

ADOPTION OF OPEN SOURCE SOFTWARE BY THE LIBRARIANS OF PRIVATE MANAGEMENT INSTITUTIONS IN NOIDA AND GHAZIABAD REGION: A GENDER BASED ANALYSIS

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ABSTRACT

This paper is a comparative study of gender-based variation in adoption of commercial or open source software among private business management institutions libraries of Noida including Greater Noida and Ghaziabad region, India. A structured questionnaire was administered among libraries of 103 institutions that run management programs in these two regions as per the details extracted from AICTE website (<https://aicte-india.org>). However, it turned out that a few of these institutions had either stopped management programs due to lack of students or they removed librarians during Covid-19 period and finally researcher got responses from 69 institutions consisting of 18 female and 51 male librarians. The current study looks in to 1) adoption of commercial or open source software by respondents, 2) reasons for choosing a particular type of software; 3) gender-based satisfaction level difference with chosen software; and 4) if there was a positive migration from commercial software to open source software among respondent libraries of private business management. Findings of this study showed that librarians of both genders had migrated to open source software from commercial software but vice versa did not happen. Easy availability and easier customization, low cost, community support were the main reasons for growing adoption of open source software. Female respondents were also satisfied and willing to explore open source software like male librarians though they were facing certain barriers in using open source software.

Keywords: *Library Software, Commercial Software, Proprietary software, Open Source Software, Comparative Study, Gender-based Study, Business School, Business School libraries, Management libraries*

1. Introduction

In 1980's, United Nations Educational, Scientific and Cultural Organization (UNESCO) introduced CDS/ISIS as a free software. (librarianship.com, 2017). LibSys was the first major commercial software launched in India in 1980's. Though other software were also launched but LibSys became the numero uno standard for library automation in India. National Informatics Centre, Government of India developed and launched e-Granthalaya as a complete Integrated Library Management Software built on open source platform for government and semi-government libraries ([\[egranthalaya.nic.in\]\(http://egranthalaya.nic.in\)\). NewGenLib was a hybrid model software developed in India by Versus Solutions Ltd., with help of Kesavan Institute of Information and Knowledge Management, Hyderabad in 2005 \(<http://www.verusolutions.biz/web/>\).](https://</p></div><div data-bbox=)

Open source software (OSS), as an alternative form of software development and distribution emerged a strong contender of commercial software during last twenty-five years after Bruce Perens and Eric S. Raymond set up Open Source Initiative (OSI) in California in 1998 (<https://opensource.org/>). It gave rise to various open source communities, which contributed in collaborative development of

various open source software for different purposes. Open source software developers had freedom to offer their software either free or for a cost but as per the license conditions of OSS they would made available its source code along with the software for anyone to further develop and redistribute without any restriction.

Use of open source software gradually penetrated in libraries due to many advantages it carried like free or low cost, easy licensing terms and conditions, no or low AMC costs, no restrictions in making changes in software and adding new features as per local needs due to availability of source code. Like other developed nations, many libraries in India too shifted to using open source software junking proprietary /commercial software earlier used in their libraries. However, not all libraries adopted open source software. Still, a very large number of libraries rely on known and popular commercial software and do not want to test or migrate to open source software.

High cost of commercial software, their licensing terms, maintenance costs and no access to the software code for trying to develop any alternative using the basic code are matter of concerns for libraries. These concerns affect more to private institutions' libraries with no government funding. These concerns should be of utmost importance to librarians irrespective of their gender, however, it is noticed that more male than female librarians adopt open source software for their libraries.

Female participation in software development has remain an area of concern as stipulated in many studies. Though library profession is not hostile to females rather people consider it as one among the safest career option to them but it is a fact that there are still lesser females in higher positions in libraries comparing to their male counterparts (Dasgupta, 1998). Female librarians still face multiple constraints at workplaces and hence they normally become risk-averting employees. Current study has made a comparative analysis of gender-based adoption of

commercial or open source software among librarians of private business management educational institutions in Noida and Ghaziabad region of Uttar Pradesh, India.

2. Review of Literature

Majority of the libraries world over use computer software for different functions of the libraries in current times. Libraries earlier had limited choices in terms of choosing library software, as only commercial software were available for libraries. With emergence of free software and set up of Free Software Foundation by Richard Stallman in 1985, libraries got option of choosing free software if they wished so. Free Software were available for free usage with their source code. They got a better choice after setting up of Open Source Initiative, a non-for-profit organization that defined open source software, developed open source standards and provided business model for open source software (OSS). They defined easy licensing conditions for distribution of open source software with source code for redevelopment and redistribution. While free software was more about philosophy, open source software offered a business model for marketing open source software. Libraries got choice of choosing either commercial of open source software after emergence of open source software for libraries. It was worth noting that open source software did not mean free software, it primarily meant availability of source code for further modification and even redistribution without any hindrance.

In past researchers conducted a number of studies on open source software (OSS) and made comparison with commercial software. Researcher found large number of studies related to history and development of free and open source software, commercial versus open source software, advantages and disadvantages of each type of software, similarity of open source software and library philosophy, licensing models of open source software, commercial versus open source software, and open source software for different functions of the libraries.

However, researchers in the past conducted very few studies on librarians' gender impact on choosing software for different functions of the libraries. Very few researchers studied adoption or non-adoption of open source software by female librarians and reasons behind the same. The scant literature available on this aspect was also highly generalized in the nature focusing on female participation in software industry in general. No one conducted a study to determine if librarians were moving from commercial to open source software or vice versa.

For current study, the researcher looked into all major databases including Ebsco, Emerald, J-Gate Social and Management Sciences and leading library science journals both in print and online format to collect and reviewed earlier studies related to these issues to some extent.

Researcher found following past studies related to the current study:

2.1. Gender Bias in Open Source Software Industry

Lie (ed) (2003) in the edited book described in detail how females were still in minority in Information Technology industry. Powell and Hunsinger (2010) discussed strong gender bias in OSS field. Terrell et al. (2017) also found a strong gender bias existing in open source software developers' teams. Lin and Besten (2018), in their study described how the software field was a male dominated industry citing male sociability as the main reason. This study called for a gender-neutral and female-friendly atmosphere in the workplace. The barriers for women in joining the software developers' community was discussed by Ford et al. (2016). Various barriers in open source software industry has been discussed by Mendez et al. (2018) particularly gender bias and they concluded that strong gender bias existed in the open source software industry.

Studies by David and Shapiro (2008) and Robles et al. (2014) identified women representation in open source software domain was not even one-tenth of their total

strength in computers field. Ghosh et al. (2002) mentioned that hardly 1.1 percent women were participating in open source software development in comparison to 98.9 percent men. Breanden (n.d.) found that even in large corporations, technical roles were assigned to a very few women only. He observed that women had double attrition rate than men in tech industry.

Nafus et al. (2006) described why open source software development was not popular among women. Faulkner and Lie (2007) suggested ways for inclusion of more women in to the ICT profession and called for curbing their marginalization after inclusion. Low representation of women in the developers' community was identified by Ford et al. (2017) and suggested increasing interaction between both genders' members to contribute more meaningfully. Ortu et al. (2017) too suggested that gender could play a significant role increasing productivity of a developers' community.

Vedres and Vasarhelyi (2018) felt that disadvantage to women was due to gendered behavior i.e. what work they did at workplace rather than a categorical disadvantage because of who they were. Mars (2018) found gender based wages differentiation among libraries and bias against women in libraries. Mendez et al. (2018) study found that there were significant barriers against women in open source software communities including social, cultural, tools and infrastructure.

Mendez et al. (2018) suggested women entering to OSS community needed to break glass ceiling to break through and contribute in open source software development. NASSCOM (2020) study found that in India IT industry, women constituted 35 percent of total workforce and in new job hiring women share reached to 43 percent. Women representation as start-up founders increased to 10 percent and women presence in leadership roles was on rise.

Singh (2019) found underrepresentation and unfair treatment of women in the open source software industry and called for developing a 'Codes of conduct' for the open

source community ensuring a welcoming collaborative environment for women. Singh and Bongiovanni (2021), studying women's experience in open source software found that women were facing judgement at every stage in OSS industry and called for developing codes of conduct for OSS communities and stressed need for mentoring women. Gender bias persisted in open source software and there was lack of diversity in OSS projects, found by Trinkenreich et al. (2021).

2.2. Proprietary versus Open Source Software Choice

A comparison of commercial versus OSS adoption in Germany, Brazil and India for government, education and corporate sector was studied by Richter et al. (2009), and found open source software was a better option.

Kamau and Namuye (2012) observed that proprietary software was still preferred among African countries and no policy existed regarding open source software adoption. In Kenya most of the libraries were using locally developed or commercial software and only a handful of the libraries have adopted or implemented open source software as reported by Amollo (2013). Kasaine and Khamadi (2018) study analyzed highest influence of organizational size on the adoption of open source software in higher educational institutions in Kenya. Kumar et al. (2018) observed proprietary software were still thriving and free and open source software (FOSS) had not been adopted as expected however, FOSS adoption in business enterprises were on significantly rise in India.

Each model of software had its advantages and disadvantages, mentioned by Picincu (2019) and it depended upon users' needs which model would be more suitable. A survey done by Chigwada (2020), found that most libraries had adopted open source software to provide quality library services after upgrading their skills by attending skills development programs. A joint study by Okuonghae and Idubor (2020) found that use of open source software among universities libraries of Nigeria was quite high.

Muhammad et al. (2022), in their paper observed that there was cost reduction in library expenses by adopting open source software.

2.3. Reasons for Use of Open Source Software

Choosing open source software over commercial software was offering independence and innovation to all category users according to Richter et al. (2009). Yaseen and Bahari (2014) listed cost, size of the organization, management support and better technology as the factors motivating open source adoption. Staff shortage and users' resistance to change were barriers in OSS adoption (Yaseen and Bahari, 2014).

Baharuddin et al. (2018) felt that organization competitive edge by making continuous improvement in open source software as per their needs was the reason behind open source software adoption in any organization. Okuonghae and Idubor (2020) observed apathy of the library staff, lack of the work force, lack of supervision, lack of technical knowledge among staff; no adequate training and high hardware cost as leading factors affecting use of open source software.

Researcher did not find any single study that covered librarians migrating from commercial to open source software or vice versa, female versus male librarians' perception towards OSS adoption and OSS advantages in comparison to commercial software (CS). Thus, there exists a need to study software migration trends among librarians, satisfaction level of librarians with each type of software and comparing gender-based variation in using the different types of software.

3. Objectives of the Study

The current study tried to look into the trends regarding use of commercial or open source software among libraries of private sector business management educational institutions of Noida and Ghaziabad region to determine if commercial or open source was the preferred choice of the software among

selected institutions. It looked into gender-based preferences in choosing a software and reasons behind the same. It also undertook to find if respondent librarians migrated from commercial software to open source software or vice versa.

The current study, therefore, has the following specific objectives:

1. To determine adoption level of commercial or open source software by librarians of the selected institutions;
2. To find out the satisfaction level of librarians with each type of software;
3. To compare the gender-based variations in satisfaction level among librarians with each type of the software;
4. To explore whether librarians migrated from commercial software to open source software or vice versa.

Outcome of this study would suggest which software would be better to adopt by other libraries taking clues from success or failure of experience of the libraries of private business management educational institutions of Noida and Ghaziabad region. Further this study may help policy makers adopting suitable measures to overcome the associated problems faced by the libraries in choosing library software.

4. Hypotheses of the Study

The study proceeded with the following hypotheses:

H1: Adoption level of open source software was growing among librarians of private business management educational institutions in Noida and Ghaziabad region.

H2: Librarians of private business management educational institutions in Noida and Ghaziabad region had better perception for open source software than commercial Software.

H3: Gender bias existed among librarians of private business management educational

institutions in terms of satisfaction level with each type of library software.

H4: There exist a positive migration movement from commercial software to open source software among librarians of private business management educational institutions in Noida and Ghaziabad region.

5. Methodology

The data was collected from the All India Council for Technical Education (AICTE) website. Information regarding 103 private universities or institutions offering management education in these two regions were taken from AICTE website (<https://aicte-india.org/>). First of all, the authors reviewed existing literature related to the topics under study. A population of entire 103 private sector universities or institutions of these two regions offering at least one program in management was chosen to administer a structured questionnaire. The respondents were librarians of those institutions. The authors sent the questionnaire through courier to all these libraries and even e-mailed the same in soft copy to respondents. In case of no response, the authors made personal visits also to those institutions to get maximum response.

It is found that a few of the institutions had stopped offering management programs any more due to lack of students. Few librarians refused to share the data in spite of multiple assurances that the data will be used only for academic purposes. It was a shocking revelation that a few institutions had forced their librarians to leave during COVID-19 peak and nationwide lockdown. Finally, out of 103 questionnaires, researcher got only 81 responses, but after checking for duplication and completeness of the data, the authors found 69 valid responses (67% response rate). The researcher approached librarians who did not provide complete information or did not respond but in vain.

The data was tabulated as per SPSS format and interpreted using Excel and SPSS software (Version 20). Researcher determined reliability of the data by applying Cronbach

Alpha reliability test, developed frequency tables using percentage analysis, used differential analysis and applied Chi-square test and determined p-value of significance to check relationships among variables and to accept or reject the hypotheses. Extensive use of tables are made to represent the output data and for visualization of the results.

6. Data Analysis and Interpretation

The researcher conducted reliability analysis on the collected data. The Cronbach's alpha values of the constructs generated above 0.7 values thereby displaying high-

internal consistency reliability meaning by suitable for further analysis.

6.1. Response Details

6.1.1. Details of Responded Institutions

Table 1 provides details of the responded institutions, their location - Noida/Greater Noida or Ghaziabad, librarian's gender and if they were using any software for their libraries or not. Researcher clubbed Noida and Greater Noida together as Noida only for data analysis, as Greater Noida was an extension of Noida only.

Table 1
Details of Responded Institutions and Gender of Librarians

Name of the Institute	Region	Gender	Software use in Library (Yes/No)
Babu Banarsi Das Institute of Technology	Ghaziabad	Female	Yes
H.R.C.T. Group of Institutions	Ghaziabad	Female	Yes
Institute of Management Studies, Ghaziabad	Ghaziabad	Female	Yes
Institute of Professional Excellence & Management	Ghaziabad	Female	Yes
R. D. Engineering College	Ghaziabad	Female	Yes
Raj Kumar Goel Institute of Management	Ghaziabad	Female	Yes
SRM University	Ghaziabad	Female	Yes
ABES Engineering College	Ghaziabad	Male	Yes
Adhunik Institute of Productivity Management & Research	Ghaziabad	Male	Yes
Ajay Kumar Garg Institute of Management	Ghaziabad	Male	Yes
Aryan Institute of Technology, Ghaziabad	Ghaziabad	Male	Yes
Bhagwati Institute of Professional Studies	Ghaziabad	Male	Yes
Centre for Management Development	Ghaziabad	Male	Yes
CHRIST University	Ghaziabad	Male	Yes
Dr. K.N. Modi Institute of Engineering and Technology	Ghaziabad	Male	Yes
Hi Tech institute of Engineering and Technology	Ghaziabad	Male	Yes
I.T.S School of Management	Ghaziabad	Male	Yes
Institute of Advanced Management & Research	Ghaziabad	Male	Yes
Institute of Management and Research	Ghaziabad	Male	Yes
Institute of Management Technology	Ghaziabad	Male	Yes

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Integrated Academy of Management and Technology	Ghaziabad	Male	Yes
Jaipuria Institute of Management	Ghaziabad	Male	Yes
Jaipuria School of Business, Ghaziabad	Ghaziabad	Male	Yes
JMS Group of Institutions	Ghaziabad	Male	Yes
KIET Group of Institutions	Ghaziabad	Male	Yes
Ramesh Chand Institute of Management(RCIM)	Ghaziabad	Male	Yes
Sanskar Group of Institutions	Ghaziabad	Male	Yes
Saraswati Institute of Engineering & Technology	Ghaziabad	Male	Yes
Seth Jaiprakash Mukandlal Polytechnic	Ghaziabad	Male	No
Sunder Deep Group of Institution	Ghaziabad	Male	Yes
Unique Institute of Management and Technology	Ghaziabad	Male	Yes
Vishveshwarya Group of Institutions	Ghaziabad	Male	Yes
Accurate Institute of Advanced Management	Noida	Female	Yes
Birla Institute of Technology, Mesra, Extension Center Noida	Noida	Female	Yes
Centre for Development of Advanced Computing, Noida	Noida	Female	Yes
Gautam Buddha University	Noida	Female	Yes
Greater Noida Institute of Technology	Noida	Female	Yes
Greater Noida Institute of Technology	Noida	Female	Yes
Institute for Integrated Learning in Management (Graduate School Of Management)	Noida	Female	Yes
International Institute of Management	Noida	Female	Yes
NTPC School of Business	Noida	Female	Yes
Symbiosis Centre for Management Studies Noida	Noida	Female	Yes
Vivekanand Institute of Technology and Science	Noida	Female	Yes
Amity University	Noida	Male	Yes
Amity University, Greater Noida campus	Noida	Male	Yes
Army Institute of Management & Technology	Noida	Male	Yes
Asian Business School	Noida	Male	Yes
Bennett University (Times of India Group)	Noida	Male	Yes
Birla Institute of Management Technology	Noida	Male	Yes
Delhi Technical Campus	Noida	Male	Yes
Dronacharya Group of Institutions	Noida	Male	Yes
G. L. Bajaj Institute of Technology and Management	Noida	Male	Yes
G.L. Bajaj Institute of Management and Research. PGDM Institute	Noida	Male	Yes
Galgotias Institute of Management & Technology	Noida	Male	Yes

Galgotias University	Noida	Male	Yes
Greater Noida Institute of Technology – MBA	Noida	Male	Yes
I Business Institute	Noida	Male	Yes
IEC Group of Institutions	Noida	Male	Yes
Institute of Management Studies, Noida	Noida	Male	Yes
Jaipuria Institute of Management	Noida	Male	Yes
Jaypee Institute of Information Technology	Noida	Male	Yes
JSS Academy of Technical Education	Noida	Male	Yes
Lloyd Business School	Noida	Male	Yes
Maharishi Institute of Management	Noida	Male	Yes
Noida Institute of Engineering and Technology	Noida	Male	Yes
Patronage Institute of Management Studies	Noida	Male	No
Sharada University	Noida	Male	Yes
Shiv Nadar University	Noida	Male	Yes
United Institute of Management	Noida	Male	Yes

6.1.2. Region-wise and Gender-wise Response

It is found (table 1 and 2) that out of a total of 69 librarians, majority (73.9%) are male

librarians and 26.1% are female librarians. A split up of librarians in the regions, Ghaziabad and Noida are visible in table 2.

Table 2

Region wise Distribution of Female and Male Librarians

Region	Female	Percent -	Male	Percent	Total	Percentage
Ghaziabad	7	21.9	25	78.1	32	100
Noida	11	29.7	26	70.3	37	100
Total	18	26.1	51	73.9	69	100

6.1.3. Response by Type of Institution

It is seen that more than 2/5th (44.93%) of the institutions are part of integrated campus.

Stand-alone institutions are 37.68% and universities 17.39% (see table 3).

Table 3

Category of Institutions

Type of Institution	Number	Percentage
Standalone	26	37.68
University	12	17.39
Part of an Integrated Campus	31	44.93
Total	69	100.00

6.2. Use of Library Software

The survey result (table 4) showed that almost cent percentage (97.10%) of the libraries

are using library software and only two libraries are not using library software.

Table 4

Library Software Usage among Libraries

Response	Number	Percentage
Using	67	97.10
Not using	2	2.90
Total	69	100.00

6.3. Type of Library Software Used

The analysis given in table 5, showed that half (50.7%) of the libraries are using commercial library software. Those libraries using open source are 13%. One third (33.3%) of the libraries are

using both. Chi-square value is 3.762 and p value 0.288. Further, more female librarians preferred time tested commercial software in comparison to their male counterpart, and lesser females preferred open source software in comparison to male librarians.

Table 5

Choice of Using Open Source/Commercial/Both/No Software

Software Type	Male		Female		Total		Chi-square	p-value
	Frequency	%	Frequency	%	Frequency	%		
Commercial	23	33.33	12	17.39	35	50.7	3.762	0.288
Open Source	8	11.59	1	1.45	9	13		
Both	19	27.54	4	5.8	23	33.3		
None	1	1.45	1	1.45	2	2.9		
Total	51	73.91	18	26.09	69	100		

Applying Chi-square test and determining p-value if there was any significant difference on gender basis, authors observed that p-value was not significant and there was no significant deviation among male and females responses. As per the data analysis (table 5), first hypothesis was proved that use of commercial software was coming down significantly and more libraries of private business management educational institutions were adopting open source software than commercial software. Comparative ratio of females adopting open source software was lesser

than males. Women librarians still had better adoption rate for commercial software.

6.4. Reasons Behind Choice of Software

Researcher applied Cronbach's Alpha statistical test for data validity to all the 15 variables used to compare reasons for choice of the software (Table 6) that generated Cronbach's Alpha value of 0.759, which confirmed the validity of data for further analysis.

Table 6
Reliability Statistics

Reliability Statistics	
Cronbach's Alpha	N of Items
0.759	15

Table 7
Reasons Behind Choice of Software

Reasons	Commercial Software		Open Source Software		Total	
	Frequency	%	Frequency	%	Frequency	%
Previous exposure to the software	35	50.7	34	49.3	69	100.00
Organization's financial support for library software	25	36.20	44	63.80	69	100.00
Better capabilities	15	21.70	54	78.30	69	100.00
Easy availability	16	23.20	53	76.80	69	100.00
Software features are excellent, conducive and easy to use	17	24.60	52	75.40	69	100.00
Documentation readily available	25	36.20	44	63.80	69	100.00
Well up to date & in tune with in-house requirements	11	15.90	58	84.10	69	100.00
Vendor reliability	27	39.10	42	60.90	69	100.00
Work with standard known platforms	7	10.10	62	89.90	69	100.00
Compatible with known international bibliographical standards	4	5.80	65	94.20	69	100.00
Community support availability	3	4.30	66	95.70	69	100.00
Modification possible and easier	3	4.30	66	95.70	69	100.00
Fear of losing valuable data or crash of the software	20	29.00	49	71.00	69	100.00
Ease the After-sales support/Post procurement maintenance	4	5.80	65	94.20	69	100.00
Save time and efforts	2	2.90	67	97.10	69	100.00

From the data, authors observed that higher percentage of librarians found reasons as valid in case of open source software than the commercial software except in case of previous exposure to the software. Even in the case of previous exposure to the software, the difference was marginal wherein half (35, 50.7%) cited exposure to commercial software as the reason to choose the same while the other half (34, 49.3%) expressed the same reason for choosing open source software. More librarians preferred open source software over commercial software due to organizational financial support, better capabilities, easy availability, features as excellent and conducive, easy documentation availability, up-to-date and meeting all needs, vendor reliability, compatibility with standard platforms, compatibility with international standards, community support, facility for modification in the software, and for savings time and efforts. Interestingly, most of the (71%) librarians were no more afraid of losing their data or crash of the software in case of using open source software, which reflected their increasing confidence with open source software. Compatible with known standards (94.2 percent), community support availability and easy modification (95.7%) each, easy after sales support (94.2%) and save in time and efforts (97.1%) were found as the major reasons as cited by the respondents for using open source software. It was worth noting librarians' confidence in open source community and even for after sales service

and maintenance. This implied open source software as a product was maturing with more and more customer support services available for the same.

From the data, it also turned out that more organizations were supporting libraries to go for open source software and providing financial support for the same as more than 3/5th (63.8%) librarians accepted getting financial support from organization as the reason for using open source software. Working with all standard known platforms also cited as a strong reason by 89.9% respondents and 84.1% respondents found the open source software well up-to-date and able to meet all in-house requirements.

6.5. Reasons on Gender Basis

Applying Chi-square test and determining p-value of significance of relationship between males and females responses, the researcher observed female also had good perception and reasons to choose open source software like male respondents and there was no significant difference in gender-based responses.

The data analysis in Table 7 and Table 8, therefore, confirmed the second hypothesis that librarians of private business management educational institutions in Noida and Ghaziabad regions had better perception for open source software than commercial software but there was no significant difference between gender-based perceptions.

Table 8
Gender Based Distribution of Reasons of Software Choice

Reason	Type of software	Gender of the Librarian							
		Female		Male		Total		Chi-square Test	p-value (Sig)
		Count	%	Count	%	Count	%		
Previous Exposure of the software	Commercial	7	38.90	28	54.90	35	50.70	1.365	0.243
	Open Source	11	61.10	23	45.10	34	49.30		
Organization's financial support for library software	Commercial	5	27.80	20	39.20	25	36.20	0.753	0.385
	Open Source	13	72.20	31	60.80	44	63.80		

Better capabilities	Commercial	4	22.20	11	21.60	15	21.70	0.003	0.954
	Open Source	14	77.80	40	78.40	54	78.30		
Easy availability	Commercial	3	16.70	13	25.50	16	23.20	0.954	0.446
	Open Source	15	83.30	38	74.50	53	76.80		
Features of the Software are excellent and conducive and easy to use	Commercial	5	27.80	12	23.50	17	24.60	0.129	0.719
	Open Source	13	72.20	39	76.50	52	75.40		
Documentation are readily available	Commercial	5	27.80	20	39.20	25	36.20	0.753	0.385
	Open Source	13	72.20	31	60.80	44	63.80		
Well up to date & in tune with in-house requirements	Commercial	2	11.10	9	17.60	11	15.90	0.424	0.515
	Open Source	16	88.90	42	82.40	58	84.10		
Vendor reliability	Commercial	6	33.30	21	41.20	27	39.10	0.344	0.558
	Open Source	12	66.70	30	58.80	42	60.90		
Work with standard known platforms	Commercial	3	16.70	4	7.80	7	10.10	1.136	0.286
	Open Source	15	83.30	47	92.20	62	89.90		
Compatible with known international bibliographical standards	Commercial	1	5.60	3	5.90	4	5.80	0.003	0.959
	Open Source	17	94.40	48	94.10	65	94.20		
Community support availability	Commercial	1	5.60	2	3.90	3	4.30	0.085	0.77
	Open Source	17	94.40	49	96.10	66	95.70		
Modification is possible and easier	Commercial	1	5.60	2	3.90	3	4.30	0.085	0.77
	Open Source	17	94.40	49	96.10	66	95.70		
Fear of losing valuable data or crash of the software	Commercial	7	38.90	13	25.50	20	29.00	1.16	0.281
	Open Source	11	61.10	38	74.50	49	71.00		
It will ease the After-sales support/Post procurement maintenance	Commercial	0	0.00	4	7.80	4	5.80	1.499	0.221
	Open Source	18	100.00	47	92.20	65	94.20		
Saves time and efforts	Commercial	0	0.00	2	3.90	2	2.90	0.727	0.394
	Open Source	18	100.00	49	96.10	67	97.10		

6.6. Gender based Satisfaction Level with Types of Software

According to data from table 9, more than half (55.6%) of female respondents felt that their gender could play a role in their decision for choosing open or commercial software while 44.4 percent did not agree to the

statement. Among male librarians, only 25.5% felt role of their gender while making choice for software selection while three fourth (74.5%) did not agree to the statement. This data implied that more female librarians faced issues while making their choices for a particular type of software in comparison to their male counterparts.

Table 9
Relationship of Gender and Choice of Software

Statement	Females	18				Males	51	Total	69	
	Yes	%	No	%	Total %	Yes	%	No	%	Total %
Relationship of gender with choice of the software	10	55.6	8	44.4	100	13	25.5	38	74.5	100

6.7. Reliability Statistics for Satisfaction Level

To know the validity of 20 variables for data analysis about satisfaction level of the respondents

with both commercial and open source software, researcher calculated value of Cronbach's Alpha (Table 10). Since Cronbach's Alpha value was 0.760, it implied that variables were suitable for data analysis.

Table 10
Reliability Statistics for Satisfaction Level Variables

Cronbach's Alpha	N of Items
.760	20

Table 11

Understanding Gender based Satisfaction Level with Both Types of Software

Statement			Gender of the Librarian (Male - 1/ Female - 0)						Chi-square Test	p-value (Sig)
			Female		Male		Total			
			Count	N %	Count	N %	Count	N %		
Highly cost effective solution for the library	Commercial	Dissatisfied	1	5.60	1	2.00	2	2.90	3.468	0.177
		Neutral	4	22.20	4	7.80	8	11.60		
		Satisfied	13	72.20	46	90.20	59	85.50		
	OSS	Dissatisfied	1	5.60	4	7.80	5	7.20	0.584	0.747
		Neutral	7	38.90	15	29.40	22	31.90		
		Satisfied	10	55.60	32	62.70	42	60.90		
Software Customizable	Commercial	Dissatisfied	16	88.90	39	76.50	55	79.70	1.516	0.469
		Neutral	2	11.10	10	19.60	12	17.40		
		Satisfied	0	0.00	2	3.90	2	2.90		
	OSS	Dissatisfied	0	0.00	3	5.90	3	4.30	4.151	0.125
		Neutral	8	44.40	11	21.60	19	27.50		
		Satisfied	10	55.60	37	72.50	47	68.10		
Customization easier	Commercial	Dissatisfied	13	72.20	32	62.70	45	65.20	0.834	0.659
		Neutral	3	16.70	14	27.50	17	24.60		
		Satisfied	2	11.10	5	9.80	7	10.10		
	OSS	Dissatisfied	0	0.00	6	11.80	6	8.70	2.504	0.286
		Neutral	7	38.90	15	29.40	22	31.90		
		Satisfied	11	61.10	30	58.80	41	59.40		
Support services easily available	Commercial	Dissatisfied	2	11.10	5	9.80	7	10.10	3.391	0.183
		Neutral	9	50.00	14	27.50	23	33.30		
		Satisfied	7	38.90	32	62.70	39	56.50		
	OSS	Dissatisfied	1	5.60	3	5.90	4	5.80	0.003	0.999
		Neutral	5	27.80	14	27.50	19	27.50		
		Satisfied	12	66.70	34	66.70	46	66.70		
Requires library skills and knowledge for customization	Commercial	Dissatisfied	12	66.70	30	58.80	42	60.90	0.842	0.656
		Neutral	3	16.70	14	27.50	17	24.60		
		Satisfied	3	16.70	7	13.70	10	14.50		
	OSS	Dissatisfied	1	5.60	5	9.80	6	8.70	0.712	0.7
		Neutral	7	38.90	15	29.40	22	31.90		
		Satisfied	10	55.60	31	60.80	41	59.40		

Adoption of Open Source Software by the Librarians of Private Management Institutions in
Noida and Ghaziabad Region: A Gender based Analysis

Library processes become faster	Commercial	Dissatisfied	1	5.60	7	13.70	8	11.60	1.14	0.566
		Neutral	5	27.80	16	31.40	21	30.40		
		Satisfied	12	66.70	28	54.90	40	58.00		
	OSS	Dissatisfied	0	0.00	3	5.90	3	4.30	4.151	0.125
		Neutral	8	44.40	11	21.60	19	27.50		
		Satisfied	10	55.60	37	72.50	47	68.10		
Facility to choose support services	Commercial	Dissatisfied	16	88.90	43	84.30	59	85.50	1.392	0.499
		Neutral	1	5.60	7	13.70	8	11.60		
		Satisfied	1	5.60	1	2.00	2	2.90		
	OSS	Dissatisfied	1	5.60	4	7.80	5	7.20	0.584	0.747
		Neutral	7	38.90	15	29.40	22	31.90		
		Satisfied	10	55.60	32	62.70	42	60.90		
Vendor support services easily available and transferrable	Commercial	Dissatisfied	10	55.60	25	49.00	35	50.70	0.282	0.869
		Neutral	5	27.80	15	29.40	20	29.00		
		Satisfied	3	16.70	11	21.60	14	20.30		
	OSS	Dissatisfied	0	0.00	3	5.90	3	4.30	4.151	0.125
		Neutral	8	44.40	11	21.60	19	27.50		
		Satisfied	10	55.60	37	72.50	47	68.10		
Various options available for each major functions of the library	Commercial	Dissatisfied	0	0.00	6	11.80	6	8.70	2.576	0.276
		Neutral	6	33.30	18	35.30	24	34.80		
		Satisfied	12	66.70	27	52.90	39	56.50		
	OSS	Dissatisfied	1	5.60	5	9.80	6	8.70	0.382	0.826
		Neutral	6	33.30	18	35.30	24	34.80		
		Satisfied	11	61.10	28	54.90	39	56.50		
Risk of losing data in involved	Commercial	Dissatisfied	9	50.00	24	47.10	33	47.80	0.046	0.977
		Neutral	5	27.80	15	29.40	20	29.00		
		Satisfied	4	22.20	12	23.50	16	23.20		
	OSS	Dissatisfied	0	0.00	4	7.80	4	5.80	3.471	0.176
		Neutral	3	16.70	16	31.40	19	27.50		
		Satisfied	15	83.30	31	60.80	46	66.70		

Authors applied 3-level Likert scale to find respondents' perception with both type of software and observed gender-based difference in responses. Table 11 provided gender division-based data about satisfaction level of respondents about different parameters with commercial software and open source software.

Applying Chi-square test and calculating p-value of any significant difference between perceptions of female and male respondents, the

researcher did not find any significant difference from gender point of view. Thus, in spite of librarians responding that gender bias existed in terms of adopting open source software, test results indicated that gender bias was not so significant in terms of satisfaction level with each type of software as responded by female and male librarians of private business management educational institutions of Noida and Ghaziabad.

Hence, researcher rejected the third hypothesis and accepted the null hypothesis that gender bias was not present among libraries of private business management educational institutions in terms of satisfaction level with choice of the library software.

6.8. Earlier Software Usage versus Current Software Usage

From the data given in table 12, the authors found that from the sample of 69 librarians, 67 were using and 2 were not using any software in their libraries. Out of total 18 female librarians, majority (83.33%) females were earlier using commercial software, which had currently come down to 66.67%. Those

female respondents who are using open source software are 5.56%. Among 51 male respondents, earlier 82.35 percent were using commercial software, Those using open source software are 23.73%. and 1.96 percent are using both type of the software and 1.96 percent were not using any software. Now, 45.10% male respondents were using commercial, 15.69 percent were using OSS, 37.25 percent were using both type of software and 1.96 percent were not using any type of software. This shows that use of open source software either exclusively or at least one open source software in both category had grown among both females and males but among females, growth was minimal while it was faster among males. Use of commercial software had come down among both females and males.

Table 12
Earlier Software Usage versus Current Software Usage

Statement		Gender of the Librarian				Chi-Square	P-Value
		Females		Males			
		Count	Percent - Female	Count	Percent - Males		
Previous	Commercial	15	83.33	42	82.35	1.954	0.582
	OSS	1	5.56	7	13.73		
	Both	1	5.56	1	1.96		
	None	1	5.56	1	1.96		
Current	Commercial	12	66.67	23	45.10	3.762	0.288
	OSS	1	5.56	8	15.69		
	Both	4	22.22	19	37.25		
	None	1	5.56	1	1.96		

Chi-square test was applied and p-value calculated to determine if there existed any significant relationship among females and responses in both previous and current usage of the software. It is however, observed that p-value was non-significant in both cases.

Hence, the analysis done in Table 12 proved the fourth hypothesis that there was a positive migration movement from commercial software to open source software among librarians of private business management educational institutions in Noida and Ghaziabad regions though there did not exist any significant difference between male and female responses.

7. Findings

Major findings of the study are:

- 1) Out of the 69 libraries 67 (97.1%) of private sector business management educational institutions of Noida and Ghaziabad were using software for library operations.
- 2) Among the total libraries, there were 26.1 percent female librarians and 73.9 percent male librarians showing that lesser number of females were reaching librarian position in comparison to males, which confirmed NASSCOM (2020) and Dasgupta (1998) findings that lesser women were reaching to higher positions.
- 3) More number of female than male librarians are using commercial software in comparison to open source software exclusively confirming the findings of Kamau and Namuye (2012) and Kenya. Kumar et al, (2018) that commercial software was still a preferred choice.
- 4) It is seen that 32 librarians (46.37%), out of the total are using some software, were using at least one open source software for some functions of their libraries. Hence, it is inferred that use of the open source software usage was on rise and commercial software usage was declining. This result is in conformity with the findings of Okuonghae and Idubor (2020), that use of open source software was growing among libraries.
- 5) Female librarians using open source software is lesser than male librarians, hence, women librarians still had better adoption rate for commercial software though they were also started using open source software.
- 6) Majority of the librarians were satisfied with open source software in comparison to commercial software. Open source software offered multiple advantages than the commercial software. Previous exposure to the software was a marginally higher factor in case of commercial software. These findings supported the earlier research by Jeyapragash and Sivakumaren (2019) conducted among engineering and research libraries about OSS usage benefits.
- 7) Both female and male librarians had good perception about open source software and no gender-based significant difference existed in findings as confirmed by applying chi-square test and determining p-value. Hence, more librarians were satisfied with benefits of open source software than the proprietary software.
- 8) More than half (55.6%) females and a quarter (25.5%) male respondents accepted that their gender had a role in determining choice of the library software. This data implied that more female than male librarians had constraints in adopting open source software confirming Trinkenreich et al. (2021) findings about gender bias in open source software.
- 9) Inquiring specific reasons why gender had a role in open source software adoption, and applying chi-square test, authors did not observe any significant difference between both genders. Thus, test results indicated that gender bias was not so significant as far as satisfaction level with each type of software was concerned confirming the findings of Vijayakumar and Sheshadri (2018) that Indian librarianship was moving towards gender equality.

- 10) The results show that both female and male librarians under survey are migrating from commercial to open source software whereas migration from open to commercial software is nil. Authors did not observe any significant variation based on gender wise responses. Hence, there was a positive migration movement from commercial software to open source software among respondent librarians from both genders.

8. Recommendations

- 1) Open source software has a bright future due to community support. It is essential that librarians join open source developers' community and contribute in terms of explaining what is missing in an open source software, which needs to incorporate in future versions of the software.
- 2) Female librarians need to be encouraged by providing equal opportunities to prove their mantle and ability. It is necessary that our policy makers, institutions authorities create an environment where librarians in general and female librarians in particular feel safe about their jobs, can innovate and experiment with latest technologies and software.
- 3) Future researchers may generalize the findings of this study by encompassing all types of libraries including public and private sector universities and institutions, public libraries, libraries of all disciplines and of all levels including school libraries.

9. Conclusion

The current study aimed at comparing gender-based adoption of commercial or open source software among librarians of private sector business management educational institutions in Noida and Ghaziabad regions and the analysis revealed that librarians from both genders had better perception for open source software than

commercial software. Use of open source software was more among male respondents. Analysis also revealed that unlike past, more female librarians were exploring open source software in current times overcoming their psychological barriers of not taking risks and following the set patterns. Librarians from both genders were migrating to open source software from commercial software and they were satisfied with open source capabilities, organizational support to change, facility to modify the software as per local needs, developers and librarians' community support for OSS, low cost, following all international standards and no vendor lock-in for seeking support. Hence, from the data and its analysis one can expect that if the trend continues, use of open source software will further grow among private business management educational institutions of Noida and Ghaziabad and in other libraries also.

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