96.24 %) documents. Communication in Computer and Information Science published 383 (15.01 %) papers which is the highest figure in terms of research output and received 639(2.74 %) Citations. It is followed by Reference Service Review (320(12.54 %), and received citations 3729(15.975), Journal of Academic Librarianship 205(8.04%), and Communications in Information Literacy 162(6.35%). However, in terms of citations received Journal of Academic Librarianship 4156(17.80 %) and Reference Services Review 3729(15.97%) stood at the first and second position respectively. Communications in Computer and Information Science through published the highest papers; it did not seem to be preferred over other popular journals given in the list of quoting viewpoints. The H-index is highest (35) for the Journal Of Academic Librarianship,(29) for Reference Services Review, (28) for College And Research Libraries, and (25) Journal Of Documentation. A very low H-index (8) is three journals calculated for ASEE Annual Conference and Exposition Conference Proceedings, Evidence Based Library and Information Practice, and International Information and Library Review.

The highest Cites core value (3.8) as per Scopus has been observed for the Journal of Academic Librarianship. It was examined that College and Research Libraries (1.78) and Communication in Information Literacy (1.66) each had the highest SJR value. Contrarily, Communication in Computer and Information Science had the lowest (0.17) SJR value. College And Research Libraries for uppermost (2.095) SNIP value as against Public Services Quarterly which had the lowest (0.322) SNIP value.

**Prolific Authors in Information Literacy Research**

**Table 3 Prolific Authors in Information Literacy Research**

S. No	Author	Country	Publications	%	Citations	%	ACPP	h-index
1	Pinto, M.	Purdue University	51	10.83	565	8.12	11.08	14
2	Lloyd, A.	Queensland University of Technology	36	7.64	1355	19.48	37.64	19
3	Julien, H.	City University of New York	33	7.01	745	10.71	22.58	16
4	Bruce, C.	Universidad de Granada	31	6.58	540	7.76	17.42	15
5	Fosmire, M.	Purdue University Libraries and School of Information Studies	25	5.31	199	2.86	7.96	7
6	Majid, S.	Nanyang Technological University	24	5.10	407	5.85	16.96	10
7	Virkus, S.	University of Zagreb	23	4.88	176	2.53	7.65	4
8	Badke, W.	The University of Sheffield	21	4.46	163	2.34	7.76	8
9	Foo, S.	University of Illinois at Urbana-Champaign	21	4.46	383	5.51	18.24	9

10	Johnson, A.M.	Wee Kim Wee School of Communication and Information	21	4.46	137	1.97	6.52	8
11	Koltay, T.	University of Alberta	21	4.46	309	4.44	14.71	8
12	Chen, L.C.	San Jose State University	20	4.25	62	0.89	3.10	5
13	Partridge, H.	University of Colorado Boulder	20	4.25	170	2.44	8.50	7
14	Špiranec, S.	Charles Sturt University, Wagga Wagga	20	4.25	136	1.96	6.80	6
15	Maybee, C.	The Ohio State University	19	4.03	237	3.41	12.47	8
16	Sales, D.	University at Albany	18	3.82	163	2.34	9.06	8
17	Walton, G.	Université McGill	18	3.82	163	2.34	9.06	5
18	Webber, S.	The University of Arizona	17	3.61	652	9.37	38.35	9
19	Fourie, I.	University of Louisville	16	3.40	133	1.91	8.31	6
20	Hepworth, M.	University of Strathclyde	16	3.40	260	3.74	16.25	9
		Total	471	100.00	6955	100.00	Avg	9.05

Table 3 denotes most top 20 prolific authors who have published their research on Information Literacy. The top twenty authors contributed 471 documents (100 %) and received 6955 (100 %) citations. Pinto, M from Purdue University was found to be the most 51(10.83%) productive author. In this respect, the result is consistent with the studies conducted by Shankar Reddy Kolhe16 (2017) and Bhardwaj Raj Kumar17 (2017). Lloyd A 36(7.645), Julien H 33(7.07%), Bruce C 31(6.58%), Formire M 25(5.31%), Majid S 24(5.10%) and Virkus S 23(4.88%) took the consecutive position in the list. Lloyd A received maximum 1355 (19.48%) citations and his average citations per paper (37.64 %) were found to be high above every author. H-index (19) was calculated for the top twenty leading authors. It gauges the number of citations of researcher’s paper11. Again Lloyd A was observed as having highest (19) h-index. Among other authors Julien H (16), Bruce C (15), Pinto M (14) and Majid, S. (10) possessed the h-index above the group average of 9.05

### Subject-Wise Distribution of Research Output

**Table 4 Subject-Wise Distribution of Research Output**

S.No	Subject	Publications	%	Citations	%	ACPP	h-index
1	Agricultural and Biological Sciences	45	0.93	386	1.19	8.58	10
2	Arts and Humanities	533	10.99	2322	7.18	4.36	22
3	Biochemistry, Genetics and Molecular Biology	71	1.46	636	1.97	8.96	15
4	Business, Management and Accounting	218	4.50	1129	3.49	5.18	17
5	Chemical Engineering	23	0.47	49	0.15	2.13	3
6	Chemistry	59	1.22	504	1.56	8.54	15
7	Computer Science	1958	40.39	15247	47.14	7.79	52



8	Decision Sciences	80	1.65	291	0.90	3.64	8
9	Dentistry	14	0.29	348	1.08	24.86	9
10	Earth and Planetary Sciences	20	0.41	66	0.20	3.30	5
11	Economics, Econometrics and Finance	46	0.95	64	0.20	1.39	5
12	Energy	14	0.29	42	0.13	3.00	2
13	Engineering	441	9.10	1368	4.23	3.10	17
14	Environmental Science	23	0.47	86	0.27	3.74	5
15	Health Professions	153	3.16	1072	3.31	7.01	16
16	Immunology and Microbiology	11	0.23	96	0.30	8.73	4
17	Materials Science	22	0.45	23	0.07	1.05	3
18	Mathematics	459	9.47	780	2.41	1.70	10
19	Medicine	621	12.81	7322	22.64	11.79	39
20	Multidisciplinary	37	0.76	511	1.58	13.81	9
		4848	100.00	32342	100.00		

Subject-wise distribution of research output is important in this study as it gives an idea as to how a particular subject discipline is influenced by IL research. But the subject category provided in the Scopus is different as a single document may fall under various subject categories 20. So the total documents under all the subject disciplines exceed the actual number of a document considered for the study during the period. The same thing can be observed in respect of citations. There is no surprise that the 1958 records are found in Computer Science with 15247 citation. Even h-index is also high (52) for this subject discipline. Next to it is Medicine which has 621 paper with 7322 citations and h-index of 39. It is followed by (553) Arts and Humanities, (459) Mathematics, (441) Engineering, (218) Business Management and Accounting (153) Health Profession, The remaining details can be viewed through table.

### RGR and doubling time

The rate of growth has been calculated as the most important feature of science and technology in recent years. Scientific progress has necessitated an increase in both manpower and financial investment. The increase in the number of publications per unit of time indicates the relative growth rate. **Mahapatra (1985)**<sup>25</sup> developed the following formula to calculate the mean relative growth rate over the specific period of the interval.

$$R(a) = \frac{(W_2 - W_1)}{(T_2 - T_1)}$$

Where,

R (a) = RGR = the mean relative growth rate over the specific period of interval

W<sub>1</sub> = the logarithm of the beginning number of publications/pages

W<sub>2</sub> = the logarithm of the ending number of publications/pages after a specific period of interval

T<sub>2</sub> – T<sub>1</sub> = the unit difference between the beginning time and the ending time.

The doubling time is the time required to double the number of records actually published in a given period. The doubling time is calculated from the relative growth rate and the natural

logarithm number is used, the difference has a value of 0.693. The following formula can be used to calculate the corresponding doubling time:

$$Dt = \frac{0.693}{R(a)}$$

**RGR and doubling time of Information Literacy research**

**Table 5 RGR and doubling time of Information Literacy research**

Year	Publications	Cum	W1	W2	RT(p)	Mean RP(p)	Dt(p)	Mean Dt(p)
2000	58	58		4.06				
2001	80	138	4.06	4.93	0.87		0.80	
2002	116	254	4.93	5.54	0.61		1.14	
2003	127	381	5.54	5.94	0.41		1.71	
2004	152	533	5.94	6.28	0.34		2.06	
2005	212	745	6.28	6.61	0.33	0.366	2.07	2.357
2006	223	968	6.61	6.88	0.26		2.65	
2007	261	1229	6.88	7.11	0.24		2.90	
2008	290	1519	7.11	7.33	0.21		3.27	
2009	346	1865	7.33	7.53	0.21		3.38	
2010	397	2262	7.53	7.72	0.19		3.59	
2011	451	2713	7.72	7.91	0.18		3.81	
2012	444	3157	7.91	8.06	0.15		4.57	
2013	576	3733	8.06	8.22	0.17		4.14	
2014	575	4308	8.22	8.37	0.14		4.84	
2015	610	4918	8.37	8.50	0.13	0.119	5.23	4.954
2016	656	5574	8.50	8.63	0.13		5.53	
2017	597	6171	8.63	8.73	0.10		6.81	
2018	639	6810	8.73	8.83	0.10		7.03	
2019	653	7463	8.83	8.92	0.09		7.57	
Total	7463	54799	137.17	146.08	4.86		73.10	

It can be seen in table 5 that the value of the average relative growth rate of publications [R(a)] decreased and increased gradually from 0.09 to 0.87 from 2000 to 2019 and again increased to 4.954 in 2020 the corresponding mean doubling time [Dt(a)] for the period increased from 0.80 to 7.57.

**Authorship pattern Information Literacy research**

**Table 6 Authorship pattern Information Literacy research**

Authorship pattern											
Year	1	2	3	4	5	6	7	8	9	>9	Total
2000	34	8	9	4	2	0	0	1	0	0	58
2001	48	15	10	5	0	2	0	0	0	0	80
2002	63	36	11	4	0	1	1	0	0	0	116
2003	75	34	12	4	1	0	0	0	0	0	127
2004	79	46	22	4	1	0	0	0	0	0	152
2005	97	65	33	7	4	3	0	1	1	1	212
2006	106	76	24	8	6	2	1	0	0	0	223
2007	116	91	38	8	5	2	1	0	0	0	261
2008	136	95	42	9	2	3	0	2	1	0	290
2009	158	113	49	16	3	4	1	1	1	0	346
2010	168	143	50	22	5	6	0	1	0	2	397
2011	178	145	71	29	15	6	3	1	2	1	451
2012	170	126	76	37	16	7	8	2	0	2	444
2013	247	166	89	38	17	14	4	1	0	0	576
2014	226	173	91	47	14	7	7	2	2	4	575
2015	224	189	92	47	28	11	11	2	1	6	610
2016	236	200	105	51	29	14	10	5	4	2	656
2017	198	173	126	60	12	9	9	4	3	3	597
2018	213	165	149	61	22	11	12	2	4	4	639
2019	203	204	129	59	25	20	6	3	3	1	653
Total	2975	2263	1224	521	207	122	75	28	22	26	7463

Year-wise author ship patterns are identified in the field of Information Literacy during the twenty-year study period from table 6. From the study, it is identified from table 6, out of 7463 research publications, 2975 research publications are contributed by single authors and the remaining 4488 research publications are multi-author contributions. During the twenty-year study period, the authorship pattern study identified that a maximum of 2263 contributions are two authors, followed by 1224 contributions contributed by three authors, and 521 publications were contributed by four authors.

**Degree of collaboration**

The degree of collaboration is the relationship between single-author and multi-author contributions. The degree of collaboration is calculated by the Subramanian (1983)<sup>26</sup> formula, used by), Vivekanandhan (2016)<sup>27</sup> Sivasamy (2020).<sup>28</sup> Ravichandran (2020)<sup>29</sup>

$$DC = \frac{Nm}{(Nm + Ns)}$$

Where DC = Degree of Collaboration

$N_m$  = Number of Multi- authored publications

$N_s$  = Number of single-authored publications

In the present study,  $N_m = 4488$ ,  $N_s = 2975$

So that the degree of collaboration is  $=4488 / (2975 + 4488) = 0.60$

**Degree of collaboration Information Literacy research**

**Table 7 Degree of collaboration Information Literacy research**

Year	Single author publications	Multi-author publications	Total author publications	Degree of collaboration DC= $N_m / (N_m + N_s)$
2000	34	24	58	0.41
2001	48	32	80	0.40
2002	63	53	116	0.46
2003	75	52	127	0.41
2004	79	73	152	0.48
2005	97	115	212	0.54
2006	106	117	223	0.52
2007	116	145	261	0.56
2008	136	154	290	0.53
2009	158	188	346	0.54
2010	168	229	397	0.58
2011	178	273	451	0.61
2012	170	274	444	0.62
2013	247	329	576	0.57
2014	226	349	575	0.61
2015	224	386	610	0.63
2016	236	420	656	0.64
2017	198	399	597	0.67
2018	213	426	639	0.67
2019	203	450	653	0.69
Total	2975	4488	7463	0.60

Table 7 shows the degree of collaboration in Information Literacy for the ten-year studies period. From this study, it is identified that the degree of collaboration is between 0.41 in the year 2000 and 0.69 in the year 2019. The average degree of collaboration is 0.60. From this study, it is identified that the majority of Information Literacy research publications are contributed by collaborative authors.

### **Collaborative Coefficient (CC)**

The pattern of co-authorship collaboration among the authors can be measured with the following formula suggested by Ajiferuke, et al. (1988)<sup>30</sup>

$$CC = 1 - \left[ \sum_{j=0}^k \left( \frac{1}{j} \right) \times F_j / N \right]$$

Whereas,

F<sub>j</sub> = Number of publications with j author papers

N = Total number of research publications and

k = the greatest number of authors/papers in the given field.

### **Collaboration Index (CI)**

The simple indicator is presently employed in the publications to the collaboration index, which is to be understood nearly as the mean number of authors per paper are suggested by Ajiferuke, et al.(1988)<sup>30</sup>

$$CI = \frac{\sum_{j=1}^k jf_j}{N}$$

Here

J - The number of co-authored papers appearing in a discipline

N - The total number of publications in the field over the same time period of interval and

k - The highest number of authors per paper in the same-time field.

### **Modified Collaboration Coefficient**

The modified collaboration coefficient (MCC) counted by the formula which is suggested by Savanur and Srikanth, (2010)<sup>31</sup>

Which is given below:

Where,

$$MCC = \frac{N}{N - 1} \left[ 1 - \frac{\sum_{j=1}^k jf_j}{N} \right]$$

j = the number authors in an article i.e. 1, 2, 3.....

F<sub>j</sub> = the number of j-authored articles

N = the total number of articles published in a year, and

A = the total number of authors per article

**Collaborative Index, Collaborative Co-efficient Modified Collaboration Coefficient**

**Information Literacy Research Publications**

**Table 8 Collaborative Index, Collaborative Coefficient Modified Collaboration Coefficient Information Literacy research Publications**

Year	Authorship pattern										CC	CI	MCC	Total
	1	2	3	4	5	6	7	8	9	>9				
2000	34	8	9	4	2	0	0	1	0	0	0.27	1.91	1.95	58
2001	48	15	10	5	0	2	0	0	0	0	0.24	1.75	1.77	80
2002	63	36	11	4	0	1	1	0	0	0	0.26	1.70	1.71	116
2003	75	34	12	4	1	0	0	0	0	0	0.23	1.57	1.59	127
2004	79	46	22	4	1	0	0	0	0	0	0.27	1.70	1.71	152
2005	97	65	33	7	4	3	0	1	1	1	0.32	1.98	1.99	212
2006	106	76	24	8	6	2	1	0	0	0	0.30	1.84	1.85	223
2007	116	91	38	8	5	2	1	0	0	0	0.32	1.87	1.88	261
2008	136	95	42	9	2	3	0	2	1	0	0.31	1.87	1.87	290
2009	158	113	49	16	3	4	1	1	1	0	0.32	1.90	1.91	346
2010	168	143	50	22	5	6	0	1	0	2	0.34	1.97	1.97	397
2011	178	145	71	29	15	6	3	1	2	1	0.37	2.14	2.14	451
2012	170	126	76	37	16	7	8	2	0	2	0.38	2.28	2.28	444
2013	247	166	89	38	17	14	4	1	0	0	0.35	2.09	2.09	576
2014	226	173	91	47	14	7	7	2	2	4	0.37	2.21	2.21	575
2015	224	189	92	47	28	11	11	2	1	6	0.39	2.35	2.35	610
2016	236	200	105	51	29	14	10	5	4	2	0.40	2.36	2.37	656
2017	198	173	126	60	12	9	9	4	3	3	0.42	2.39	2.40	597
2018	213	165	149	61	22	11	12	2	4	4	0.42	2.48	2.49	639
2019	203	204	129	59	25	20	6	3	3	1	0.43	2.42	2.43	653
<b>Total</b>	<b>2975</b>	<b>2263</b>	<b>1224</b>	<b>521</b>	<b>207</b>	<b>122</b>	<b>75</b>	<b>28</b>	<b>22</b>	<b>26</b>	<b>6.71</b>	<b>40.78</b>	<b>40.95</b>	<b>7463</b>

It is observed in table 8, the collaborative coefficient is calculated and presented during the ten-year study period from 2000 to 2019. For Disaster management research publications, it is observed from table 8 highest collaboration coefficient is 0.43 in 2019 of year and the lowest CC is 0.23 in the year 2003, average CC is 0.33. The collaboration index observed in table 7 maximum collaboration Index is 2.48 in the year 2018, a minimum of 1.70 in the year 2012, and 2014, and an average CI is 2.04. The Modified collaboration coefficient observed in table 7 maximum of modified collaboration coefficient is 2.49 in the year 2018, a minimum of 1.71 in the year 2012, and 2014, and the average MCC is 2.05.



**Distribution by Type of Document Information Literacy research**

**Table 9 Distribution by Type of Document Information Literacy research**

S.No	Document Type	Publications	Pub %
1	Article	5125	68.67
2	Conference Paper	1079	14.46
3	Review	505	6.77
4	Book Chapter	429	5.75
5	Book	79	1.06
6	Note	74	0.99
7	Editorial	73	0.98
8	Conference Review	54	0.72
9	Short Survey	19	0.25
10	Letter	18	0.24
11	Erratum	5	0.07
12	Retracted	2	0.03
13	Undefined	1	0.01
		7463	100.00

Scopus has given 7 types of documents. There is a number of ways to make scientific communication possible. One may write a scholarly article or may contribute in the form of a book chapter. In spite of these views being expressed in a number of forms, they keep on updating the academic communities in relation to their subject’s fields. No doubt, the Article is the most favored source. In the present study, 5125 (68.67 %) documents have been seen in the form of Articles followed by 1079 (14.46 %) conference papers, 505 (6.77 %) reviews, 429 (5.75 %) book chapters, 79 (1.06 %) books, 74 (0.99 %) Note, 73 (0.98 %) Editorial, 54 (0.72 %) conference reviews. The remaining document types have been mentioned under ‘other’ wherein twenty-two articles were about to publish. 19(0.25) short surveys and 18(0.24%) Letters had been carried out, and erratum, and retracted documents though we’re not in large quantity, were evident as source types.

**Distribution of Research Output by Country Information Literacy research**

**Table 10 Distribution of Research Output by Country Information Literacy research**

S.No	Country	Publications	%	Citations	%	CPP	ICP	%	h-index
1	United States	3418	53.31	34505	57.08	10.10	252	22.76	66
2	United Kingdom	533	8.31	6767	11.20	12.70	145	13.10	36
3	Australia	369	5.76	4842	8.01	13.12	80	7.23	35
4	Canada	333	5.19	3295	5.45	9.89	60	5.42	30

5	China	223	3.48	372	0.62	1.67	38	3.43	9
6	Spain	222	3.46	1438	2.38	6.48	92	8.31	19
7	Germany	139	2.17	946	1.57	6.81	59	5.33	15
8	Taiwan	123	1.92	787	1.30	6.40	17	1.54	15
9	Brazil	116	1.81	261	0.43	2.25	33	2.98	9
10	Nigeria	111	1.73	400	0.66	3.60	23	2.08	12
11	South Africa	100	1.56	933	1.54	9.33	46	4.16	15
12	India	99	1.54	556	0.92	5.62	18	1.63	8
13	Croatia	93	1.45	265	0.44	2.85	40	3.61	8
14	Japan	89	1.39	203	0.34	2.28	20	1.81	8
15	Finland	85	1.33	865	1.43	10.18	44	3.97	13
16	Sweden	85	1.33	739	1.22	8.69	38	3.43	14
17	New Zealand	69	1.08	890	1.47	12.90	15	1.36	16
18	Singapore	69	1.08	936	1.55	13.57	23	2.08	15
19	Turkey	68	1.06	561	0.93	8.25	33	2.98	11
20	Hong Kong	67	1.05	884	1.46	13.19	31	2.80	14
		6411	100.00	60445	100.00		1107	100.00	

Table 10 country-wise research output along with total citations. Citation per paper, international collaborative papers, and h-index. The results revealed that most of the papers 3418 (53.31%) resulted from the USA which received 34505 citations. The citation share was near about 57.08 percent of the overall citation share. Citation per paper was seen high (13.57%) for Singapore, followed by Hong Kong (13.19) %. Next place to occupy the list was New Zealand, United Kingdom, Finland, United States, Canada, and South Africa was all over again seen at the top in case the of international collaborative papers (252), followed by the United Kingdom (145), Spain (92), Australia (80), Canada (60) and Germany (59). It was quite natural to have the USA a higher (66) h-index with the United Kingdom (36) and Australia (35) following it.

**Institutional Output Information Literacy research**

**Table 11 Institutional Output Information Literacy research**

S.No	Institutions	Country	Publications	%	Citations	%	CPP	h-index
1	Purdue University	United States	92	9.46	569	4.53	6.18	13
2	Queensland University of Technology	United Kingdom	73	7.50	1066	8.50	14.60	20
3	City University of New York	Australia	71	7.30	884	7.04	12.45	14
4	Universidad de Granada	Canada	69	7.09	643	5.12	9.32	15
5	Purdue University Libraries and School of Information Studies	China	60	6.17	434	3.46	7.23	11
6	Nanyang Technological	Spain	58	5.96	874	6.97	15.07	14

	University							
7	University of Zagreb	Germany	51	5.24	219	1.75	4.29	8
8	The University of Sheffield	Taiwan	48	4.93	1126	8.97	23.46	16
9	University of Illinois at Urbana-Champaign	Brazil	46	4.73	462	3.68	10.04	11
10	Wee Kim Wee School of Communication and Information	Nigeria	43	4.42	762	6.07	17.72	13
11	University of Alberta	South Africa	40	4.11	796	6.34	19.90	17
12	San Jose State University	India	39	4.01	442	3.52	11.33	14
13	University of Colorado Boulder	Croatia	38	3.91	329	2.62	8.66	11
14	Charles Sturt University, Wagga	Japan	37	3.80	1133	9.03	30.62	17
15	The Ohio State University	Finland	36	3.70	501	3.99	13.92	15
16	University at Albany	Sweden	36	3.70	501	3.99	13.92	12
17	Université McGill	New Zealand	35	3.60	329	2.62	9.40	10
18	The University of Arizona	Singapore	35	3.60	387	3.08	11.06	13
19	University of Louisville	Turkey	33	3.39	300	2.39	9.09	9
20	University of Strathclyde	Hong Kong	33	3.39	791	6.30	23.97	12
		total	973	100.00	12548	100.00		

Table 11 Institutions-wise research output along with total citations. Citation per paper, h-index. Purdue University in the United States has published a maximum of 92(9.46%) documents and received almost 569 citations. The Queensland University of Technology QUT from Australia has 73 (7.5%) papers to its credit. The total citation received by it is high at 1066 compared to other institutes along with a higher (20) h-index. The City University of New York from Australia though published 71(7.30) papers and at the third position, it has a higher 884 citations per paper and also has the second higher (17) h-index. Universidad de Granada, Purdue University Libraries, and School of Information Studies, 4th and 5th position consecutively.

**Most Popular Keywords Information Literacy research**

**Table 12 Most Popular Keywords Information Literacy research**

S.No	Keyword	Publications	%
1	Information Literacy	4195	34.83
2	Human	787	6.53
3	Students	755	6.27
4	Education	660	5.48
5	Humans	604	5.01
6	Information Science	506	4.20

7	Article	486	4.04
8	Teaching	484	4.02
9	Academic Libraries	463	3.84
10	Libraries	389	3.23
11	Library Instruction	359	2.98
12	Internet	311	2.58
13	Female	306	2.54
14	Higher Education	298	2.47
15	Male	274	2.27
16	Curricula	262	2.18
17	Adult	250	2.08
18	Assessment	250	2.08
19	Curriculum	203	1.69
20	Learning	202	1.68
		12044	100.00

Table12 throws light on the top 20 most popular keywords used in the documents considered for the study of global research output on IL. Overall, 12044 keywords were found. It was quite natural for “Information Literacy” to be occurring most 4195(34.835) times since it is the most significant keyword. “Human/s” is the second keyword that has been found 787(6.535) times. The third keyword “Students” has been observed 755(6.275) times. The word “Education” has appeared 660(5.48%) times. In point of fact, some keywords may be very significant i.e. critical thinking in that they denote their direct association with IL. Nevertheless, some keywords may not predict such kind of connection; but they provide the backdrop with which IL has conversed. The lowest keyword is 202(1.68%) Learning.

### **Finding and Conclusion**

- ❖ From this study, it is identified that a maximum of 656(8.79%) research publications are contributed in the year 2016 and citations of 2355(3.69%), with citations per paper of 3.59, H-index 26.
- ❖ Communication in Computer and Information Science published 383 (15.01 %) papers which is the highest research output and received 639(2.74 %) Citations. The cite core value of 0.7, SJR value of 0.17, SNIP value of 0.367 and H-index is 9.
- ❖ Pinto, M from Purdue University was found to be the most 51(10.83%) productive author, with citations 565(8.12%), citations per paper 11.08, H-index 14, and 1958 records are found in Computer Science with 15247 citations. Even the h-index is also high 52 for this subject discipline
- ❖ relative growth rate of publications [R(a)] decreased and increased gradually from 0.09 to 0.87 from 2000 to 2019 and again increased to 4.954 in 2020 the corresponding mean doubling time [Dt(a)] for the period increased from 0.80 to 7.57.

- ❖ Out of 7463 research publications, 2975 research publications are contributed by single authors, and the remaining 4488 research publications are multi-author contributions, and the average degree of collaboration is 0.60.
- ❖ Highest collaboration coefficient is 0.43 in 2019 of year and lowest CC is 0.23 in the year 2003, average CC is 0.33. The collaboration index observed a maximum of collaboration Index is 2.48 in the year 2018, a minimum of 1.70 in the year 2012, and 2014 and an average CI is 2.04. The Modified collaboration coefficient observed a maximum of modified collaboration coefficient is 2.49 in the year 2018, a minimum of 1.71 in the year 2012, and 2014, and an average MCC is 2.05.
- ❖ In the present study, 5125 (68.67 %) documents have been seen in the form of Articles, and the results revealed that most of the papers 3418 (53.31%) resulted from the USA which received 34505 citations.
- ❖ During Purdue University in the United States has published a maximum of 92(9.46%) documents and received almost 569 citations. Followed by a maximum of 92(9.46%) documents and received almost 569 citations. The Queensland University of Technology QUT from Australia has 73 (7.5%) papers to its credit.

## Conclusion

Though IL research is visible from 1975 in the present study, there has been exceptional growth from 2000 onwards. This is because its significance has been accepted by all. Becoming information literate has become an essential prerequisite in every sphere of human life. Higher education is not an exception to that. As an articulation of the meaning of IL as a theory and practice within librarianship and almost every subject discipline was a necessary concern<sup>15</sup>. The growth in IL research is evidence that the concern might have been well-spoken about. The study aptly provides a glance at major source titles, most prolific authors, country-wise contributions, and most prolific institutions that have been influential to promote IL research. Such kind of study is useful to take review and find out the current drift of IL research across the globe.

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