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Factors for adoption of OSILS in university libraries of Bangladesh

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Abstract

This study identified the influential factors for adoption of OSILS in university libraries in Bangladesh. The survey was carried out among 196 library professionals from 14 private and seven public university libraries by a structured questionnaire which was adapted cautiously as per local arrangements after conducting a pilot survey. Factors for adoption of OSILS were analyzed by multiple regressions where overall satisfaction was used as dependent variable, and 14 factors for adoption of OSILS were applied as the independent variables. The entire model of regression analysis was established to be significant and revealed that cost-effectiveness, open source code, supporting community, backup and restore systems, easy to integrate with other software, and freedom from licensing fee significantly influenced library professionals to adopt OSILS. Moreover, an effort has been made for the first time to evaluate significant factors for adoption of OSILS in university libraries of Bangladesh that will prompt future research on OSILS.

Keywords

Bangladesh, factors for adoption, integrated library system, open source software, OSILS, university libraries

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Introduction

University libraries exist for meeting the information needs of their user community by providing "the right information to the right person at the right time" (Alam, 2018: 6). To provide quality services for the user community, information and communication technologies (ICTs) are being applied in library and information institutions which can be categorized into three wide segments: "Integrated Library Systems (ILS), information storage and dissemination, and administration management tasks" (Alam, 2017: 1). Generally, the ILS can be classified into three types which are open source, freeware, and proprietary/commercial (Chouhan, 2010). The practices of open source integrated library systems (OSILS) in library and information institutions have gained popularity and caused interest in recent years (Alam, 2018; Kumar and Jasimudeen, 2012).

The OSILS is "free application software for library automation" (Alam, 2017: 6) where a source code is "available under the GNU General Public License" (GPL) (Riewe, 2008: 93). An ideal OSILS refers to having acquisition, cataloging, OPAC, serials control, patron management, circulation, inter-library loans (ILL), and report generation modules under one system (Ahammad, 2014; Khatun, 2014; Silvestre, 2010). Each of the functional modules of an OSILS is incorporated with an integrated interface. An OSILS has two graphical user interfaces (GUIs) which are GUI for staff and GUI for users. There is no basic difference among the functional modules of open source, freeware, and proprietary ILS, but the substantial disparity is apparent in the development process and distribution (Kumar and Abraham, 2009).

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The provisions of OSILS distribution as per the Open Source Initiative (2018) are:

> free redistribution, open source code, derived works allowed, integrity of the author's source code, no discrimination against persons or groups, no discrimination against fields of endeavor, distribution of license, license must be technology-neutral, license must not be specific to a product, and license must not restrict other software.

The classic definition of the adoption is "making full use of a new idea as the best course of action available" (Mezbah-ul-Islam, 2003). In practice, this definition is used in all adoption analysis implicitly or explicitly.

From the available literature, two types of library systems, i.e. ILS and non-ILS, are used in Bangladeshi university libraries. Three kinds of ILS, i.e. open source, freeware, and proprietary, are used to automate the library systems of Bangladeshi universities. However, the majority of university libraries in Bangladesh have not yet adopted ILS. There are also some libraries which are not aware of ILS (Alam, 2017). In recent years, university libraries have tended to shift towards the implementation of OSILS globally including in Bangladesh. Based on the available literature, several scholars conducted research in Bangladesh on the usability of the Koha interface (Khatun and Ahmed, 2018), challenges and remedies for the adoption of OSILS (Alam, 2017), and sharing practical experience in implementing Koha (Ahammad, 2014). However, not much initiative has been taken to evaluate the significant factors for the adoption of OSILS in Bangladesh. So, it is desirable to evaluate the significant factors which influence library professionals to adopt OSILS in Bangladeshi university libraries. Therefore, it can be concluded that for the first time an initiative has been taken to evaluate the significant factors for adoption of OSILS in Bangladeshi university libraries.

Literature review

An open source integrated library system (OSILS) is developed by the combination of open source software and an integrated library system (ILS). The term ILS is recognized as a library management system (LMS) which is an enterprise resource planning (ERP) system for a library that is used to manage patrons, track items, prepare orders, and pay bills (Anuradha and Sivakaminathan, 2009; Uzomba et al., 2015). Silvestre (2010) stated that "an OSILS is planned, conceived and developed to coordinate and automate several library functions, and register all the library operations". Müller (2011: 2) described the OSILS as "multifunctional adaptable software applications" that permits library personnel to "manage, catalog and circulate their library materials to users". Kiriyanant (2012) mentioned that each user has a unique ID in the patron database and each item has a unique ID in the bibliographic database which allow OSILS for tracking its every operation. Libraries should choose appropriate OSILS based "not only on the performance and efficiency of the software but also on its fundamental flexibility to readily adapt to the forthcoming demands and necessities of their users" (Uzomba et al., 2015: 4). A reliable and excellent OSILS improves access to electronic or printed resources that are available virtually or physically in a library which may be online journals, e-books, online databases, digital institutional repositories, or printed books, journals and CD/DVDs (Omeluzor et al., 2012).

To avoid alienating for-profit businesses and to be part of the free software community, the term "open source software" is used rather than "free software" so that "free to copy or modify without charge" would not be confused (Riewe, 2008). Rafiq and Ameen (2009: 2) described OSS as "computer software whose source code is available under GPL that allows users to use, change and improve the software, and to redistribute it in modified or unmodified form". Kenwood (2001) defined OSS as the free software where the source code is available under GPL. The copyright holders provide the right to "study, use, copy, and distribute the software with or without modifications", and that can be offered "either with or without a fee" (p. 11). Contrary to OSILS, the copyright holders of proprietary ILS provide only "binary code and withhold source code" so that users can "use the software but cannot modify, progress or study" (Ahammad, 2014: 8).

Koha, Evergreen, NewGenLib, PMB, OPALS, EspaBiblio, Emilda, InfoCID, GNUteca, Jayuya, OpenBiblio, oBiblio, OpenAmapthèque, PhpMyLibrary, SLiMS, and Kuali OLE are available OSILS packages. Among them, PhpMyLibrary, OpenBiblio, Emilda, and Jayuya are considered inactive OSILS because no improvement action has been found on their discussion lists or in their source codes for a long time. In addition, Kuali, oBiblio, OpenAmapthèque, OPALS, Gnuteca, and InfoCid are identified to be just released due to having no significant mass of users, developers, and contributors currently. SLiMS and PMB are considered improving and emerging OSILS. NewGenLib and Evergreen are considered sustainable but improving OSILS. Lastly, Koha is established

as a sustainable, mature, and popular OSILS (Alam, 2018; Müller, 2011).

Rafiq and Ameen (2009) presented an analysis of 370 responses from 48 countries including Pakistan, India, Australia, Canada, USA, and UK. They revealed that OSILS adoption in libraries and information institutions is still at infancy level. Kumar and Abraham (2009) identified that lack of awareness and knowledge in the technology of OSILS among library professionals restricts the extensive adoption of OSILS. The OSILS has created opportunities for libraries whose budget shrinks and cannot afford the cost of commercial ILS (Kiriyanant, 2012). Alam and Islam (2011) reviewed automation systems and found that the automated systems of Bangladeshi libraries are still in their infancy. Many library professionals in Bangladesh are trying to develop their libraries as global standards. BRAC University (BRACU) Library developed their ILS through Koha in 2010 (Afroz, 2014). Koha is used by 21 university libraries, two university libraries, and three institutional libraries in Bangladesh (Koha-community, 2018). According to the SLiMS (Senayan Library Management Software) official website, three institutional libraries, and two university libraries in Bangladesh use SliMS (SLiMSBD, 2018). But SLiMS is not yet used by any university library in Bangladesh (Habib, 2015). BRACU Library integrated Radio Frequency Identification (RFID) with Koha in 2011 to protect book stealing. Subsequently, North South University (NSU) Library adopted RFID-based ILS in 2012. The Shahjalal University of Science and Technology (SUST) Library in 2013, Bangladesh University of Engineering and Technology (BUET) Library in 2014 and Sher-e-Bangla Agricultural University (SAU) Library in 2015 integrated RFID technology with their Koha OSILS (Alam, 2017; Rahman, 2014). To enhance the adoption of OSS in Bangladesh, BRACU Library, East West University (EWU) Library, Daffodil International University (DIU) Library, and Bangladesh Association of Librarians, Information Scientists and Documentalist (BALID) organized training or workshops on various OSS like Koha, SLiMS, Greenstone, DSpace, Vufind, Zotero, Drupal, etc. Moreover, they also help in the development of ILS in other libraries via Koha or SLiMS (Alam, 2018).

Budget is not the only factor that causes libraries to shift towards the implementation of OSILS from proprietary ILS. Keast (2011: 8) found two main reasons for turning to OSILS from previous systems of Australian libraries – specifically, the lack of flexibility in achieving customizations and budgetary difficulties. Poulter (2010) cites strategic reasons apart from the budget, as well as dissatisfaction regarding proprietary ILS, for making libraries adopt OSILS. Singh (2013) revealed that the common factor for adoption is the cost-effectiveness of OSILS compared to proprietary ILS among libraries in the USA. Libraries refer to many causes for shifting to OSILS which are usability, cost-effectiveness, and community and vendor support (Singh, 2013). In addition to these reasons, flexibility and ease of customization are also significant factors for the widespread adoption of OSILS (Carlock, 2008). Singh (2014) suggested that the libraries that have already migrated must share their experience, knowledge, and recommendations for every stage of the migration process to encourage more libraries to adopt OSILS. Kohn and McCloy (2010) stated that they were determined to migrate to an OSILS due to frustration with their existing proprietary ILS. Dennison and Lewis (2011) showed another reason for migrating to OSILS from proprietary ILS which was much more complex than the necessity: no one understood the system due to their staff turnover. This lack of expertise increased yearly costs which led to a move towards OSILS. Singh (2013) argued that functionality is one of the factors for choosing OSILS. Riewe (2008) showed that the ability to customize, portability, cost, and freedom from vendor lock-in are the reasons for choosing OSILS based on a survey. Sunil and Harinarayana (2013) argued that when a library selects OSILS, it chooses not only a means of reducing its costs on the software but also opportunities to become free concerning its choices of software vendors. Arch (2011) said that open access and open source are philosophically associated with intellectual freedom, which is eventually the mission of libraries. The other two common reasons are cost and functionality which are the two key aspects that are mentioned in any discussion on the issue of choosing an OSILS. One of the advantages of OSILS is the capability to customize and develop functions that are specific to any library. Gireesh Kumar and Jayapradeep (2015) showed that 85% of the respondents support the implementation of OSILS in libraries. The highest factor for adoption of OSILS is cost-effectiveness, followed by openness to customize, collaborative network of user community, freedom from licensing and maintenance fee, vendor lock-in, open source code, ease of installation and maintenance, concerns regarding the suppliers of proprietary ILS, availability of quality documentation, and to become a part of the consortium.

Objective of the study

In Bangladesh, 21 university libraries are now using Koha as OSILS software, and a small number of university libraries are in the process of developing their OSILS using Koha. However, no university libraries in Bangladesh are using any other OSILS software yet apart from Koha. Here, a question is raised: which factors influence library professionals for the adoption of the existing OSILS in the university libraries of Bangladesh? This study has made an objective based on the questions raised, research gap, and social impact. The objective of this study is to identify the influential factors for adoption of OSILS in the university libraries of Bangladesh.

Hypothesis

The study has formulated a hypothesis (the higher the desirable features of the software, the higher the adoption of OSILS).

Methodology

A quantitative approach was used in the methodology. In Bangladesh, there are 41 public, 103 private, and three international universities (UGC, 2018). Among them, the study selected 14 private and seven public universities whose libraries were using OSILS. For attaining the research objective and testing the hypothesis, the study attempted to collect quantitative data from primary sources of information through a structured questionnaire. The use of OSILS, 14 factors for the adoption of OSILS, one statement regarding overall satisfaction towards OSILS, and demographic information of library professionals were included in the questionnaire. Fourteen factors were incorporated from the literature review and expert opinions. A five-point agreement scale was made using "5 = Strongly Agree, 4 = Agree, 3 = Agree Less, 2 = Disagree, and 1 = Strongly Disagree" to identify the significant factors for the adoption of OSILS. Another five-point satisfaction scale was constructed using "5 = Highly Satisfied, 4 = Very Satisfied, 3 = Satisfied, 2 = Less Satisfied, and 1 = Not Satisfied" to assess the overall satisfaction level of library professionals towards existing OSILS. The questionnaire was adapted cautiously as per local arrangements after conducting a pilot survey. The pilot survey helped to reshape the technical and technological terms that have been used in the Bangladeshi context. The researcher visited the chosen university libraries and distributed the questionnaire to the library staff with the minimum Master's/Bachelor's/PGD qualification in Library and Information Science. Out of 262 questionnaires, 223 (85.11%) were returned and of these 196 (74.81%) which were completely filled up by the library professionals were considered for analysis (Table 1).

Table 1. Respondents of the study.

SL	University	Category	Respondents
1	University of Dhaka	Public	25
2	Bangladesh University of Engineering and Technology	Public	14
3	University of Rajshahi	Public	12
4	Khulna University of Engineering and Technology	Public	8
5	Shahjalal University of Science and Technology	Public	7
6	Sher-e-Bangla Agricultural University	Public	7
7	Chittagong Veterinary and Animal Sciences University	Public	4
8	East West University	Private	15
9	International Islamic University Chittagong	Private	15
10	BRAC University	Private	14
11	Northern University Bangladesh	Private	11
12	Daffodil International University	Private	10
13	Independent University Bangladesh	Private	8
14	University of Liberal Arts Bangladesh	Private	8
15	Eastern University	Private	7
16	Southeast University	Private	7
17	Green University Bangladesh	Private	6
18	Premier University	Private	5
19	United International University	Private	5
20	Chittagong Independent University	Private	4
21	Manarat International University	Private	4
	Total		196

Reliability

The Bartlett's test of sphericity evaluated the suitability of the data for factor analysis. The value of Bartlett's Test should be 0.05 or less (Schierholz and Laukkanen, 2007). The Bartlett's test has a p-value = 0.001 for 14 factors indicating that the internal consistency of the data is suitable. The reliability of each multiple-item scale was assessed by the Cronbach's Alpha. Nunnally (1978: 245) recommended that "alpha values should be 0.70 or greater". The results of Cronbach's Alpha suggested that internal consistency of all items is $\alpha = 0.880$, and 14 factors for the adoption of OSILS is $\alpha = 0.881$ indicated that the overall questionnaire items have a good reliability.

Table 2. Inter-item correlation matrix of factors for adoption.

Factors	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	Alpha
F1	1.000	.525	.313	.258	.284	.365	.396	.517	.511	.351	.378	.348	.098	.088	.874
F2	.525	1.000	.455	.365	.473	.384	.329	.413	.488	.282	.343	.371	.286	.096	.871
F3	.313	.455	1.000	.404	.532	.425	.516	.419	.341	.442	.502	.370	.265	.161	.870
F4	.258	.365	.404	1.000	.317	.357	.389	.327	.254	.535	.468	.434	.252	.236	.873
F5	.284	.473	.532	.317	1.000	.525	.542	.482	.286	.353	.429	.243	.204	.205	.871
F6	.365	.384	.425	.357	.525	1.000	.501	.488	.363	.581	.489	.239	.258	.210	.869
F7	.396	.329	.516	.389	.542	.501	1.000	.683	.326	.442	.461	.261	.138	.134	.869
F8	.517	.413	.419	.327	.482	.488	.683	1.000	.393	.380	.399	.246	.211	.165	.869
F9	.511	.488	.341	.254	.286	.363	.326	.393	1.000	.465	.399	.384	.158	-.014	.874
F10	.351	.282	.442	.535	.353	.581	.442	.380	.465	1.000	.606	.461	.249	.226	.868
F11	.378	.343	.502	.468	.429	.489	.461	.399	.399	.606	1.000	.375	.337	.266	.868
F12	.348	.371	.370	.434	.243	.239	.261	.246	.384	.461	.375	1.000	.345	.197	.875
F13	.098	.286	.265	.252	.204	.258	.138	.211	.158	.249	.337	.345	1.000	.556	.880
F14	.088	.096	.161	.236	.205	.210	.134	.165	-.014	.226	.266	.197	.556	1.000	.888

Validity

Several methods have been used to evaluate the validity of the factors for adoption of OSILS in university libraries of Bangladesh.

Item loading. The loading items of extracted variables were shown between 0.578 and 0.749 for 14 factors indicating that all the variables successfully represent the factor dimension.

Commonalities. Nadiri (1970) recommended that all commonalities of a perfectly adequate sample above 0.5 can be accepted. The commonalities of the extracted variables were shown between 0.517 and 0.721 for 13 out of 14 factors, indicating that most of the variables are within the acceptable range.

KMO value. The significant level of Kaiser-Meyer-Olkin (KMO) value is above 0.7. The overall KMO value matrix for 14 OSILS factors is 0.859, meaning that the sample size (196) is statistically significant for the exploratory factor analysis and there is no problem with the data.

Discriminant validity. If the average variations derived from the correlated latent variables are higher than the alpha coefficient of each scale, discriminating validity is achieved (Andaleeb and Simmonds, 1998; Fornell and Larcker, 1981). The results support discriminating validity because the correlation between one factor and the other is as low as the alpha coefficient of each factor (Table 2).

Factor analysis. Table 3 shows that only three factors were recovered and all the items were loaded on the factors when no constraints were imposed on the extraction of factors in a factor analysis with varimax rotation. Each of the three factors had an eigenvalue of greater than one which had a total of 60.03% of the variance. However, the results support the validity of the data.

Data analysis and findings

Demographic information of library professionals

Table 4 demonstrates that among the respondents, 68 (34.7%) were female and 128 (65.3%) were male. Among the respondents, 76 (38.8%) were from the public university libraries and 120 (61.2%) were from the private university libraries. The highest number of responses were from Library Officers (54, 27.6%), followed by Assistant Librarian (51, 26.0%), Assistant Library Officers (28, 14.4%), Deputy Librarian (19, 9.7%), Sr Assistant Librarian (17, 8.7%), Sr Library Officers (13, 6.6%), Library Assistant (4, 2.0%), Librarian (4, 2.0%), Junior Assistant Librarian (3, 1.5%), and Joint Librarian (3, 1.5%). The more significant proportion of the responses were from the age group 31 to 40 years (100, 51.0%), followed by 21 to 30 years (50, 25.5%), 41 to 50 years (35, 17.9%), and 51 to 60 years (11, 5.6%). The more significant number of the respondents 164 (83.7%) have a Master's, followed by PGD 12 (6.1%), MPhil nine (4.6%), PhD nine (4.6%), and Bachelor's two (1.0%) in Library and Information Science as the highest professional degree. Among the respondents, 79 (40.3%) do not have an ICT degree. Only 73 (37.2%) respondents have a Certificate course, 35 (17.9%) respondents have PGD, and nine (4.6%) respondents have a Master's in ICT. Among the respondents, 79.1% have training on Koha, and 96.9% have practical

Table 3. Factor analysis with varimax rotation.

	Extraction sums of squared loadings			Rotation sums of squared loadings		
Component	Eigenvalue	% of Variance	Cumulative %	Eigenvalue	% of Variance	Cumulative %
Factor-1	5.756	41.113	41.113	3.493	24.948	24.948
Factor-2	1.510	10.786	51.899	2.852	20.371	45.319
Factor-3	1.138	8.126	60.025	2.059	14.707	60.025
Factor-4	.972	6.940	66.966			
Factor-5	.782	5.588	72.554			
Factor-6	.682	4.873	77.427			
Factor-7	.571	4.082	81.509			
Factor-8	.511	3.651	85.161			
Factor-9	.475	3.393	88.554			
Factor-10	.417	2.980	91.533			
Factor-11	.397	2.835	94.368			
Factor-12	.271	1.936	96.305			
Factor-13	.263	1.879	98.184			
Factor-14	.254	1.816	100.000			

Extraction method: Principal Component Analysis.

experience in OSILS. The significant number of the library professionals (56, 28.6%) have three years' practical experience, followed by (47, 24%) five years or more, (42, 21.4%) four years, (26, 13.2%) one year, and (25, 12.8%) two years of working experience. The demographic information of the sample suggested the response of a large cross-section of the population.

Descriptive statistics of factors for adoption of OSILS

Table 5 shows that "international standard options" occupied the highest mean of 4.33 among the 14 factors for the adoption of OSILS, followed by "adequate functionalities" which scored 4.27, both "easy to customize for local needs" and "easy backup and restore system" which scored 4.23, "control over the data and software" scored 4.19, both "availability of open source code" and "ability of data migration" scored 4.18, "adequate features" scored 4.17, "freedom from licensing fee" scored 4.16, both "cost-effectiveness" and "supporting community" scored 4.13, "easy to integrate with other software" scored 4.11, and "quality documentation" scored 3.95. On the other hand, the "concerns about the suppliers of proprietary ILS" formed the lowest perceived mean of 3.56 among the factors for the adoption of OSILS.

Overall professionals' satisfaction with OSILS

The study included a statement "What is your overall satisfaction level in existing OSILS of your university library" in the questionnaire to evaluate the effectiveness of the existing OSILS. Table 6 shows that the overall satisfaction mean was 3.76 indicating that the library professionals of Bangladeshi university libraries showed positive acceptance of OSILS and their level of satisfaction towards it is very good.

Multiple regressions analysis

A hypothesis was developed earlier to evaluate which factors influence library professionals most significantly to adopt OSILS in university libraries of Bangladesh. Multiple-regression analysis was applied for this purpose where 14 factors for adoption of OSILS were used as independent variables, and overall satisfaction of library professionals was used as the dependent variable. Table 7 illustrates that the model clarified 18% variation in professionals' satisfaction, as suggested by adjusted R^2 value ($R^2 = .180$). The P value of the regression model is ($P < 0.001$) indicating that the entire model was established as significant. Many researchers apply the Cohens' criterion "(less than .01 = trivial; .01 up to .30 = weak; .30 up to .50 = moderately strong; .50 or greater = strong)" to determine whether the correlation between independent and dependent variables is weak or strong (Cohen et al., 2003). The correlation was appropriately recognized in this study as moderately strong (Multiple R = .489) as per the Cohens' criterion.

Residuals are the difference between the obtained and predicted dependent variable scores which represent unexplained variation. A model with a large regression sum of squares in comparison to the residual sum of squares indicates that the model accounts for most of the variation in the dependent variable (Andaleeb and Simmonds, 1998; Michigan State University, 2017). Table 8 shows that the regression

Table 4. Demographic information of respondents.

Variable	Classification	Frequency	Percent	Valid %	Cumulative %
Gender	Female	68	34.7	34.7	34.7
	Male	128	65.3	65.3	100.0
Category of University	Public	76	38.8	38.8	38.8
	Private	120	61.2	61.2	100.0
Designation	Library Officer	54	27.6	27.6	27.6
	Assistant Librarian	51	26.0	26.0	53.6
	Assistant Officer	28	14.4	14.4	68.0
	Deputy Librarian	19	9.7	9.7	77.7
	Sr. Asst. Librarian	17	8.7	8.7	86.4
	Sr. Library Officer	13	6.6	6.6	93.0
	Library Assistant	4	2.0	2.0	95.0
	Librarian	4	2.0	2.0	97.0
	Jr. Asst. Librarian	3	1.5	1.5	98.5
	Joint Librarian	3	1.5	1.5	100
Age group	31–40 years	100	51.0	51.0	51.0
	21–30 years	50	25.5	25.5	76.5
	41–50 years	35	17.9	17.9	94.4
	51–60 years	11	5.6	5.6	100.0
Professional Degree	Master's	164	83.7	83.7	83.7
	Diploma	12	6.1	6.1	89.8
	MPhil	9	4.6	4.6	94.4
	PhD	9	4.6	4.6	99.0
	Bachelor	2	1.0	1.0	100.0
ICT Degree	None	79	40.3	40.3	100.0
	Certificate	73	37.2	37.2	77.5
	Diploma	35	17.9	17.9	95.4
	Master's	9	4.6	4.6	100.0
Training	Yes	155	79.1	79.1	79.1
	No	41	20.9	20.9	100.0
OSILS experience	Yes	190	96.9	96.9	96.9
	No	6	3.1	3.1	100.0
Years of experience	Three years	56	28.6	28.6	28.6
	Five years or above	47	24	24	52.6
	Four years	42	21.4	21.4	74
	One year	26	13.2	13.2	87.2
	Two years	25	12.8	12.8	100.0

model has a large residual sum of squares (83.876) compare to regression sum of squares (26.369) indicating that the model does not count for most of the variations in the dependent variable.

Table 9 shows that six factors for adoption of OSILS had significant impact on professionals' satisfaction. The six significant factors were freedom from licensing fee ($b = 0.183$; $p < 0.043$); supporting community ($b = -0.236$; $p < 0.013$); easy to integrate with other software ($b = 0.219$; $p < 0.019$); cost-effectiveness ($b = 0.273$; $p < 0.002$); easy backup and restore system ($b = -0.241$; $p < 0.020$); and open source code ($b = 0.211$; $p < 0.011$). Another eight factors, control over the data and software ($b = -0.107$, $p > 0.229$); data migration ($b = 0.054$, $p > 0.520$); easy to customize for local needs ($b = 0.056$, $p > 0.538$); adequate features ($b = -0.061$, $p > 0.549$); adequate functionalities ($b = 0.058$, $p > 0.555$); international standard options ($b = 0.084$, $p > 0.362$); quality documentation ($b = 0.001$, $p > 0.997$); and concerns about the suppliers of proprietary ILS ($b = 0.105$, $p > 0.199$) were not significant. However, the supporting community and easy backup and restore system had a significant negative impact on professionals' satisfaction. In addition, control over the data and software, and adequate features had an insignificant negative effect on professionals' satisfaction. The standardized beta values suggested that cost-effectiveness of OSILS had the most significant effect on professionals' satisfaction. The results of the standardized beta values also indicated that library professionals attribute

Table 5. Descriptive statistics of factors for adoption of OSILS.

SL	Factors	Mean	SD	Item loading	Commonalities
1.	Higher the availability of international standard options, higher the adoption of OSILS	4.33	.698	.735	.558
2.	Higher the availability of adequate functionalities, higher the adoption of OSILS	4.27	.767	.705	.633
3.	Higher the ability of easy to customize for local needs, higher the adoption of OSILS	4.23	.843	.674	.625
4.	Higher the availability of easy backup and restore system, higher the adoption of OSILS	4.23	.719	.729	.552
5.	Higher the ability of control over the data and software, higher the adoption of OSILS	4.19	.667	.705	.517
6.	Higher the availability of open source code, higher the adoption of OSILS	4.18	.769	.578	.634
7.	Higher the ability of data migration, higher the adoption of OSILS	4.18	.747	.629	.445
8.	Higher the availability of adequate features, higher the adoption of OSILS	4.17	.811	.713	.721
9.	Higher the freedom from licensing fee, higher the adoption of OSILS	4.16	.806	.619	.584
10.	Higher the availability of cost-effectiveness, higher the adoption of OSILS	4.13	.771	.613	.665
11.	Higher the availability of supporting community, higher the adoption of OSILS	4.13	.760	.656	.522
12.	Higher the ability of easy to integrate with other software, higher the adoption of OSILS	4.11	.813	.712	.575
13.	Higher the availability of quality documentation, higher the adoption of OSILS	3.95	.806	.691	.674
14.	Higher the concerns about the suppliers of proprietary ILS, higher the adoption of OSILS	3.56	.940	.749	.698

Table 6. Descriptive statistics of overall professionals' satisfaction.

Statement	N	Minimum	Maximum	Mean	STD
"Your overall satisfaction level in existing OSILS of your university library"	196	1	5	3.76	.752
Valid N	196				

the second highest significant magnitude to the easy to backup and restore systems of OSILS, followed by supporting community, easy to integrate with other software, open source code, and freedom from licensing fee.

Figures 1 and 2 show that the histogram and normal probability plot explain no deviation from the assumptions and usually the dependent variable is distributed. The residual statistics would be reasonably confident that the use of the model would not be severely restricted.

After the normality of the data in the regression model is achieved, the subsequent step is to determine whether the independent variables in a model are similar through multicollinearity tests. In a good regression model neither multicollinearity nor the correlation between independent variables should occur (Andaleeb and Simmonds, 1998). The multicollinearity is problematic because it can increase the variation of the regression coefficients, making them unstable and complicated to interpret. According to the Spsstests.com (2015), "if the variance inflation factor (VIF) value lies between 1 and 10, then there is no multicollinearity problem". But, "if the VIF <1 or > 10, then there is a multicollinearity problem". As per Minitab.com (2017), "If the VIF = 1 there is no correlation, if the VIF = 1 < VIF < 5 there is moderate correlation, and if the VIF = > 5 to 10 there is high correlation between predictors". These indicators are applied to explain how much correlation between predictors (multicollinearity) exists in a regression model. Based on the coefficients output – collinearity statistics (Table 9), obtained VIF values are 1.928 for freedom from licensing fee, 2.081 for supporting community, 1.856 for control over the data and software, 1.694 for data migration, 1.979 for easy to customize for local needs, 2.032 for easy to integrate with other software, 2.426 for adequate features, 2.330 for adequate functionalities, 1.803 for cost-effectiveness, 2.504 for easy backup and restore system, 2.017 for international standard options, 1.617 for open source code, 1.781 for quality documentation, and 1.591 for

Table 7. Model summary of factors for adoption of OSILS.

Model	R	R square	Adjusted R square	Std. error of the estimate	Change statistics				
					R Square change	F change	df1	df2	Sig. F change
1	.489[a]	.239	.180	.681	.239	4.064	14	181	.000

[a]Predictors: (constant), F14, F9, F4, F5, F12, F8, F2, F6, F13, F3, F11, F1, F10, F7.
[b]Dependent variable: Overall professionals' satisfaction.

Table 8. ANOVA table of factors for adoption of OSILS.

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	26.369	14	1.883	4.064	.000[b]
	Residual	83.876	181	.463		
	Total	110.245	195			

[a]Dependent variable: Overall professionals' satisfaction.
[b]Predictors: (Constant), F14, F9, F4, F5, F12, F1, F6, F13, F3, F8, F11, F2, F7, F10.

concerns about the suppliers of proprietary ILS. The VIF values obtained from 1.591 to 2.504 indicated that a moderate correlation exists between the predictors, and multicollinearity symptoms are not present in the regression model.

Discussion

A total of 223 (85.11%) questionnaires were returned out of 262. Among them, 196 (74.81%) questionnaires were found to be completely filled in by the respondents including 120 professionals from 14 private and 76 professionals from seven public university libraries and these were considered for analysis. The main objective of this study is to identify the significant factors for the adoption of OSILS in Bangladeshi university libraries from library professionals' point of view. The multiple regression analysis assessed the significant factors for OSILS adoption. The international standard options occupied the highest perceived mean among the 14 factors for OSILS adoption, followed by the following top five features: adequate functionalities, easy to customize for local needs, easy backup and restore system, both freedom from licensing fee, and availability of open source code. Concerns about the suppliers of proprietary ILS formed the lowest perceived mean. The overall satisfaction of library professionals towards OSILS showed positive acceptance, indicating the efficiency of the existing OSILS in Bangladeshi university libraries.

Hypothesis: The higher the desirable features of the software, the higher the adoption of OSILS. A hypothesis was developed earlier to evaluate the significant factors for adoption of OSILS in Bangladeshi university libraries from the library professionals' viewpoint. To test the hypothesis, a multiple-regression analysis was applied where overall satisfaction was used as a dependent variable and 14 factors were used as independent variables. The entire model of regression analysis of the higher the desirable features of the software, the higher the adoption of OSILS was established to be significant and explained 18% of the variation in user satisfaction. The regression models recommended that cost-effectiveness, open source code, supporting community, backup and restore systems, easy integration with other software, and freedom from licensing fee significantly influenced library professionals to adopt OSILS. The supporting community and easy backup and restore system had a significant negative effect on professionals' satisfaction. The standardized beta values indicated that the cost-effectiveness of OSILS had the greatest impact on library professionals' satisfaction. The results of this study also suggested that library professionals attach the second highest importance to the easy backup and restore systems of OSILS, followed by supporting community, easy integration with other software, open source code, and freedom from licensing fee.

The Bartlett's Sphericity Test and Cronbach's Alpha evaluated the reliability of each multiple-item scale indicating that the overall questionnaire items of library professionals are very reliable. To evaluate the validity of the study several methods were used. The correlation between one factor and the other is not as strong as the alpha coefficient of each factor, which supported discriminating validity. Only three factors were recovered and all the items were loaded on the factors when no constraints were imposed on the extraction of factors in a factor analysis with varimax rotation. Each of the three factors had an eigenvalue of greater than one which had a total of 60.03% of the variance which indicating the validity of the data. The overall Kaiser-Meyer-Olkin (KMO) value matrix is 0.859 for 14 factors indicated that the sample size (196) is statistically significant for the exploratory

Table 9. Regression results with 14 factors.

Model		Un-standardized coefficients		Standardized coefficients			95.0% Confidence interval for B		Collinearity statistics	
		B	Std. error	Beta	T	Sig.	Lower bound	Upper bound	Tolerance	VIF
1	(Constant)	1.642	.424		3.872	.000	.805	2.479		
	Factor-1	.171	.084	.183	2.036	**.043**	.005	.337	.519	1.928
	Factor-2	-.233	.093	-.236	-2.520	**.013**	-.416	-.051	.480	2.081
	Factor-3	-.120	.100	-.107	-1.208	.229	-.317	.076	.539	1.856
	Factor-4	.055	.085	.054	.645	.520	-.113	.222	.590	1.694
	Factor-5	.050	.081	.056	.617	.538	-.110	.211	.505	1.979
	Factor-6	.203	.086	.219	2.372	**.019**	.034	.372	.492	2.032
	Factor-7	-.056	.094	-.061	-.601	.549	-.241	.129	.412	2.426
	Factor-8	.057	.097	.058	.591	.555	-.134	.249	.429	2.330
	Factor-9	.266	.085	.273	3.131	**.002**	.098	.434	.555	1.803
	Factor-10	-.252	.107	-.241	-2.349	**.020**	-.464	-.040	.399	2.504
	Factor-11	.091	.099	.084	.914	.362	-.105	.286	.496	2.017
	Factor-12	.206	.081	.211	2.561	**.011**	.047	.365	.618	1.617
	Factor-13	.000	.081	.000	-.004	.997	-.160	.159	.561	1.781
	Factor-14	.084	.065	.105	1.290	.199	-.059	.199	.629	1.591

[a]Dependent variable: Overall professionals' satisfaction.

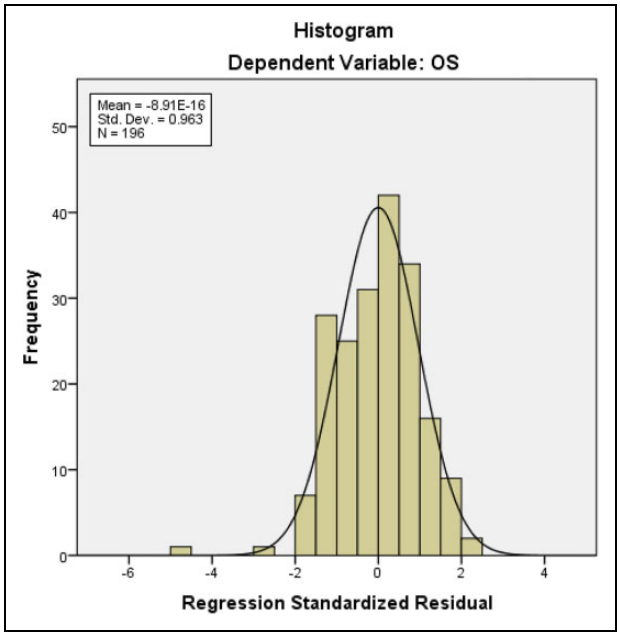

Figure 1. Visual identification of the shape of normal distribution.

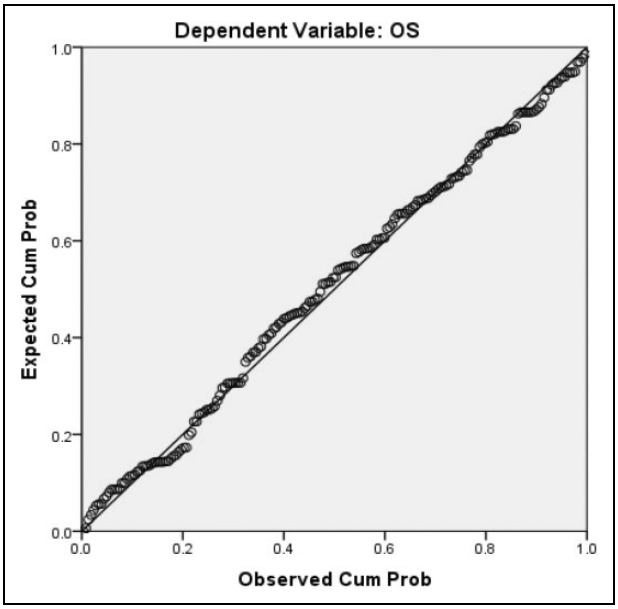

Figure 2. Normal probability plot of the standardized regression residual.

factor analysis. The items loading of the extracted variables were found to be between 0.578 and 0.749 for all factors, indicating that all variables represent respective dimensions successfully. The commonalities of variables extracted between 0.517 and 0.721 for 13 out of 14 factors suggested that the variance of most variables is within the acceptable range.

The application of the Cohens' criterion for effect size, the relationship between independent variables (factors) and dependent variables (satisfaction) was appropriately characterized as moderately strong. The model has a smaller regression sum of squares compared to the residual sum of squares, which means that the model does not account for the majority of the variation in the dependent variable. The histogram and normal probability plot of the standardized residual regression do not recommend any deviation from the assumptions, and the dependent variable is

normally distributed. The residual statistics would be relatively confident that the use of the model would not be severely limited. After the normality of the data is met in the regression model, the multicollinearity is needed to test for determining if there is any similarity between the independent variables in a model. In an appropriate regression model, no correlation between independent variables should occur, or no multicollinearity should happen. The VIF values obtained between 1.591 to 2.504 and it can be concluded that there were no multicollinearity symptoms. However, the consequences of the validity tests support the validity of the study.

Rafiq and Ameen (2009) stated that OSILS adoption in libraries is at infancy level after surveying 370 responses from 48 countries including Pakistan, India, Australia, Canada, USA, and UK. Alam and Islam (2011) showed that the automated systems of Bangladeshi libraries are still at infancy level. Alam (2017: 1) identified that a "lack of OSILS consortium, unwillingness of library professionals, inadequate funding, lack of IT infrastructure, and lack of training & retraining of library professionals" were the significant causes of lower adoption of OSILS in Bangladeshi university libraries. Alam (2018) showed that only 14% of university libraries had adopted OSILS in Bangladesh. Seven public university libraries out of 41 and 14 private university libraries out of 103 (two in 2010, three in 2011, seven in 2012, three in 2013, two in 2014, one in 2015, two in 2016 and one in 2017) automated their libraries using Koha OSILS; but, no university libraries of Bangladesh are using any other OSILS. Among them, 52% of the university libraries did not apply any automation software previously, 33% shifted their proprietary ILS into OSILS, and 14% moved their freeware ILS into OSILS. He also found that the selected university libraries overall were using 59% of Koha modules, and the level of satisfaction showed positive acceptance from the library users and professionals. Khatun and Ahmed (2018) examined the usability of the Koha OPAC of BRACU Library empirically from a user perspective and provided favorable information about the Koha interface and its usability. Marshall Breeding (2017) conducted an international survey on library automation among 4042 libraries from 92 countries and showed that Koha received top marks in the 2016 perceptions survey. Müller (2011) conducted a multidimensional analysis among 20 free and OSILS software and found that Koha was recognized as the most sustainable and mature OSILS. Kiriyanant (2012) found that 59% of Thai university libraries in Bangkok and Pathumthani tended to move towards OSILS adoption although they currently used proprietary ILS. Among them, 55% thought that they would select Koha when they wanted to change library automation. From the above discussion, it can be said that the OSILS adoption and practices in libraries and information institutions around the world including Bangladesh have gained popularity in recent years due to the sustainability, maturity, efficiency, and usability of Koha.

Conclusion

The purpose of the study is to identify the influential factors for adoption of open source integrated library systems in Bangladeshi university libraries. A structured questionnaire was adapted cautiously as per local arrangements after conducting a pilot survey. The final survey was carried out among 196 library professionals from 14 private and seven public university libraries via the structured questionnaire. The influential factors for the adoption of OSILS were analyzed by multiple regressions where overall satisfaction was used as the dependent variable, and 14 factors were applied as independent variables. The Bartlett's test and Cronbach's Alpha evaluated the reliability of each multiple-factor scale which suggested that the internal consistency of all factors was very satisfactory. Moreover, discriminant validity, item loading, commonalities, factor analysis with varimax rotation, normal probability plot, histogram, KMO, multicollinearity, and VIF values supported the validity of the study. The entire model of regression analysis was established to be significant and recommended that cost-effectiveness, open source code, supporting community, backup and restore systems, easy integration with other software, and freedom from licensing fee significantly influenced library professionals to adopt OSILS in Bangladeshi university libraries. It will help to build consciousness among library professionals and users regarding OSILS. Moreover, an attempt has been made for the first time to evaluate the significant factors for adoption of OSILS in Bangladeshi university libraries. Ideally, this study will prompt future research that assesses the extent to which the adoption of OSILS has been done and the factors that hinder its adoption from the professionals' point of view of non-OSILS.

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