The Bottom Line

Status of collection in agricultural libraries of Northern India with an overview of the trend in acquisition

Nazir Ahmad Bhat, Shabir Ahmad Ganaie,

Article information:

To cite this document:
Nazir Ahmad Bhat, Shabir Ahmad Ganaie, (2017) "Status of collection in agricultural libraries of Northern India with an overview of the trend in acquisition", The Bottom Line, Vol. 30 Issue: 01, pp.23-32, https://doi.org/10.1108/BL-07-2016-0028
Permanent link to this document:
https://doi.org/10.1108/BL-07-2016-0028

Status of collection in agricultural libraries of Northern India with an overview of the trend in acquisition

Nazir Ahmad Bhat
Central Library, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar, India, and

Shabir Ahmad Ganaie
Department of Library and Information Science, University of Kashmir, Srinagar, India

Received 11 July 2016
Revised 31 January 2017
Accepted 2 February 2017

Abstract

Purpose – This paper of this study is to attempt to explore the status of collection in agricultural libraries of Northern India and assess the magnitude of impact of the advent of electronic information resources (EIRs) on the contemporary acquisition.

Design/methodology/approach – While adhering to the survey method, the questionnaire was used as a data collection tool to collect data from university librarians. Telephonic interaction and e-mail correspondence were also used to clear doubts, remove ambiguities and obtain data of higher significance from the respondents.

Findings – The majority of the agricultural libraries in Northern India have a sound collection of information resources in the print form, which may continue to act as a source of attraction for users in the future for a long time to come. Yet, the acquisition of information resources in the print form across the studied libraries continues at routine pace, and as such the advent of e-resources seems to have not yet laid any prominent impact on acquisition of resources in print form. E-Books have not yet been fully incorporated into the library collection and that e-journal collection "CeRA" (Consortium for Electronic Resources in Agriculture) seems to gratify the needs of users of these libraries, as no additional e-journals are seen to be subscribed to at present.

Research limitations/implications – Only seven agricultural libraries have been taken as a sample. Moreover, the work is confined to only two aspects, i.e. current status and the impact of EIRs on acquisition of information resources. Other aspects like those of collection development, storage and accommodation, preservation, library functionality and library services need to also be studied.

Originality/value – This is first work of its nature in Northern India with agricultural libraries as their domain. The findings will help the librarians and the library advisory committees decide on logical grounds about the proportion at which the print and electronic forms of information resources need to be acquired.

Keywords Agricultural libraries, Electronic information resources (EIRs), Impact of EIRs, Northern India, Print sources of information, Status of collection

Paper type Research paper

1. Introduction

Libraries are witnessing a continuous change in almost all aspects associated with its construct and functionality, for instance, the format of sources of information, media of storage, mechanism of communication, rendering of services, etc., as these aspects are

The Bottom Line
Vol. 30 No. 1, 2017
pp. 23-32

0888-045X
DOI 10.1108/BL-07-2016-0028

getting transformed with the passage of time. Paper, as medium of storage and communication of information, has now been in place for almost 2000 years since its invention in China in 105 CE (Carter, 1955). The nature and type of storage medium used to store and disseminate the information have witnessed a paradigm shift toward the terminal decades of nineteenth century with the invention of electromagnetic devices like that of Edison's tinfoil *phonograph* by 1877, recording disc or *gramophone* of Emile Berliner by 1888 (Courtney, 1935; Library of Congress, 2002), two-layer *magnetic tape* of Matthias (Jorgensen, 1996) and *vinyl long playing records* by 1950s (Cass, 2010). In 1884 Herman Hollerith tried to devise a mechanised means of processing, storing and retrieving the information to a different fashion by using the punch card concept of Joseph M. Jacquard (Pugh and Heide, 2013; Truesdell, 1965). At a parallel, the *electric typewriter*, invented by Thomas Edison in 1872 and improved by G. C. Blickensderfe in 1902 and Electromatics, Inc. in 1930 and finally by IBM 1935 (PBWorks, 2005), seems to be the earliest device that marked the beginning for recording the information in electronic (digital) format. The scenario got revolutionised with the advent of much compact *electromagnetic storage drives* like that of *hard disk* at IBM in 1956; *floppy disk*, invented by Alan Shugart at IBM in 1971 (Schoenherr, 2002) and finally the process got much more sophisticated with the advent of *optical storage devices*, i.e. *compact discs* (CDs) co-invented by Philips Electronics N.V. and Sony Corporation in 1980 ("Compact disc", 2016). The research on this front is going on, that is why newer and more capacious versions like that of flash drives, pen drives, digital versatile discs (DVDs), silicon chips and the like are the buzzwords of modern-day information storage and communication landscape.

This un-imaginary high-capacity and efficiency of the modern storage media allowed the publishing world to harness the benefits for the publication of information resources in electronic (both analogue/digital) forms. This has led to the emergence of *electronic information resources* (EIRs), which now go neck to neck with the traditional print information resources (PIRs). As a matter of fact, the libraries across world at present are in a transitory phase. The emergence of EIRs has started to lay an impact on the overall function of libraries including the collection development process and acquisition of information resources. At present, the libraries are observed to be hybrid in character. At the start of the electronic era, the e-resources were existing mainly as external storage devices and were usable on standalone machinery confined to a single place by a single user at a time, hence termed as *offline mode of access*. With the advancement in information and communications technology, the mode of access has improved, as EIRs are now usable across distant geographical destinations by more than one user simultaneously at a time. This is known as *online mode of access* and the resources are called as online EIRs.

2. Statement of problem

As understood from the introductory para and the review of literature, the EIRs have now been in the information landscape for more than three decades, and a paradigm shift is visualised in the medium used for storage and communication of information. Agricultural libraries of India are also witnessing a change and are in the process of adaptation to this changing environment. It is very essential *to determine status of collection and analyse the trend in collection development* across agricultural libraries of India *with regard to two formats of information resources, namely, print and electronic format*. It is in this connection that a need has emerged *to assess the proportion at which these two formats of information resources are being procured* by the agricultural libraries.

3. Objectives

The study has been conducted with following objectives under consideration:

- To explore the present status of collection in agricultural libraries of Northern India.
- To understand the trend with regard to proportion at which the print and electronic formats of information resources are acquired.

4. Scope

The scope of the study has been confined to agricultural libraries of Northern India. Only main sources of information, namely, books, journals and theses, have been taken as the entities of investigation for assessing the status and analysing the trend with regard to the proportion at which the two formats (print and electronic) are procured at present. Data pertaining to the time period of 2009-2010 to 2013-2014 (financial years) are under study.

5. Review of literature

This section tries to throw light on the works conducted about the theme under study and thus bring about a picture with regard to the status of collection in agricultural libraries of India.

Despite rigorous efforts, the investigator could not find any literary works which would reveal the status of the offline EIRs in Indian academic libraries. This reveals that either the collections of offline category of electronic resources are not prominently available in Indian academic libraries or, despite their existence, they had not had any remarkable impact on libraries and the users. On the other hand, the researchers do not seem to have considered it as a matter of their optimum research interest. Gowda and Shivalingaiah (2009) at least have touched the topic by reporting that among university libraries of Karnataka micro documents such as microfiche and micro-films were found only in two libraries.

The electronic abstract databases like that of AGRIS, AGRICOLA, FSTA and CAB Abstracts commonly known as CDROM databases were the first and foremost EIRs introduced in the agricultural libraries of India. With the passage of time, more and more e-resources are being incorporated into the collection of these libraries. Agricultural libraries of India have started to avail the e-resources made available by various networks like that of INFLIBNET, ARISNET, etc. The users across these libraries are seen to use the online catalogues like that of local OPACs, or WorldCat of OCLC, etc. But it has been found that *agricultural libraries of India* are yet operating in a *hybrid mode* as they possess information resources both in print and electronic form and are rendering their services both through print and electronic means (Lal, 1998; Rokade and Rajyalakshmi, 2006). While analysing the present status of agricultural information systems, Patil (2011) put forth his opinion that "India does not have anything to be called an agricultural information system (AIS). Also, there is no organised effort to co-ordinate, collect, collate and disseminate agricultural information in India." However, ICAR has been taking initiatives to bring the agricultural information systems closer to, if not at par with, the libraries of general-type academic universities. Work has been done both on the fronts of developing the infrastructure and enriching the information resources in print and in electronic formats. This has lead Singh and Chikate (2014) to realise that the Indian agricultural libraries are now making a transition to the era of collaboration and digitisation to provide proficient retrieval systems and access to faster information around the clock. World Bank-aided projects like that of NATP (1998) and NAIP (2006)

and the implementing authority of these projects, i.e. ICAR, played a vital role in developing the required infrastructure, digitizing the content and acquiring adequate number of quality information resources in agricultural libraries of India. It is because of these efforts that the libraries of Indian agricultural universities/research institutes are able to provide access to full text of around 3,000 e-journals of premier publishers of the world through Consortium for Electronic Resources in Agriculture (CeRA), are able to subscribe to some e-books on an individual basis like CABI e-Books, have started to gain state-of-the-art visibility over Web through the development of a union catalogue of their resources over OCLC platform under e-Granth project, are building institutional repositories and have established a national repository of Doctoral Dissertations and the like (Bhat, 2016).

6. Methodology

Keeping in view the nature of problem, the survey method was adopted to conduct the study and questionnaire was used as a data collection tool. The questionnaire was served only to the university librarians. Telephonic interaction and e-mail correspondence was also resorted to in order to seek clarifications, remove ambiguities and obtain data of higher significance from the respondents.

6.1 Sampling

In light of the classification of Indian states made by *mapsindia.com*, Northern India was considered to comprise seven states, namely, Delhi, Haryana, Himachal Pradesh, J&K, Punjab, Uttarakhand, Uttar Pradesh. While adhering to cluster sampling technique, four out of seven clusters were taken in hand for study as a representative sample. The four states, namely, Delhi, Himachal Pradesh (HP), Jammu & Kashmir (J&K) and Punjab, were selected randomly as a sample for investigations. It was found that seven well-established agricultural universities exist in four selected states of Northern India, two in each state except Delhi, where only one agricultural university exists. All the seven universities were selected for study. The list of the seven selected universities is as given in Table I.

6.2 Tools and tests

The data collected through the survey have been processed with the help of Statistical Package for Social Science (SPSS). To convert the data into meaningful information and draw necessary inferences on scientific grounds, the data about each entity was codified into

Table I.
Detail of universities taken as sample for study

Sr. No.	Name of university	University code	State
1	Indian Agricultural Research Institute, New Delhi	IARI	Delhi
2	Chowdhury Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur	CSKHPKV	Himachal Pradesh
3	Dr Y.S. Parmar University of Horticulture and Forestry, Nauni-Solan	DYSPUH&F	Himachal Pradesh
4	Sher-e-Kashmir University of Agricultural Science & Technology of Jammu, Jammu	SKUAST-J	Jammu & Kashmir
5	Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Srinagar	SKUAST-K	Jammu & Kashmir
6	Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana	GADVASU	Punjab
7	Punjab Agricultural University, Ludhiana (Punjab)	PAU	Punjab

meaningful numerical and alphabetical codes. The values were entered in the form of standardised codes to avoid misinterpretation and spelling errors. The collected data were analysed to be of *nominal* type, and the variables were judged to be *independent* in nature as opposite to *paired* type, and it is also evident that *more than two groups* are under investigations. Moreover, the application of *Shapiro–Wilk's Normality Distribution Test* indicated that the data are *not normally distributed*. Keeping these facts in view, *chi-square* (χ^2) *test* was found to be appropriate and applicable for substantiating the level of significance of the derived facts and for determining the association among the variables on scientific grounds.

7. Data analysis and interpretation

The questionnaire, designed to collect information about the proportion at which the North Indian agricultural libraries have procured the print and electronic sources of information, was administered to all the seven sample libraries. The data are analysed and interpreted under the following headings:

- print form of information resources; and
- EIRs subscribed.

7.1 Print information resources

The libraries were asked to furnish detail about the volumes of information resources existing with them under four main categories. The number of volumes in each of the library under each category is presented in Table II.

It is evident from Table II that all of these universities have more than 10,000 books, four have above 50,000 books and even two libraries have more than 100,000 books. PAU, with 248,041 books ranks as number-one university, followed by IARI library with 104,500 books. GADVASU, the youngest university in the list, possesses the lowest number of books (15,500). In total, 545,025 books are available in these seven libraries.

The collection of theses in the Agricultural Libraries of India comprise Master- and Doctoral-level dissertations. In total, 72,275 theses are present in libraries under the scope of the present study. The PAU has the highest number of theses (37,127), again followed by IARI library with 23,500 theses. GADVASU with only 1,156 theses ranks last in the list.

Table II further reveals that even at present, a good number of journals are subscribed in print form by selected North Indian agricultural university libraries. These journals include both Indian and foreign tiles. All except one of these libraries subscribe to more than 100

Table II.
Status of collection of information resources in print format

Sr. No.	University code	Year of establishment	No. of books	No. of theses	No. of journals, current	No. of journals, backfile
1	CSKHPKV	1978	54,183	4,285	175	29,362
2	DYSPUH&F	1984	46,114	4,404	100	17,037
3	GADVASU	2006	15,500	1,156	19	4,021
4	IARI	1905	104,500	23,500	488	350,000
5	PAU	1972	248,041	37,127	178	103,623
6	SKUAST-J	1999	26,502	638	102	10,735
7	SKUAST-K	1982	50,185	1,165	144	19,000
Total			545,025	72,275	1,206	533,778

journals. IARI subscribes to the highest number of journals i.e. 488 (350 Indian and 138 foreign), followed by PAU with 178, and CSKHPKV with 175 journal titles. This way, a treasure of primary information in shape of the backfile collection of Indian and foreign journals has been accumulated in these libraries. In total, 533,778 backfile volumes of Indian and foreign journals exist in seven responding libraries. IARI has the maximum number of backfile volumes (350,000), followed by PAU (103,623).

This indicates that agricultural libraries of Northern India at present have a rich information base in the print form, which shall act as a source of attraction for its users in future for a long time to come.

7.1.1 Acquisition of books in print form. To assess the current status about acquisition of print form of books and see if the advent of e-resources has had any impact on such acquisition, the librarians of the selected set of libraries were asked to provide information about the number of books purchased by them from 2009 to 2013. Only six out of the seven selected libraries provided the information, which is presented in Table III.

It is evident from Table III that, in total, 48,243 books have been procured by six respondent libraries during the five years at an average of 1,608 books per library per year. All libraries, except one, are seen to acquire an average of more than 1,000 books per annum. PAU is the only library which on average purchased more than 3,000 books per annum. This is followed by SKUAST-J and SKUAST-K, with an average annual procurement of 1,829 and 1,730 books, respectively. In other words, we can say that procurement of print form of books continues without any influence from advent of e-resources. *It is also statistically observed that the number of books procured in print form varies significantly from year to year and from library to library ($p < 0.01$).*

The overall trend in vogue across agricultural libraries of Northern India, regarding the procurement of print form of books during 2009-2013, is displayed in Figure 1.

It is evident from Figure 1 that the number of books purchased by these six libraries from year to year is not uniform, i.e. it is sometimes increasing and sometimes decreasing.

7.1.2 Acquisition of journals in print form. The selected set of libraries was also asked to share information about the number of journals purchased from 2009 to 2013, with a purpose to assess the current status about the subscription of the print form of journals and see if there is any impact on this subscription due to the emergence of e-resources. Six out of seven libraries responded to the query. The response of the libraries in this regard is presented in Table IV.

Table III.
Number of books acquired in print form during 2009 to 2013

University	2009	2010	2011	2012	2013	Average No.	Rank
PAU	3,038	1,307	4,708	2,911	4,483	3,289	1*
SKUAST-J	2,809	1,983	953	1,566	1,834	1,829	2
SKUAST-K	2,022	1,120	912	1,690	2,907	1,730	3
CSKHPKV	405	797	2,203	1,383	997	1,157	4
DYSPUH&F	1,421	355	659	1,034	1,747	1,043	5
IARI	380	502	602	710	805	599	6
Total	10,075	6,064	10,037	9,294	12,773	48,243	
Average	1,346	844	1,606	1,382	1,962	1,608	

$\chi^2 = 5{,}425.90$; df = 20; $p < 0.01$

Note: *Rank has been derived on the basis of the average number of books acquired during five years

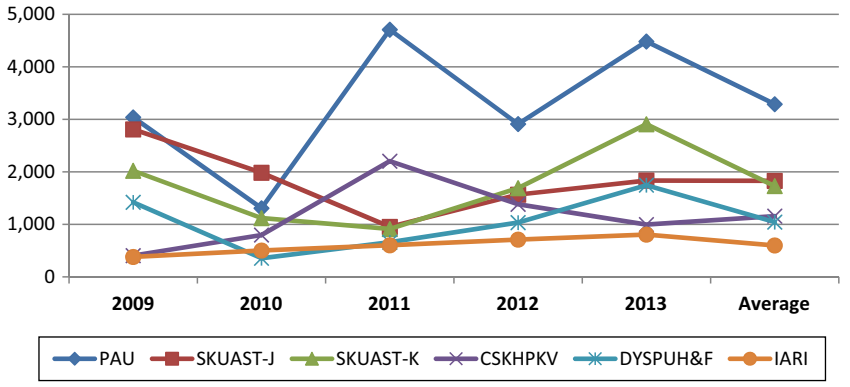

Figure 1. Trend regarding acquisition of print books - 2009 to 2013

University code	2009	2010	2011	2012	2013	Average	Rank
IARI	343[a]	256	290	304	211	281	1[b]
PAU	349	353	289	222	216	286	2
SKUAST-J	188	163	34	86	21	98	3
SKUAST-K	83	88	90	70	63	79	4
DYSPUH&F	130	51	100	105	100	97	5
CSKHPKV	175	175	175	175	175	175	6
Average	211	181	163	160	131	169	
Total	1,268	1,086	978	962	786	1,016	

$\chi^2 = 241.96$; df = 20; $p < 0.01$

Notes: [a]Number of journals subscribed to by a particular library in a particular year; [b]rank has been derived on the basis of the average number of journals subscribed during five years

Table IV. Number of journals subscribed in print form during 2009 to 2013

It is evident from Table V that each library, on average, purchased 169 journals per year. Two libraries (IARI and PAU) are observed to have purchased more than 200 journals on average in a year followed by CSKHPKV with 175 journals. The remaining three universities on average have purchased below 100 journals per year. The average acquisition of journals made during these five years shows that the number of journals acquired is steadily decreasing each year, as it was 1,268 in 2009 and has come down to 786 journals only in 2013. *The result of chi-squared*

Sr. No.	University code	No. of e-books	No. of e-journals	No. of e-theses
1	CSKHPKV	610	1,800	0
2	DYSPUH&F	0	0	0
3	GADVASU	20	0	0
4	IARI	0	0	0
5	PAU	70	74	355
6	SKUAST-J	625	0	0
7	SKUAST-K	750	1,807	0

Table V. Collection of information resources subscribed in electronic format

test indicates a statistically significant variation in the number of journals subscribed by the individual universities in print form during 2009 to 2013 ($p < 0.01$).

7.2 Electronic information resources

Data regarding three main EIRs, namely, e-books, e-journals and e-theses subscribed to by the respondent libraries, were collected through an open-ended question and is presented in Table V.

It is clear from Table V that four of the seven surveyed libraries subscribe to e-books. SKUAST-K (750), SKUAST-J (625) and CSKHPKV (610) prove to be the three leading universities with regard to procurement of e-books. PAU and GADVASU have procured only a set of 70 and 20 e-books, respectively. IARI and DYSPUH have not yet purchased any e-book collection. Majority of the respondent libraries (57 per cent) do not subscribe to any of e-journal collections. Only one of the respondent libraries, i.e. PAU, subscribes to 355 e-theses.

As per information provided by the libraries, the CSKHPKV and SKUAST-K subscribe to *J-Gate Agricultural and Biological Sciences* (*JABS*), a metadata discovery service of +1,800 e-journals not covered by CeRA. PAU subscribes to 74 e-journals. SKUAST-K also reports to provide access to seven highly reputed e-journals covered neither in CeRA nor in JABS, under Free Online Access against Print (FOAP) category.

7.2.1 Availability of electronic journals on consortia basis. Information about EIRs available on consortia basis was sought through a close-ended question with an option to choose from five scientific consortia-based e-journal collections commonly used in India. The response of users in this regard is presented in Table VI.

It is evident from Table VI that all the seven respondent libraries avail the e-journal collection viz, CeRA, which provides them online access to full-text content of more than 3,000 journals with high reputation in the field of Agricultural and Biological Sciences. It is obvious from the table that CeRA seems to fully gratify the needs of users of these libraries, which is why a majority of them are not seen to subscribe to or participate in any other consortia.

8. Findings

It is quite obvious from Table II that the *majority* of the agricultural libraries in Northern India have a sound collection of information resources in the *print form*, comprising 545,025 books, 533,778 volumes of journals, 72,275 theses, etc. The size of the print collection *varies significantly from library to library*. It is also obvious that the *number of books, journals and theses is directly proportional to the age of a particular library*, which means that older the library, higher is its collection.

Table VI.
E-Journals available on consortia basis

Sr. No.	University code	CeRA	ERMED	JUGCI	HELINET	INDEST
1	CSKHPKV	Yes	No	No	No	No
2	DYSPUH&F	Yes	No	No	No	No
3	GADVASU	Yes	No	No	No	No
4	IARI	Yes	No	No	No	No
5	PAU	Yes	No	No	No	No
6	SKUAST-J	Yes	No	No	No	No
7	SKUAST-K	Yes	No	No	No	No

So far as the acquisition of print books is concerned, Table III indicates that *the acquisition of books in the print* form across the libraries under scope of present study *continues at routine pace*. As such the *advent of e-books* seems to *have not yet had any prominent impact* on the acquisition of *print books* as on average 1,608 books have been found to be acquired in the print form each year (2009-2013) by each library. It is understood from the existing size of collection and continuity in acquisition of print books that *agricultural libraries of Northern India have a rich information base in the form of print books*, which is still growing and shall continue to act as a source of attraction for users in the future, for a long time to come.

It is also evident from the Table IV that *the purchase of journals in print form still continues* without any break or without any decrease in their number. The table also show that each library on average *purchases 169 journals* per year. These findings are similar to the findings of Kumar (2012) who reveals that the developing countries like India, even at present, tend to maintain a major part of their collections in print format.

Table V depicts that *the majority of the agricultural libraries in Northern India* (57.14 per cent) *are still not procuring e-books*, as only one e-book collection (CAB eBooks) comprising mere 650 book titles that too of a single societal publisher (CABI) is recorded to be purchased by only three of the universities under the scope of the present study. It implies that whatsoever *budget* is available for the purchase of books, it *is preferably used to procure print books* and the electronic books are still given only second priority. This is contrary to the situation traced across developed countries, which have started to spend increased proportion of their budget on subscription of full-text e-databases, e-books and e-journals either on individual basis or in packaged form (Collins, 2011). Chan (2012), reported that the "University of Hong Kong library has increased its expenditures on e-books, while decreasing spending on print monographs by more than five percent and forecasted that the projected spending on e-books is expected to rise from 20 percent to 45 percent in the next five years." In this regard, Fooladi *et al.* (2011) also forecasted that scholarly and professional e-books sale is going to double from 2010 to 2013 at the expense of sale of print books. The findings of present study, however, indicate that this will not happen in the near future in India, particularly in the domain of agricultural libraries.

So far as the subscription of e-journals is concerned, *the libraries seem to be in a position to meet the requirement of their users through the e-journals available at CeRA platform* and *thus are not interested to subscribe to any additional e-journals* of their own (Table VI). Although two libraries are seen to subscribe to *JABS* available against a nominal annual renewal subscription fee of Rs. 85,000 only, this again is merely an indexing and abstracting service subsidiary to CeRA, and is not a full-fledged e-journal collection of distinction.

9. Suggestion

The libraries must conduct regular usage analysis to adjudicate the quantum of use individually for both print and EIRs and decide about the proportion at which these two formats of information are acquired. Need is also felt to explore the reasons why the acquisition of e-books is low and why the libraries do not subscribe to more full-text e-journals in addition to the ones available on the CeRA platform.

References

Bhat, N.A. (2016), "Electronic resources in agricultural libraries of northern India: usage and impact", Unpublished doctoral dissertation, The University of Kashmir, Jammu and Kashmir.

Cass, T.L. (2010), "A short history of gramophone", The Museum of Technology available at: www.museumoftechnology.org.uk/stories/grams.html (accessed March 15, 2016).

Chan, G. (2012), "A sustainable e-book purchase model: a successful partnership", in Delory, C. (Ed.), *Library Connect Newsletter*, Elsevier, San Diego, CA, p. 4.

Compact disc (2016), Encyclopædia Britannica, available at: www.britannica.com/technology/compact-disc

Courtney, B.H. (1935), *The Gramophone Record*, Ernest Benn, London.

Fooladi, P., May, N. and Worlock, K. (2011), *Worldwide E-Books, Market Size and Forecast Report 2009-2013*, Outsell, Burlingame, CA.

Gowda, V. and Shivalingaiah, D. (2009), "Attitude of research scholars towards usage of electronic information resources: a survey of university libraries in Karnataka", *Annals of Library and Information Studies*, Vol. 56 (September), pp. 184-191.

Jorgensen, F. (1996), *The complete handbook of magnetic recording*. TAB Books, New York NY.

Kumar, S. (2012), "Impact of internet search engines on OPAC users: a study of Punjabi university, Patiala (India)", *Program: electronic library and information systems*, Vol. 46 No. 1, pp. 56-70, doi: 10.1108/00330331211204566.

Lal, C. (1998), "Growth of agricultural libraries in India in post-independence era", *DESIDOC Bulletin of Information Technology*, Vol. 18 No. 2, pp. 13-20.

Library of Congress (2002), *Emile Berliner and the Birth of the Recording Industry*, Library of Congress, Washington, DC, available at: https://memory.loc.gov/ammem/berlhtml/berlhome.html (accessed 15 March 2016).

Patil, T.M. (2011), "National information system for agricultural science in India", *International Referred Research Journal*, Vol. 3 No. 25, pp. 7-8.

PBWorks. (2005), "Who invented the first electric typewriter?" available at: http://typewriters.pbworks.com/ (accessed March 16, 2016).

Pugh, E.W. and Heide, L. (2013). "Early punched card equipment: 1880-1951", *Proceedings of the IEEE*, Vol. 101 No. 2, pp. 546-552.

Rokade, S.M. and Rajyalakshmi, D. (2006), "Evaluation of electronic information services in agricultural university libraries in Maharashtra: A study". *In Proceedings of 4th International Convention CALIBER-2006*, Gulbarga, 2-4 February, 2006 (pp. 453-460). Ahmadabad: INFLIBNET Centre.

Schoenherr, S. (2002), *The History of Magnetic Recording*, Audio Engineering Society, University of San Diego, available at: www.aes.org/aeshc/docs/recording.technology.history/magnetic4.html (accessed March 15, 2016).

Singh, N. and Chikate, A. (2014), "Transformation of Indian agricultural libraries in a digital and collaborative era: a case study", *Agricultural Information Worldwide*, Vol. 6, pp. 147-156.

Truesdell, L.E. (1965), *The development of punch card tabulation in the Bureau of the Census, 1890-1940*: With outlines of actual tabulation programs. U.S. G.P.O, Washington, D.C.

Corresponding author
Nazir Ahmad Bhat can be contacted at: bhatnazeerahmad@gmail.com