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Research Evaluation of Information Seeking Among Scientists: A Review

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Abstract

Purpose*:* The purpose of this study is to identify and review existing research on information-seeking behavior of the Scientists.

Methodology: A literature review of 19 studies was undertaken systematically. Based upon the protocol based approach, the relevant literature was searched and retrieved. Such literature was then summarized and finally compiled.

Findings: The relevant studies showed unfamiliarity of the users with the electronic resources and their lack of knowledge for using the electronic resources.

Limitations: The research is limited to the studies of information gathering habits of scientists only.

Practical implications*:* By understanding the information seeking behavior of scientists, the libraries would be able to incorporate new services such as user education, customization of search services, redesign study and research facilities and obtain new collections.

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Originality/value: This is the first in-depth study exploring the information seeking behavior of scientists in India as well as abroad.

Index Terms: Electronic resources, information seeking behaviour, Scientists.

Introduction

The study of information needs and information-seeking behaviour dates back to 1948. The period from 1940s to 1960s was the era of investigations by the engineers and scientists. This has been discovered in the papers published by at the Royal Society Scientific Information Conference on scientific data (Bernal[1],1960). In the conference, the initial stage of the contemporary study of human information-seeking behaviour was discussed by Menzel, Lieberman, and Dulchin[2] (1960). The period between mid sixties to the mid eighties focused mainly on information service provision and quality, the period between mid eighties to the mid nineties focused basically upon empirical studies and models of information-seeking, whereas the period from mid nineties till date is being focused upon integrating information-seeking and information retrieval (Feather and Sturges[3], 2002).

Information Seeking in Sciences

Herner[4] (1954) in his paper entitled "Information gathering habits of workers in pure and applied science" discovered the informal sources in sciences. He found that for the purpose of seeking information, pure scientists depend mainly on literature than the applied scientists. He also found that the primary formal source of information was the scientific literature, whereas the most important verbal source of information was the informal conversation. He observed that textbooks and monographs, research journals and handbooks were most preferred by pure and applied scientists. He found that the secondary source of information preferred by pure scientists was personal recommendations, whereas applied scientists preferred the cited references.

Skeleton[5] (1973) compared the results of user studies in 13 science disciplines with INFROSS (Investigating into information requirements of the social sciences) in his paper entitled "Scientists and social scientists as information users: a comparison of results of science user studies with the investigation into information requirements of the social sciences"

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[1] Bernal, J.D. (1960). Scientific information and its users. *ASLIB Proceedings, 12*, 432-38.

[2] Menzel, H., Lieberman, L., & Dulchin, J. (1960). *Review of studies in the flow of information among scientists*. New York: Cocumbia University Bureau of Applied Social Research.

[3] Feather, J., & Sturges, P., eds. (2002). *International encyclopedia of information and library science*. London: Taylor & Francis.

[4] Herner, S. (1954). Information gathering habits of workers in pure and applied science. *Industrial Engineering Chemistry*, *46*, 228-236.

[5] Skeleton, B. (1973). Scientists and social scientists as information users: a comparison of results of science user studies with the investigation into information requirements of the social sciences. *Journal of Librarianship*, *15*, 138-156.

discovered that citations, abstracting and indexing journals, personal recommendations were the most important sources used by the physical scientists to retrieve information. Instead of retrospective searching, he found that abstracting journals were mainly used by the physical scientists. He concluded that physical scientists habitually discover information by chance than by formal use of bibliographical tools.

Bichteler, and Ward[6] (1989) in their paper entitled "Information-seeking behavior of Geoscientists" found that the geoscientists had no preference for bibliographical services, end user searching and computer shortcuts like e-mail or personal databases. They discovered that the respondents read comparatively little foreign material and preferred journals for obtaining information. The authors noted that the variations in the pattern of seeking information depends upon the position held, availability of time and the constraints set by the employers.

Sridhar[7] (1989) in his paper entitled "Information-seeking behaviour of the Indian space technologists" found that the space technologists are stimulated by the self improvement, up to date in their field of specialization, self satisfaction, etc. They seek information for S & T information and news. The significant sources of bibliographic information used by Indian space technologists of ISRO satellite centre (ISAE), Bangalore were library catalogues, recommendations from fellow colleagues, browsing of library shelves and citations in current reading material. He further discovered that only 6% of the space technologists frequently delegated the information gathering work to their juniors, whereas 40% delegated it occasionally. The space technologists on an average spend 9.2 hours per week for collecting the information from formal along with documentary sources of information. They found that in order to keep themselves up to date, above 52% participants depend upon journals, 13% depend upon discussion with colleagues and 9% depend upon trade literature. He finally concluded that the information-seeking behaviour of Indian space technologists varied as per their rank, credentials, kind of work, specialization and professional activities and accomplishments.

[6] Bichteler, J., & Ward, D. (1989). Information-seeking behavior of Geoscientists. *Special Libraries, 80,* 169-178.
[7] Sridhar, M.S. (1989). Information-seeking behaviour of the Indian space technologists. *Library Science with a Slant to Documentation*, *26(2),* 127-166.

Premsmit[8] (1990) in his paper entitled "Information needs of academic medical scientists at Chulalongkorn University" discovered that majority of the participants (46.5%) identified up-to-date information as important research related situation, library / information centre on campus was the major information provider (25.5%) and convenience was cited as the major factor in choosing information provider by 70.9% participants. He found that the library was most frequently used by the academic scientists to photocopy material for personal research collection. The results of his study showed that majority of the participants were library users. Only 5% of the participants were non-users of the library. The reasons for their non-use were lack of time, didn't need library, etc. He finally concluded that medical scientists have three kinds of information needs, viz. up-to-date information, acquiring relevant studies and data, and developing research topics. The information–seeking behaviour of Thai scientists was different from other scientists of the developed countries as they depend more on seeking information from abroad.

Ramesh, and Karisiddappa[9] (1993) in their study entitled "Information needs of engineering scientists of regional research laboratory, Bhubaneswar: a case study" explored the information-seeking methodology of the scientists so that a necessity based information system and services could be drafted and developed. Moreover, the study also examined the utility of library collection. Their study revealed that chemical abstracts and metal abstracts were the highly referred secondary sources of information by the respondents. They found that the scientists have the knowledge about information services of INSDOC used online resources for current research information and scan current periodicals for updating their information. They found that the participants preferred library automation and were contented over the existing collection of library and majority (63%) of the scientists preferred library current awareness service.

[8] Premsmit, P. (1990). Information needs of academic medical scientists at Chulalongkorn University. *Bulletin of the Medical Library Association*, *78(4),* 383-387.

[9] Ramesh, D.B., & Karisiddappa, C.R. (1993). Information needs of engineering scientists of regional research laboratory, Bhubaneswar: a case study. In Kuldip Chand (Ed.), *Current trends in information technology: it's Impact on information science in India* (pp.95-108). New Delhi: Batra Pub.

Lalitha[10] (1995) in her article entitled "Information seeking behaviour of medical and engineering personnel: a comparative study with reference to their library use" made a comparative study of the medical and engineering personnel including teachers, students, practitioners and researchers regarding their use of five libraries in Thiruvananthapuram (India). She found that both the medical as well as engineering personnel were unable to understand the complexities of the information needs and information-seeking and highlighted the need for user education for both the professional groups.

Cheng, and Lam[11] (1996) in their study entitled "Information-seeking behavior of health professionals in Hong Kong: a survey of thirty seven hospitals" examined the information needs of health professionals; assessed the satisfaction level of the users and the influence of library services especially 'Hospital Authority Library Information System (HALIS)'. The results of their study revealed that majority of the respondents (65.7%) used their own hospital libraries. They found that the medical staff members were frequent users of the library and were visiting the library at least once a week. They also found that majority of the respondents were using sources of information other than HA libraries such as local book shops, Hong Kong Polytechnic Library, Hong Kong Medical Library and public libraries. The users visited the library to find some precise subject matter, to consult and borrow books, journals and to get the photocopy of the desired material. They found that doctors frequently used the libraries as compared to other groups and they were least aware about the computer searching facilities. They concluded that there is a need for improvement in the user training of the participants in computer searching, collection development and enhancing the electronic information sources along with expansion of printed and audiovisual material.

Reddy, and Karisiddappa[12] (1997) in their paper entitled "Information seeking behaviour of the professionals in the field of disabilities with special reference to mental handicap in India" studied the information-seeking behaviour of 160 professionals including special educators, psychologists, medical staff, vocational counselors, and speech therapists. The results of their

[10] Lalitha, M. (1995). Information-seeking behavior of medical and engineering personnel: a comparative study with reference to their library use. *Library Science with a Slant to Documentation*, *32(2),* 65-74.

[11] Cheng, G.Y.T., & Lam, L.M.C. (1996). Information-seeking behavior of health professionals in Hong Kong: a survey of thirty seven hospitals. *Bulletin of the Medical Library Association*, *84(1),* 32-40.

[12] Reddy, S.H.K., & Karisiddappa, C.R. (1997). Information seeking behaviour of the professionals in the field of disabilities with special reference to mental handicap in India. *Annals of Library Science and Documentation*, *44(2),* 54-64.

study revealed that majority of the respondents preferred to use books, periodicals, subject bibliographies, abstracting and indexing services, current literature reviews, databases, meetings and conferences, discussion with colleagues and personal files. They revealed that majority of the respondents (71.1%) considered library collection as excellent, whereas 22.8% and 6.1% considered it adequate and fair respectively. They concluded that the user's awareness of sources varies with age, experience, qualifications and their professional position.

Pelzer, Wiese, and Leysen[13] (1998) in their paper entitled "Library use and information-seeking behavior of veterinary medical students revisited in the electronic environment" compared their data with the data of another study that was conducted a decade ago. They found that in the year 1997, the library was most frequently used by veterinary students for photocopying, office supplies and studying coursework. The respondents preferred to consult textbooks and handouts for up-to-date information. They discovered that when veterinary students seek information ahead of textbooks and handouts, there was seen a paradigm switch from the use of print indexes and abstracts in 1987 towards the use of computerized indexes and electronic resources in 1997. They found that 60% of the veterinary students find the information on Internet and the students who were subjected to the problem-based learning instructions made maximum use of electronic resources. They concluded with the advice that irrespective of focusing on the students already practicing in remote geographical locations, the preference should be given on the students while studying so that they may go well equipped with knowledge of electronic resources which will be used in their profession as practitioners.

Zawawi, and Majid[14] (2001) in their article entitled "Information needs and seeking behaviour of the IMR biomedical scientists" revealed that the biomedical scientists at IMR (Malaysia) used diverse information sources to fulfill their information needs. They found that most preferred information source were the journal articles by 90.7% respondents. The respondents who were involved in teaching, cited books (94.4%) as the most preferred source of information for teaching purpose. Their study also revealed that majority of the respondents (90.7%) preferred to use printed materials. They also observed that although all the respondents

[13] Pelzer, N., Wiese, W.H., & Leysen, J.M. (1998). Library use and information-seeking behavior of veterinary medical students revisited in the electronic environment. *Bulletin of Medical Library Association*, *86(3),* 346-355.

[14] Zawawi, S., & Majid, S. (2001). Information needs and seeking behaviour of the IMR biomedical scientists. *Malaysian Journal of Library & Information Science, 5(1),* 25-41.

visited their library personally, still majority of them sought assistance from the support staff to get the required information. They found that CD-ROM and e-mail was the most frequently used IT and Internet based information source. Their study also revealed that the journals, books, indexing and abstracting sources, physical facilities such as air conditioner (47%), seating capacity (44%), furniture (43%), etc. were considered 'adequate' by the majority of the respondents. The difficulty faced by majority of the respondents in seeking information was that the librarians were not familiar with medical subject knowledge. They concluded that the medical librarians must augment their knowledge for better understanding of the information needs of the scientists.

Hemminger, Lu, Vaughan, and Adams[15] (2007) conducted a census survey entitled "Information seeking behavior of academic scientists" at the University of North Carolina to recognize their existing information-seeking behaviour. They discovered as to how the electronic communication transition influences different facets of seeking information. They found the remarkable changes in the information-seeking behavior of the respondents as they depend upon web based resources to a great extent, visits the library less and were exclusively dependent upon electronic sources of information. They found that majority of the respondents (91%) had access to the Internet in their office or laboratory and in their departments. They discovered that journals, web pages, databases, and personal communications were most frequently used by the respondents and personal communication was found to be the most popular source for non-scholarly information. They noted that as compared to medical scientists (45%), the basic science researchers (65%) use preprints at least annually. They observed that the rudimentary information-seeking practice of science scholars was altered due to accessibility of online journal articles. They concluded that there is a strong relationship between Internet access and electronic searching, explicating and maintaining personal article collections.

Baljinder Kaur[16] (2009) in her study entitled "Use and impact of electronic resources in engineering and technological institutions in India" examined the usage of e-resources, user satisfaction and obstacles faced in accessing e-resources by the participants from Indian Institute

[15] Hemminger, B.M., Lu, D., Vaughan, K.T.L., & Adams, S.J. (2007). Information seeking behavior of academic scientists. *Journal of American Society for Information Science and Technology, 58(14),* 2205-2225.

[16] Baljinder Kaur (2009). *Use and impact of electronic resources in engineering and technological institutions in India.* (Unpublished Doctoral Thesis). Thapar University, Patiala.

of Technology (Delhi), Indian Institute of Technology (Roorkee), Thapar University (Patiala) and Punjab Engineering College (Chandigarh). The results of her study revealed that 57.92% of the respondents visited their library website/homepage and were aware of open access e-journals. Majority of the faculty members (77.87%) and postgraduates (91.11%) were aware of INDEST and UGC–Infonet e-journals. Majority of the research scholars (98.95%), faculty (95.38%), and postgraduates (73.24%) were using INDEST e-journals more as compared to undergraduates (20%). She found that Internet was used maximum for e-mail (90.55%), followed by Internet website (53.74%) as compared to e-journals and CD-ROM and OPAC was used by 60.77% respondents. Majority of the respondents (60.77%) expressed that Internet was a very slow process. 94.23% respondents considered training as imperative to increase the use of e-resources. The findings of her study revealed that the participants preferred to use the information in both the formats, i.e., electronic as well as print although participants expressed that the e-documents cannot replace the print documents. The results of her study indicated that there was an increase in the collection and usage of e-resources annually. She concluded that the respondents have started accepting electronic information resources for seeking information.

Kumar[17] (2010) in his paper entitled "Analytical study of information seeking behavior among agricultural scientists in Sardar Vallabhbhai Patel University of Agriculture and Technology" conducted the quantitative survey to explore the preferences of respondents concerning various formal, informal and electronic information sources of information. He found that for the teaching and research purposes, the respondents preferred journals, Internet resources and services as the most important sources of information. He further suggested that librarians should be aware of the needs of the scientists and their ways of consulting the library. The results of his study revealed that scientists visit the library frequently for the requisite information. For obtaining exact and up-to-date information, scientific journals were ranked first, while these were ranked second as far as attaining the background information is concerned. He concluded that the preferences of agricultural scientists fluctuate with the attributes of the individual agricultural scientist, nature of information required, personal knowledge and accessibility of resources.

[17] Kumar, D. (2010). Analytical study of information seeking behaviour among agricultural scientists in Sardar Vallabhbhai Patel University of Agriculture and Technology. *International Journal of Library and Information Science*, *2(8),* 164-168.

Olatokun, and Ajagbe[18] (2010) in their study entitled "Analyzing traditional medical practitioners' information-seeking behaviour using Taylor's information-use environment model" studied 160 traditional medical practitioners and found that traditional medical practice was male subjugated. The majority of the participants seek information first and foremost from informal sources, predominantly from contemporaries in the ambit of similar professional association. They further observed that low level education of the participants deprived them of access to knowledge. They further found that this knowledge could be refined and more relevant to deliver their services in the treatment/management of sickle cell anemia for the Nigerian society practitioners and finally concluded that the traditional medical practitioners should be brought into the already established organization by giving them appropriate training, facilities and back-up for referral.

Mahapatra, Swain, and Jena[19] (2010) in their article entitled "Information seeking behaviour of teachers of engineering colleges in capital city of Odisha: a case study" evaluated the information-seeking behaviour of faculty members of engineering colleges, their habit of using the libraries, their information requirements, their awareness of information system and services and the extent to which they make use of the libraries in the electronic age. They found that lending services were considered important by majority of the respondents (100%), followed by photocopy service (95.7%), keyword access was the preferred method of information access. They observed that majority of the respondents (78.87%) sought information for teaching and research and lack of time was the found as the major obstacle to information seeking by 78.87% respondents. They found that 100% of the respondents used conventional printed documents, viz., books and journals. However, majority of the faculty members used online information on daily basis (61.97%). Google was used by 100% respondents, followed by yahoo (73.24%). They finally concluded that library professionals of engineering colleges of Bhubaneswar should implement novel strategies to meet the information needs of the faculty members so that the distinction in academics is guaranteed.

[18] Olatokun, W.M., & Ajagbe, E. (2010). Analyzing traditional medical practitioners' information-seeking behaviour using Taylor's information-use environment model. *Journal of Librarianship and Information Science, 42(2),* 122-135.

[19] Mahapatra, R.K., Swain, D.K., & Jena, K.L. (2011). Information seeking behaviour of teachers of engineering colleges in capital city of Odisha: a case study. *International Journal of Library and Information Studies*, *1(1),* 16-24.

Ahenkorah-Marfo, Teye, and Senyah[20] (2011) in their paper entitled "Information seeking behaviour of faculty: the case of the College of Science, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana" found that majority of the respondents (57.1%) preferred reviewing articles, followed by Internet resources (52.8%) for seeking information. They found that 86% respondents sought information for the purpose of research work and consulted textbooks (84.3%) for information. Almost all the respondents used Google, followed by yahoo (64.3%) to access information on the Internet. ScienceDirect and Ebscohost were the most frequently used online journals. They observed three major problems being encountered by the faculty members while seeking information, i.e., 65.7% respondents cited that the information was not available, followed by information material too old (61.4%), incomplete information material (34.3%). They recommended that the faculty should be involved in selection of textbooks, library should initiate to purchase full-text articles on behalf of faculty members.

Sethi, and Panda[21] (2011) in their paper entitled "Use of e-resources by life scientists: a case study of Sambalpur University, India" investigated the awareness, and usage of e-resources, the search strategies and the information requirements of the faculty members, research scholars, M.Phil and post graduate students of life sciences at Sambalpur University. The results of their study revealed that majority of the respondents (92.18%) preferred to use e-resources, out of which more than 70% of the respondents use them for the purpose of keeping themselves up-to-date. They found that majority of the respondents preferred to use e-journals (67.18%) and e-books (54.68%) by surfing from the departmental computer laboratory, university central library, cyber café, etc. The data of their study further revealed that more than 70% of the respondents followed 'keyword' searching method, and 79.38% participants preferred to read full-text articles in 'pdf' format. Likewise, majority of the participants considered 'e-mail' and 'www' as effective means for retrieving e-resources and 'Google' was the most commonly used search engine by the respondents. The major constraint in usage of e-resources was cited as lack of training in accessing e-resources by the respondents. They

[20] Ahenkorah-Marfo, M., Teye, V., & Senyah, Y. (2011). Information seeking behaviour of faculty: the case of the College of Science, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. *Journal of Science and Technology (JUST), 31(1),* 1-16. Retrieved from http://dx.doi.org/10.4314/just.v31i1.64889

[21] Sethi, B.B., & Panda, K.C. (2011). Use of e-resources by life scientists: a case study of Sambalpur University, India. *Library Philosophy and Practice*. Retrieved from http://unllib.unl.edu/LPP/

concluded that the faculty, research scholars and students have the same perception about electronic resources, and therefore, recommended that the library should augment access to back files of e-journals, should increase subscription of e-journals, should develop and run electronic archive, and should organize training on the need of e-resources.

Maharana, Dhal, and Pati[22] (2013) in their paper entitled "Exploring the information seeking behavior of medical science professionals: a case study of Veer Surendra Sai Medical College, Burla, Odisha" investigated the awareness, use, and types of library and information resources used by the students and faculty members. They found that majority of the students (91.15%) and teaching faculty (90.74%) preferred Internet / online resources as the most convenient information channel. The faculty members preferred personal collection (85.84%), whereas students preferred library (86.11%) as an important information channel. The faculty members sought information for the purpose of publication (77.88%), whereas 100% students sought information for the purpose of study only. Internet was the most familiar resource by the respondents, followed by research articles and textbooks. OPAC was most preferred online resource and google was the most preferred search engine by the respondents. They noted that majority of the respondents were moderately satisfied with the library services.

Barki, and Kapade[23] (2014) in their paper entitled "Information seeking behavior of science faculty: a study" studied the information-seeking behaviour of faculty members in the biological departments of only science colleges in Gondia Education Society, Gondia. They revealed that majority of the science faculty preferred reference books (28.85%), followed by books (22.16%) and periodicals (15.39%). They found that the participants preferred to use reference service (4.31%) and lending service (15.39%). They observed that 32.7% respondents were using diverse search engines to access online information sources, whereas only 28.85% respondents were using e-journals for information seeking. Majority of the faculty members cited lack of time (40.39%) and lack of knowledge (12.10%) of information sources in the library as the major problem faced by them while accessing the information.

Observations Based on the Literature Reviewed

[22] Maharana, R.K., Dhal, A.P., & Pati, S. (2013). Exploring the information seeking behavior of medical science professionals: a case study of Veer Surendra Sai Medical College, Burla, Odisha. *International Journal of Information Dissemination and Technology*, *3(1),* 62-66.

[23] Barki, M., & Kapade, D. (2014). Information seeking behavior of science faculty: a study. *IOSR Journal of Humanities and Social Science (IOSR-JHSS), 19(3),* 32-34.

A review of literature shows that most of the studies on information-seeking behaviour have been undertaken in developed countries and accordingly revealed the information-seeking surroundings of such countries. However, conditions in developing countries are considerably different, and it is relatively difficult to befittingly apply data from the developed countries to them. The relevant studies showed unfamiliarity of the users with the electronic resources and their lack of knowledge for using the electronic resources. The findings of the literature also revealed the lack of adequate training and lack of vital skills amongst the users in using the electronic resources. It has been revealed that use of IT and electronic resources have improved drastically in recent years. It has also been revealed in the studies that these components are best attained with the support from effective user education programmes held by the libraries as well as guidance from the library professional staff. It is expected that the findings of this study will be useful for the information professionals to properly understand and evaluate the information needs of scientists. The findings will be relevant in augmenting library resources and services for better retrieval of information and utilization by the scientists.

Conclusion

The review in hand provides an organizing framework for current research, discusses emerging issues, and discovers future research needs and practical implications of information gathering habits. The review highlights that although there is a growing multidisciplinary literature on the theme, yet a lot more remains to be studied.

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