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A Bibliometric review on Information Seeking Behaviour research literature in Library and Information Science using HistCite and VOSviewer

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Abstract:

The study provides a bibliometric review of 920 research studies on Information Seeking Behaviour (ISB) in the discipline of Library and Information Science of last thirty years i.e., 1991-2020, published in 68 academic journals, authored by 1614 authors. We extracted the bibliographical data from the Web of Science database and analyzed using HistCite for citation counts and VOSviewer for bibliographic coupling and cartography analysis of network visualization. The main purpose of the study is to find out the most influential authors, articles, journals, institutions and countries of last thirty years. Furthermore, by applying bibliographic coupling and co-occurrence of keywords analysis, we have identified three vital research clusters in ISB: i) Models of Information Seeking Behaviour ii) Information Needs and iii) User Studies. We have conducted a systematic content analysis of research articles in all the three clusters and identified future research directions in Information seeking Behaviour.

Keywords: Information Seeking Behaviour, Histcite, VOSViewer, Web of Science (WoS), Bibliometric review

1. Introduction:

Information has become a vital commodity in our society. With the advent of Information Communication and Technology (ICT) the publication, sharing and exchange of information has grown in leaps and bounds. Thus, information is very important in our day to day activities; we required it for education, research, healthcare, employment, entertainment, problem solving and for lifelong learning. (Madden, 2000) Information is representation of Knowledge. It is also treated as fact, idea or data. Besides, Information is also the part of communication process and acts as a resource.

Information needs differ depending upon an individual's respective functions and tasks. Besides, it also rely upon their level of knowledge ,experience and certain areas of interest on a particular subject or specialized fields which motivates them to seek for information and satisfy their information needs (Kuruppu, 1999).

Information seeking is an activity or process of an individual that leads to removal of uncertainties or removal of ambiguity in the understanding or in the acquisition of information. In simple words, It is a conscious human effort towards understanding which involves activities of search, retrieval, recognize and application of meaningful content (Kingrey, 2005). On the other hand, Information behaviour is basically the different activities of an individual which is related to their own behaviour that may be engaged in identifying sources and channels of information, which includes active information seeking and use of information; like face to face interaction with someone and also passive information reception; like watching television advertisement without any intention to act on the information (Wilson, 2000). Thus, by using citation bibliometric analysis, bibliometric coupling, cartography analysis and content analysis of available research literature, this study finds the answers to the following research questions below:

Research Question 1: Find the yearly Growth of Information Seeking Behaviour Research studies in the Last thirty years?

Research Question 2: Which Channels (Journals, Institutions, Authors and countries) are the most influential in Information Seeking Behaviour research studies?

Research Question 3: How are Information Seeking Behaviour research articles clustered and what are future research directions?

2. Theoretical Background:

According to Wilson (1999) Information seeking behavior is deliberate seeking of information as a result of need to satisfy a goal or to remove uncertainty or to solve any problem. It is actually refers to the way an individual search for and utilize information (Poongodi, 2017). Information seeking behaviour can also be described as a situation in which a person deliberately needs information to solve problems related to their work or personal life. The main objective is to clear uncertainties and to achieve certain goals. During the process of information seeking the person may consult different information sources like books, magazines, journals, newspaper etc or even can have face to face interaction with certain people which would help them in solving their problem and finding out answers. Besides they may also consult information systems either manually or through human computer interaction.

Following are the important models of Information Seeking Behaviour:

The Wilson Model (1981): The Wilson Model suggest that Information seeking behaviour arises due the information need perceived by an individual to achieve certain objectives, Thus in order to satisfy that needs, the individual makes demands upon formal and informal information sources and services. These demands of information will ultimately lead to success or failure in finding the relevant information. The success will result in user satisfaction with their information need or partially satisfied. On the other hand failure will restart the process of seeking information again. In this whole process the model also highlights on the involvement of other people through information exchange and that information perceived as useful may be passed to other people.

Dervin's Sense Making Model (1992): Brenda Dervin developed this model and uses sense making approach to study Information seeking behaviour of an individual to discover the strategies, expectations, attitudes, and anxieties within their lives and work situations. Her model implemented four constituent elements – Situation, Gap, Outcome and Bridge. A situation defines an individual need for information. Gap identifies the difference between the contextual situation and the desired situation. The outcome is the result that the individual desired after information seeking process is completed then the bridge means closing the gap between situation and outcome throughout the process.

There are other models which describes the Information seeking behaviour of individuals in different ways. Kuhulthau's Model (1992) explains about the six stages of an individual during the process of seeking information; he stated these six stages as: Initiation, Selection, Exploration, Formulation, Collection and Presentation. Ellis et al (1993) and Ellis and Haugan (1997) proposed and elaborate behavioural model of information Searching strategies and identified six major categories to cover the characteristics of the information seeking patterns of social scientists, namely; Starting, Chaining, Browsing, Differentiating, Monitoring, and Extracting.

Bonitz (1982) define Bibliometrics as a sub-field of library and Information Science, which includes complex mathematical and statistical methods used for analysis of different published academic studies. Bibliometrics is mostly used for the measurement of scientific literature like articles, books, conference proceedings, websites, monographs etc. It helps to identify how much influence or impact a selected research articles has on future research.

Bibliometrics also deals with quantitative and qualitative evaluation of authors, publications and institutions which includes several descriptive statistics of citation data, network analysis of authors, journals, Universities, countries and keywords based on citations of frequency and search techniques. It also helps in identifying research clusters and provides in depth overview of current research interests and shows latest research trends in a field.

In this study we have used both HistCite and VOSviewer software to conduct bibliographic analysis that evaluates networking among highly cited articles. HistCite and VOSviewer has been widely use in various studies, it helps to highlight the most cited articles and provides sketch visualization graphs of citations (Thelwal, 2008; Garfield, 2009). HistCite software is very useful to demonstrate and analyze the citations in articles retrieved from Web of Science (WOS). The study also investigates which journals, articles and countries have more research output on Information Seeking Behaviour studies. Besides, the Genealogic antecedents of a research field can be discovered through citation behaviour as more commonly cited publications are highlighted by co-citation analysis (Fetscherin et al., 2010). Moreover, VOSviewer is also used for Bibliographic coupling and cartographic analysis from the data retrieved from WOS. As a result it will help in identifying frequently occurring keywords in Information Seeking Behaviour studies.

3. Methodology:

The main purpose of the study is to conduct bibliometric analysis on Information Seeking Behaviour (ISB) research literature. The collection of bibliography data for this study has been collected from most renowned academic database – ISI Web of Science (WoS). Thus, to collect relevant

bibliography data, we applied keyword search in WOS database on the month of August, 2021. We have collected the data from WoS (Web of Science) database which is a top-quality database, tracking top basic-science, social science, and arts and humanities journals. It assesses more than 22,000 journals and 50 million publications in 70 languages and 151 research categories. For its comprehensiveness and top-tier quality, WoS was preferred over other research engines, such as Google Scholar, SCOPUS or SciELO.

HistCite and VOSviewer were searched for in the WoS core collection database (August 2021). It was found that no research has been done till now in the field of Bibliometric analysis in Information Seeking Behaviour using Histcite and VOSviewer.

The table below shows detailed keyword search process using Boolean Operations.

STEP	KEY WORD SEARCH	RESULT
1	('Information Seeking Behavior' AND 'Information Retrieval')	502
2	('Information Seeking Behavior' AND 'Information Searching')	880
3	('Information Seeking Behavior' AND 'Information Needs')	977
4	(('Information Searching' OR 'Information Retrieval' OR 'Information Needs') AND 'Information Seeking Behaviour'))	1,594

Table I: Search techniques applied to retrieve data from WoS database

Refined by:

Languages: English
Research Areas: Information science library science
Document types: Article
Web of Science Categories: Information science library science
Time span: 1991-2020.
Indexes: SCI-EXPANDED, SSCI, A&HCI
Manually going through all the titles and screened **920** articles for data analysis purpose

A total of 920 research articles on Information Seeking Behaviour were extracted from the WoS database and saved into a text document containing authors' names, articles' titles, journal names, document types, abstracts, and reference lists. This information is valuable for bibliometric analysis. Then, the file was imported into HistCite, and most influential authors, journals, institutions and countries were extracted. Citation mapping related to Information Seeking Behaviour was also performed, and the product was output in tabular form (Garfield et al., 2003). Then, we imported the text file into VOSviewer to extract a bibliographic coupling and cartography analysis for Information Seeking Behaviour. These outputs allowed us to explore the research streams of Information Seeking Behaviour articles in the field of Library and Information Science.

4. Data Analysis and Discussions:

4.1 Analysis of articles on Information Seeking Behaviour in Histcite and VOSviewer softwares

4.1.1 Yearly output and the most influential authors and journals

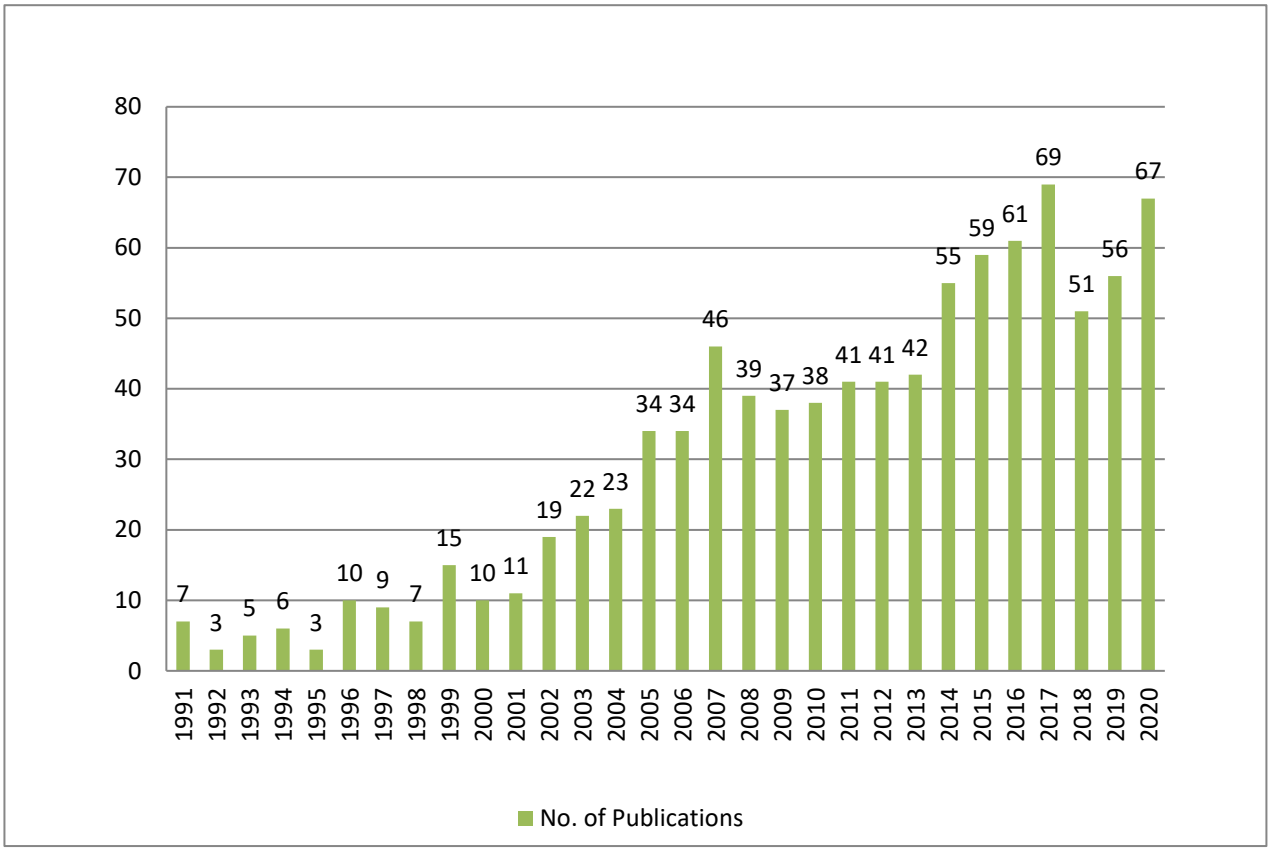

Figure I: Number of Publications on Information Seeking Behaviour per year

The HistCite Analysis indicated that only 184 research articles out of the 920 were published between 1991 and 2006. From 2007 to 2020, 736 papers were published and 493 of those were published in the last four years as shown in figure I. This indicates that Information Seeking Behavior is a most prominent area of research in the discipline of Library and Information Science and much research work has been published in this area. The research activities on Information Seeking Behavior gained momentum from the year 1991 mainly after the development of Wilson`s Model of Information Seeking Behaviour proposed in the year 1981. From figure I it can be seen that before 2007, there were only 184 articles related to Information Seeking Behavior in total, which indicates that Information Seeking Behavior research developed slowly during this period. From 2007, the number of research studies increased rapidly and in 2017 there was a peak in the amount of research literature in ISB. This phenomenon may be due application of the knowledge of Psychology in the field of Library and Information Science research. This also indicates that since studying the behavior of library users is a vital aspect in rendering quality information containing resources to the end users hence a need was felt to apply the psychological principles in the field of library and information science research. The Total Local Citation Score (TLCS), Total Global Citation Score

(TGCS) along with the percentage of all the publications each year generated by using HistCite software arranged in table II.

Table II: Number of Publication per year along with Total Local Citation Score (TLCS) and Total Global Citation Score (TGCS)

Sl No.	Year	No. of Publications	Percent	TLCS	TGCS
1	1991	7	0.7	50	290
2	1992	3	0.3	9	30
3	1993	5	0.5	52	359
4	1994	6	0.6	25	164
5	1995	3	0.3	17	164
6	1996	10	1.1	143	659
7	1997	9	1	71	387
8	1998	7	0.7	48	293
9	1999	15	1.6	379	1961
10	2000	10	1.1	48	331
11	2001	11	1.2	91	458
12	2002	19	2	134	1087
13	2003	22	2.4	197	1424
14	2004	23	2.5	145	957
15	2005	34	3.6	128	1561
16	2006	34	3.6	224	1731
17	2007	46	4.9	188	1404
18	2008	39	4.2	138	1238
19	2009	37	4	140	1056
20	2010	38	4.1	115	954
21	2011	41	4.4	124	1050
22	2012	41	4.4	51	544
23	2013	42	4.5	76	668
24	2014	55	5.9	84	646
25	2015	59	6.3	72	619
26	2016	61	6.5	51	481
27	2017	69	7.4	50	626
28	2018	51	5.4	16	158
29	2019	56	6	18	187
30	2020	67	7.2	2	84
Total		**920**	**100%**		

* **TLCS:** Total Local Citation Score
***TGS:** Total Global Citation Score

We also found that 1614 number of authors have authored the 920 articles. As shown in table III, most prominent author producing highest number of research studies related to Information Seeking Behaviour is Savolainen with authorship of 27 articles and comes at top of the list for his contribution. This is followed by other five top authors (in descending order of contribution of research articles) Spink, Fourie, Nicholas, Du and Shah. A network visualization map is also created

using VOSviewer as shown in figure III, which highlights the network of all the prominent authors for contributing research in ISB.

Table III: Ranking of most Prominent Authors based on total number of articles contributed by each author

Rank	Author	Recs	TLCS	TLCS/t	TGCS	TGCS/t	TLCR
1	Savolainen R	27	96	10.65	585	57.15	162
2	Spink A	21	152	7.67	751	39.38	45
3	Fourie I	16	6	0.72	74	8.17	107
4	Nicholas D	14	45	3.21	344	31.69	22
5	Du JT	11	22	2.58	111	14.04	58
6	Shah C	11	26	3.39	148	19.01	50
7	Marcella R	10	24	1.11	110	5.68	10
8	Beheshti J	9	27	1.91	242	14.58	35
9	Cole C	9	47	3.31	287	18.81	34
10	Jamali HR	8	31	2.33	194	17.37	27
11	Wilson TD	8	238	10.73	1150	52.51	20
12	Abrizah A	7	12	1.63	86	16.57	24
13	Baxter G	7	24	1.11	101	4.72	8
14	Belkin NJ	7	72	4.98	355	23.52	27
15	Ford N	7	87	4.43	447	23.7	10

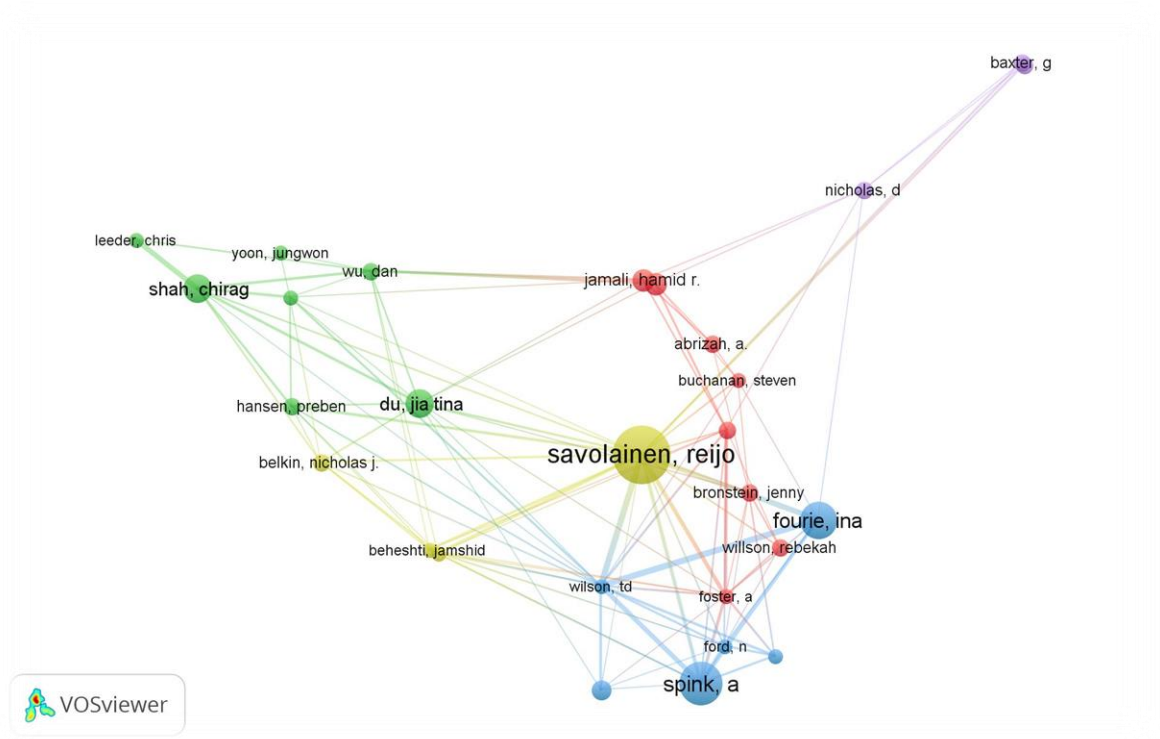

Figure III: Network Map of Authors for Information Seeking Behaviour

We sorted the most influential authors having great influence on Information Seeking Behaviour research studies according to the total global citation score (TGCS) and total local citations score (TLCS) against each author as presented in table IV. "The TGCS indicates how many times an

article was cited by other articles globally, while the total local citations score (TLCS) indicates how many times the article was cited within the collection of the retrieved set" (Shah et.al., 2018). Here again, Wilson took the first place both in terms of TGCS and TLCS, with a TGCS of 1150 and TLCS of 238. This is followed by Spink who occupied the second position in the list both in terms of TGCS and TLCS, with a TGCS of 751and TLCS of 152. Savolainen occupied the third position in the most influential authors list with a TGCS of 585.

Further, after precisely evaluating the most influential author in terms of Total global citation score per year (TGCS/t) it can be seen that Savolainen has scored the highest TGCS per year (TGCS/t) by 57.15 table IV, in spite of occupying third position in terms of scoring Total global citation score (TGCS) by 585. This is followed by Wilson and Spink occupying second and third position respectively in the list in terms of their TGCS per year (TGCS/t).

Table IV: Ranking of Most Influential Authors based on TLCS and TGCS

Rank	Author	TLCS	TLCS/t	Author	TGCS	TGCS/t
1	Wilson TD	238	10.73	Wilson TD	1150	52.51
2	Spink A	152	7.67	Spink A	751	39.38
3	Foster A	119	6.34	Savolainen R	585	57.15
4	Ellis D	109	4.94	Foster A	574	30.51
5	Pettigrew KE	105	4.14	Pettigrew KE	488	19.55
6	Savolainen R	96	10.65	Ford N	447	23.7
7	Ford N	87	4.43	Ellis D	424	18.94
8	Leckie GJ	85	3.27	Andrews JE	370	21.76
9	Sylvain C	85	3.27	Belkin NJ	355	23.52
10	Vakkari P	79	3.8	Johnson JD	351	23.56
11	Belkin NJ	72	4.98	Hirsh SG	349	14.03
12	McKenzie PJ	62	3.44	Nicholas D	344	31.69
13	Kim KS	61	4.09	Leckie GJ	332	12.77
14	Fidel R	55	2.63	Sylvain C	332	12.77
15	Hyldegard J	53	3.62	Vakkari P	330	15.17

A total of 68 academic journals have publications related to Information Seeking Behaviour. The top 15 most significant journals were assessed and listed with the help of HistCite according to total number of articles published in each journal on Information Seeking Behaviour, as shown in table V. Among the top 15 most influential journals, Information Research-An International Electronic Journal published highest number of articles on Information Seeking Behaviour as it has published a total of 125 numbers of articles on Information Seeking Behaviour; which is followed by Journal of Documentation and Journal of The American Society for Information Science and Technology occupying second and third positions respectively in the list.

For more precise assessment, Journal of The American Society for Information Science and Technology has received the highest TGCS of 3328 out of the 15 top journals on Information seeking behavior followed by Journal of Documentation with TGCS of 3235. A network

visualization map is also generated using VOSviewer software as shown in figure IV, which highlights the significant journals publishing research studies in ISB.

Table V: Journals Extracted from WoS database containing publications on Information Seeking Behaviour along with their respective Rank

Rank	Journal	Recs	TLCS	TLCS/t	TGCS	TGCS/t	TLCR
1	Information Research-An International Electronic Journal	125	0	0	1294	104.65	432
2	Journal of Documentation	102	591	39.31	3235	225.33	504
3	Journal of The American Society for Information Science and Technology	81	572	37.15	3328	225.84	325
4	Information Processing & Management	58	392	25.26	2471	169.9	160
5	Library & Information Science Research	52	238	15.89	1517	105.3	159
6	Journal Of The Association For Information Science And Technology	46	92	15.28	505	86.86	205
7	Health Information and Libraries Journal	41	27	3.02	338	41.32	55
8	Journal Of Health Communication	37	56	4.29	1383	108.15	49
9	Aslib Journal of Information Management	33	26	4.95	134	27.52	147
10	Journal of Information Science	31	39	3.67	291	29.3	108
11	Journal of The Medical Library Association	30	114	7.34	1138	76.71	48
12	Journal of Librarianship and Information Science	26	15	1.8	126	22.55	59
13	Aslib Proceedings	24	65	4.32	430	30.55	54
14	Journal of Academic Librarianship	22	52	4.84	450	38.86	68
15	Electronic Library	15	7	0.79	99	8.93	4

***TLCS/t:** Total Local Citation Score per year
***TGCS/t:** Total Global Citation Score per year
***TLCR:** Total Local Cited Reference

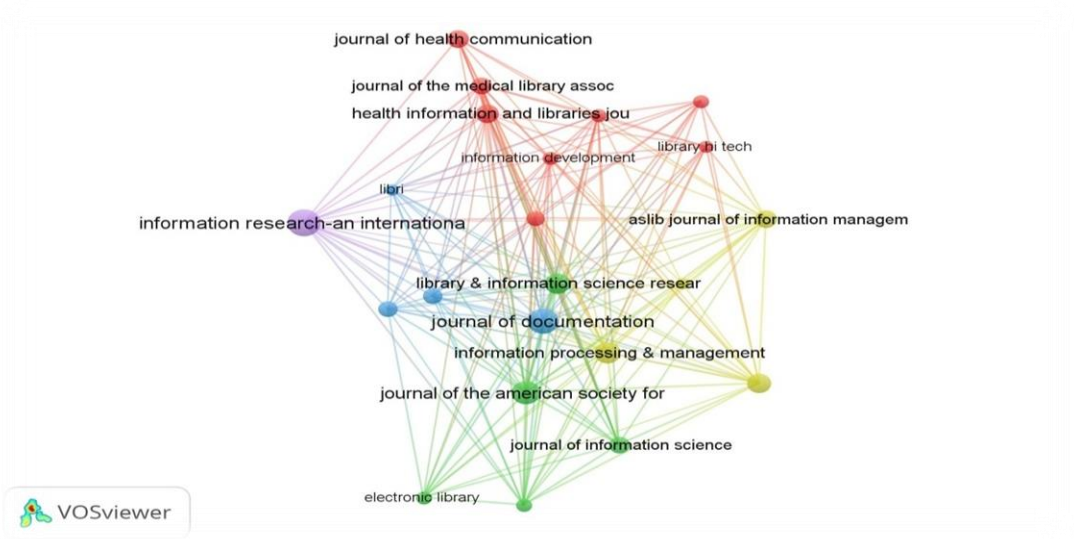

Figure IV: Network Map of Journals for Information Seeking Behaviour

4.1.2 Most-influential institutions and Countries:

Table VI: Ranking of most Influential Institution based on the number of articles contributed

Rank	Institution	Country	Recs	TLCS	TGCS
1	Tampere University	Finland	31	211	1144
2	Sheffield University	England	30	340	1697
3	Rutgers State University	USA	28	121	875
4	University of Wisconsin	USA	24	118	794
5	University of North Carolina	USA	19	129	843
6	University of Pretoria	South Africa	19	6	85
7	University of Washington	USA	19	119	807
8	McGill University	Canada	16	62	493
9	Robert Gordon University	Scotland	16	25	180
10	Wuhan University	China	16	13	125
11	University of Malaysia	Malaysia	15	20	129
12	University of Tennessee	USA	15	69	797
13	City University of London	England	14	53	344
14	Pennsylvania State University	USA	14	138	675
15	University College London	England	14	55	425

After analyzing our extracted data of 920 publications we have found a total number of 644 institutions contributing research studies related to Information seeking behaviour. We have sorted out top 15 institutions in terms of their highest number of research publications related to ISB. As shown in table VI; we have assessed and listed the 15 most influential institutions that are producing research studies on Information seeking behaviour; Tampere University, Sheffield University and Rutgers State University are the top three most influential institutions that provided most number of articles on Information Seeking Behaviour. Also in terms of TGCS received then Sheffield University with TGCS of 1697 comes at the top of the list followed by Tampere University and

Rutgers State University. A network visualization map is also generated using VOSviewer as shown in figure V for most influential Institutions.

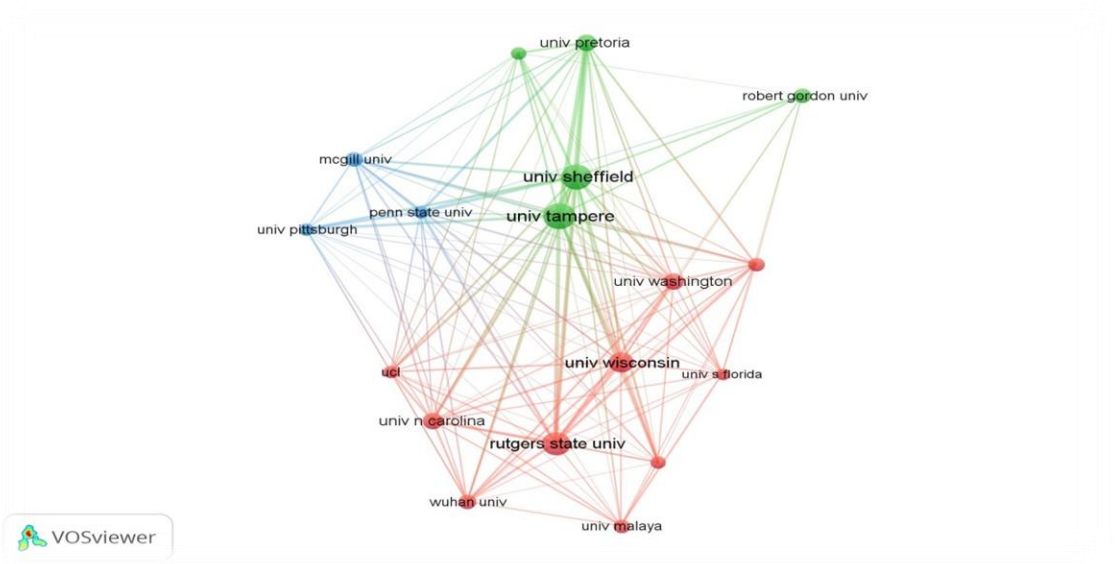

Figure V: Network Map of Influential Institutions contributing research studies in ISB

Table VII: Most Influential Countries to contribute Research studies in ISB.

Rank	Country	Documents	Citations	Total link strength
1	USA	351	10425	1467
2	England	101	3327	766
3	Finland	57	1494	474
4	Canada	52	1537	358
5	Peoples Republic China	53	450	315
6	Australia	51	614	286
7	Scotland	35	447	194
8	South Africa	35	263	184
9	Denmark	21	607	176
10	Wales	12	614	156
11	Iran	24	241	125
12	Malaysia	22	194	117
13	Singapore	17	310	114
14	Sweden	20	234	95
15	Taiwan	24	137	94

In our study, after analyzing the 920 studies we have found a total of 62 countries contributing research studies related to Information seeking behaviour. We have sorted out top 15 countries in terms of their highest number of research publications related to ISB as shown in table VII. We have assessed and listed the most influential countries of 920 publications; USA comes at the top of the list as with the highest number of 351 research publications, with highest number of citations of 10425; followed by England and Finland with a total number of 101 and 57 research publications respectively, with citations of 3327 and 1497 respectively. The country with highest total link strength is USA of 1467, followed by England and Finland with total link strength of 766 and 474

respectively. A network visualization map for the influential countries is also generated using VOSviewer as shown in figure VI.

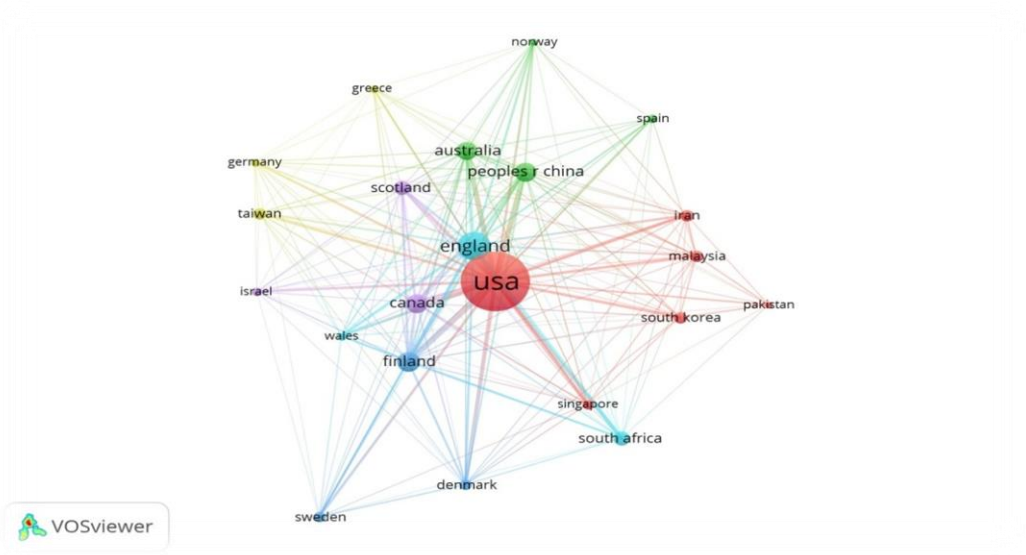

Figure VI: Network Map of Influential Countries to contribute Research studies in ISB

5. Cluster Analysis and Future Directions:

5.1 Bibliographic coupling using VOS viewer:

The study applied the VOS viewer bibliographic coupling technique for citation mapping, documents as the unit of analysis and full counting method for authors. From the total of 920 documents we have selected only those documents with a minimum number of 50 citations. Thus, out of 920 documents; 106 documents meet the threshold and are selected for the cluster analysis. These 106 documents are analyzed and categorized in three clusters related to significant research areas of Information Seeking Behaviour. For each of the 106 documents, the total strength of the bibliographic coupling links with other documents is calculated with the help of VOS viewer software and the documents with highest total link strength are selected. In this study we used two standard weighting attributes; number of citations received by a document and total link strength, to highlight the emergence and significance of a given article in a specific cluster. The first cluster is represented by red color shown in figure VII; containing 50 articles, out of which we have selected top 15 articles and after content analysis of each selected article we revealed that articles in cluster I mostly related to: 'Models of Information Seeking behaviour' as indicated in table VIII . Similarly, the second cluster is represented by green color shown in figure VII containing 34 articles out of which we have selected top 15 articles and after analyzing we revealed cluster II articles are mostly related to: 'Information Needs', as indicated in table IX. And lastly, the third cluster is represented by blue color as shown in figure VII containing 22 articles out of which we have selected top 15 articles and after analyzing we revealed cluster II articles are mostly related to: 'User Studies', as indicated in table X. The bibliographic coupling for citation mapping of all the three clusters highlighting the article sources are shown in figure VII which distinguishes the three clusters of research studies in ISB.

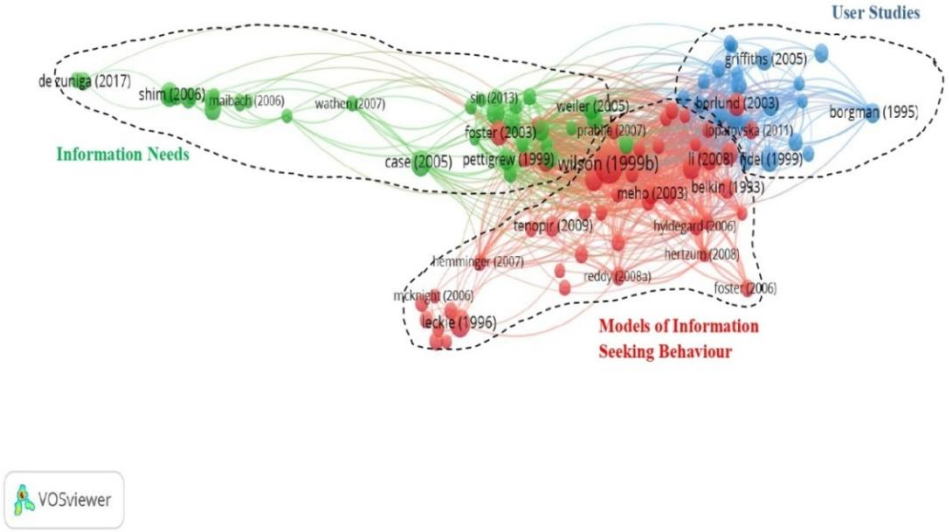

Figure VII: Bibliographic coupling of ISB research articles

5.2 Co-occurrence of Keywords:

In this study we have created a network visualization map using VOS viewer software of the most frequently occurring keywords for all 920 publications. We selected co-occurrence as the type of analysis and all keywords as the unit of analysis. We selected minimum number of co- occurrences of a keyword as 11 and as a result 109 keywords meet the threshold. In VOSviewer we have assigned a parameter of minimum cluster size as 20 keywords; thus small clusters are removed and finally three clusters were created with a total of 87 keywords. VOSviewer transformed these 87 keywords into a visual form and classified the frequently occurring keywords into three main clusters in the network visualization view as shown in figure VIII. Keywords with similar colors belong to same cluster. In figure VIII clusters are represented by red, blue and green colors respectively. All three clusters confirm and represent the significant research areas obtained from bibliographic coupling of 106 selected articles of Information Seeking behaviour as shown in figure VII. The first cluster is represented by red color consist of 31 keywords confirms and signifies the bibliographic coupling research area: 'Models of Information Seeking Behaviour'. The second cluster represented by green color consists of 30 keywords confirms and signifies the bibliographic coupling research areas: 'Information Needs'. At last the third cluster represented by blue color consists of 26 keywords confirms and signifies the bibliographic coupling research area: 'User Studies'. From each of the three clusters the top 15 most frequently occurring keywords are displayed in the network visualization as shown in the figure VIII.

5.3 Cluster I: Models of Information Seeking Behaviour:

Cluster I comprises of 50 research articles out of which we have selected top 15 articles based on the weightings of two attributes (Highest citations and total link strength) represented on table VIII. Content analysis of top 15 articles indicates that most of the articles focus on the 'Models of Information seeking behaviour' which indicates that there are a lot of research literature developed in the areas of modeling and theories of Information seeking behaviour, Information retrieval strategies and Information search process in web. Here Wilson (1999b) research article have a lot of influence

in this research area of ISB as it has highest citations of 874 and total link strength of 177. After that Leckie (1996), Foster (2003), Ellis (1997), Borlund (2003) has total citations of their research articles as 332, 231, 226 and 185 respectively and total link strength of 50, 75, 109, and 114 respectively. Besides, after analyzing the co-occurrence of keywords in cluster I we found that keywords like model, seeking, behaviour, retrieval and search process has highest number of occurrences and total link strength; which confirms that the research literature in cluster I are most probably related to models of information seeking behaviour.

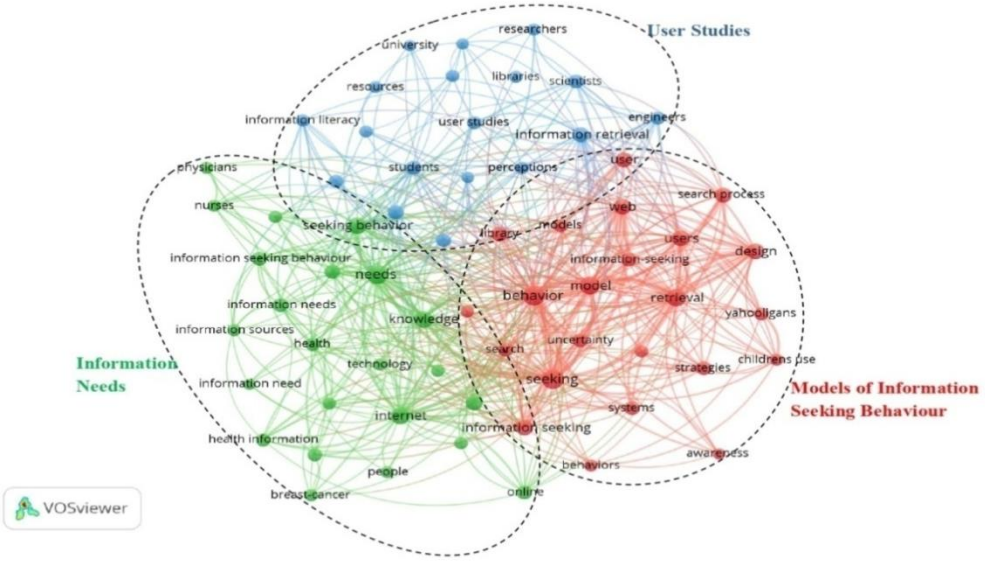

Figure VIII: Co-occurrence of keywords

5.4 Cluster II: Information Needs:

Cluster II comprises of 32 research articles out of which we have selected top 15 articles based on the weightings of two attributes (Highest citations and total link strength) represented on table IX. Content analysis of top 15 articles indicates that most of the articles focus on the 'Information Needs'. In cluster II we have found that the articles are very significant in the emergence of research in ISB due to Information needs or demands of users for different purposes like health, education, research and everyday activities etc. The research articles highlighted the strategies, behaviour and purposes of users for seeking information to clear their uncertainties. It has been identified that there is a rise of research articles on information needs related to medical, health treatments, diagnosis, diseases especially on cancer related information. In Cluster II Case (2005) research article has highest number of citations of 292 followed by McKenzie (2003) and Shim (2006) having citations of 224 and 216; besides the total link strength of the three authors are 70, 109 and 16 respectively. Moreover after analyzing the co-occurrence of keywords in cluster II we have found that keywords like Information Needs, Information Sources and Health Information has highest number of occurrences and total link strength; which confirms that the research literature in cluster II are most probably related to information needs.

TableVIII: Top -15 research articles in Cluster I

Cluster: I Models of Information Seeking Behaviour

Sl. No	Author	Title	Citations	Total Link Strength
1	Wilson (1999b)	Models in information behaviour research	874	177
2	Leckie (1996)	Modeling the information seeking of professionals: A general model derived from research on engineers, health care professionals, and lawyers.	332	50
3	Foster (2003)	Serendipity and information seeking: an empirical study.	231	75
4	Ellis (1997)	Modelling the information seeking patterns of engineers and research scientists in an industrial environment.	226	109
5	Borlund (2003)	The IIR evaluation model: a framework for evaluation of interactive information retrieval systems.	185	114
6	Vakkari (1999)	Task complexity, problem structure and information actions - Integrating studies on information seeking and retrieval.	180	201
7	Vakkari (2001)	A theory of the task-based information retrieval process: A summary and generalisation of a longitudinal study.	149	140
8	Li (2008)	A faceted approach to conceptualizing tasks in information seeking	147	104
9	Meho (2003)	Modeling the information-seeking behavior of social scientists: Ellis's study revisited.	140	198
10	Foster (2004)	A nonlinear model of information-seeking behavior.	136	124
11	Belkin (1993)	Braque - Design Of An Interface To Support User Interaction In Information-Retrieval.	124	62
12	Tenopir (2009)	Electronic journals and changes in scholarly article seeking and reading patterns.	121	49
13	Lopatovska (2011)	Theories, methods and current research on emotions in library and information science, information retrieval and human-computer interaction.	108	60
14	Reddy (2008a)	Collaborative information seeking: A field study of a multidisciplinary patient care team.	101	96
15	Reddy (2008b)	A model for understanding collaborative information behavior in context: A study of two healthcare teams.	99	226

Table IX: Top -15 research articles in Cluster II

Cluster: II Information Needs

Sl. No	Authors	Title	Citations	Total Link Strength
1	Case (2005)	Avoiding versus seeking: the relationship of information seeking to avoidance, blunting, coping, dissonance, and related concepts	292	70
2	McKenzie (2003)	A model of information practices in accounts of everyday-life information seeking	224	109
3	Shim (2006)	Cancer information scanning and seeking behavior is associated with knowledge, lifestyle choices, and screening	216	16
4	Weiler (2005)	Information-seeking behavior in generation Y students: Motivation, critical thinking, and learning theory	188	65
5	Chatman (1991)	Life in a small world – Applicability of Gratification Theory to Information Seeking Behaviour	175	26
6	Finney Rutten (2006)	Cancer-Related Information Seeking: Hints from the 2003 Health Information National Trends Survey (HINTS)	174	33
7	Connaway (2011)	If it is too inconvenient I'm not going after it:" Convenience as a critical factor in information-seeking behaviors	171	63
8	Karl (2007)	Relationships between information seeking and context: A qualitative study of Internet searching and the goals of personal development	171	179
9	Pettigrew (1999)	Waiting for chiropody: contextual results from an ethnographic study of the information behaviour among attendees at community clinics	156	79
10	Spink (2006)	Human information behavior: Integrating diverse approaches and information use	127	185
11	Rains (2007)	Perceptions of traditional information sources and use of the world wide web to seek health information: Findings from the Health Information National Trends Survey	124	23
12	Czaja (2003)	The determinants and consequences of information seeking among cancer patients	122	24
13	Talja (1999)	The production of 'context' in information seeking research: a metatheoretical view	144	98
14	De Zuniga (2017)	Effects of the News-Finds-Me Perception in Communication: Social Media Use Implications for News Seeking and Learning About Politics	122	9

15	Sin (2013)	International students' everyday life information seeking: The informational value of social networking sites	88	27

Table X: Top -15 research articles in Cluster III

Cluster: III User studies and Web based Information Searching behaviour

Sl. No	Author	Title	Citations	Total Link Strength
1	Fidel (1999)	A visit to the information mall: Web searching behavior of high school students	234	28
2	Hirsh (1999)	Children's relevance criteria and information seeking on electronic resources	159	96
3	Griffiths (2005)	Student searching behavior and the web: Use of academic resources and google	152	14
4	Schacter (1998)	Children's Internet searching on complex problems: Performance and process analyses	148	110
5	Borgman (1995)	CHILDRENS SEARCHING BEHAVIOR ON BROWSING AND KEYWORD ONLINE CATALOGS - THE SCIENCE LIBRARY CATALOG PROJECT	135	79
6	Bilal (2002)	Differences and similarities in information seeking: children and adults as Web users	129	149
7	Kim (2002)	Cognitive and task influences on Web searching behavior	109	124
8	Large (2002)	Gender differences in collaborative Web searching behavior: an elementary school study	99	14
9	Solomon (1993)	CHILDRENS INFORMATION-RETRIEVAL BEHAVIOR - A CASE ANALYSIS OF AN OPAC	97	57
10	Kellar (2007)	A field study characterizing Web-based information-seeking tasks	91	121
11	Spink (2002)	Multitasking information seeking and searching processes	83	50
12	Sutcliffe (2000)	Empirical studies of end-user information searching	78	123
13	Nah (1996)	Affective and cognitive searching behavior of novice end-users of a full-text database	67	27
14	Kim (2001)	Information seeking on the Web	66	94
15	Markey (2007)	Twenty-five years of end-user searching, part 1: Research findings	63	54

5.5 Cluster III: User Studies:

The cluster III comprises of 22 research articles out of which we have selected top 15 articles based on the weightings of two attributes (Highest citations and total link strength) represented on table X. Content analysis of top 15 articles in cluster III reveals that most of the articles are related to the 'User Studies'. The research articles are also focus towards the strategies and behaviour of different users like Students, Children, Doctors, and Engineers etc in seeking information. Besides, the articles also highlighted the use of internet and web for searching and retrieving information. By analyzing the articles in cluster III he have identified that user studies is also a very significant research area of information seeking behaviour which also emphasize on the levels and kinds of information needs of users and by evaluating information usage and patterns of users we can identify vital sources of information as well as know about the future information needs of the users. In cluster III the research article of Fidel (1999) has highest number of citations followed by Hirsh (1999) and Griffiths (2005) with 159 and 152 citations respectively. All the three authors have total link strength of 28, 96 and 14 respectively. Moreover after analyzing the co-occurrence of keywords in cluster III we have found that keywords like User studies, Students, Researchers, Perception etc has highest number of occurrences and total link strength; which confirms that the research literature in cluster III are most probably related to user studies.

5.3 Future Directions:

The research trends in ISB of users are changing with the development of ICT, its significant research areas are Information retrieval, web search process, Information Seeking strategies, Human behaviour, Serendipity and users perceptions towards different information sources. Further, In our study after analyzing contents of several articles we have found a rise in research literature of health information needs of users related to medical, treatments, diagnosis especially cancer disease related information.

Overall, the future directions of research in ISB is fast growing as in our study we have found that in last thirty years 2017 has highest number of research publications related to ISB followed by 2020 has the second highest number of research publications. The research contributions also highlights on development of users Information literacy, skills, fluency, knowledge in using and finding information more efficiently and effectively to satisfy ones information needs as information seeking is the interaction between information source and user.

6. Findings and Limitations:

This study provides a comprehensive review of the research articles published on Information Seeking Behaviour in the domain of Library and Information Science, by performing bibliometric analysis of the retrieved research articles. We collected bibliography data of 936 articles from the WoS database, authored by 1614 scholars published in the last 30 years (1991 to 2020). In the following sub-section, we summarize the key findings to the three objectives stated in the introduction section:

6.1 Yearly Growth of Information Seeking Behavior Research studies in the Last Thirty Years:

Research Question 1: Find the yearly Growth of Information Seeking Behaviour Research studies in the Last thirty years?

From figure I it can be seen that before 2007, there were only 184 articles related to Information Seeking Behavior in total, which indicates that Information Seeking Behavior research developed slowly during that period. However, from the year 2007, the number of researches increased rapidly, and in 2017, there was a peak in the amount of literature. As revealed by figure I there is an overall gradual rise in the number of research articles on Information seeking behavior with little fluctuations in the entire time span of thirty years.

6.2 Key Journals, Institutions, Authors and Countries:

Research Question 2: Which Channels (Journals, Institutions, Authors and countries) are the most influential in Information Seeking Behaviour research studies?

The Key journals in terms of TGCS/t in the area of research on Information Seeking Behaviour are: Journal of Documentation and Journal of The American Society for Information Science and Technology. In terms of TGCS ranking, Sheffield University, Tampere University and University of North Carolina are the top three most active institutions in the field of research in Information Seeking Behaviour. The top three authors, ranked by the number of publications contributed by them (in parentheses), are Savolainen (27), Spink (21) and Fourie (16). In terms of TLCS and TGCS ranking, the top two authors that come in the list are Wilson and Spink. Out of the top 15 countries to contribute most number of research articles on Information Seeking Behaviour studies as listed in table VII; the country that comes at the top of the list is USA for making a contribution of 351 articles on Information Seeking Behaviour studies. In terms of total citations received and the total link strength the country that comes at the top is USA which is followed by England and Finland.

6.3 Clusters and Future research directions:

Research Question 3: How are Information Seeking Behaviour research articles clustered and what are future research directions?

In our study as shown in the figure VII and figure VIII we have categorized the selected documents in three clusters which are related to significant research areas of Information Seeking Behaviour. The cluster I of research articles are indicated with red color which indicates: Models of Information Seeking behaviour. The cluster II is represented by green color which indicates: Information Needs and the cluster III is represented by blue color which indicates: User studies.

The future directions in ISB of users are changing with the development of ICT, its significant research areas are Information needs, User studies, Information retrieval, web search process, Human behaviour, Serendipity, health and medical related information needs.

6.4 Limitations:

Information seeking is very old phenomenon, the systematic research and development of ISB started very late. Our main limitation in this study is that we have chosen research studies only of last thirty years on Information seeking behaviour i.e. 1991- 2020. The main intention of this study is to track the emergence of latest research literature and sources in ISB which is well incorporated with the latest development of Information communication technology as at present user's information seeking behaviour has also changed with the development of electronic environment. Secondly, the

articles chosen for this study are extracted from WoS which are from reputed journals. Therefore, few important publications which are not available in WoS index journals couldn't bear information in our study and not shown in our analysis.

7. **Conclusion:**

Information seeking behaviour is a vital area under Library and Information Science discipline. With the evolvement of Information communication technology and e-resources libraries are transforming from traditional libraries to modern or digital libraries; and Users information demands and information seeking is also changing in the electronic environment. Information seeking is a strategy that leads to acquisition of information, both personal and in technical contexts. ISB is much related to User studies, User needs, Information availability and Information needs assessment. The research paper mainly focuses to bring out available research literature of last thirty years related to ISB and identify the most influential authors, articles, journals, institutions, and countries with help of HistCite and VOSviewer software. We also conducted cluster analysis of the documents by performing bibliographic coupling and co-occurrence of keywords using VOSviewer and identified three significant research clusters of ISB as Models of Information seeking behaviour, Information Needs and User studies. This paper will help academic researchers in library and Information science subject to identify important aspects of ISB and analyze the growth of research literature in this area.

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