Technological Sustainability and Green Libraries: A Study among Library Professionals Working in Select Higher Education Institutions In and Around Chennai

Kalpana.T.M
Indian Statistical Institute
Taramani. Chennai. kalpana.ttcpl@gmail.com

S. Gopalakrishnan
National Institute of Fashion Technology
Taramani, Chennai. gopusg@yahoo.com

Abstract

This study focused on technological sustainability, environmental sustainability and adaptability of green computing and green ware with specific reference to implementation in libraries. 60 questionnaires were distributed among library professionals working in select higher educational institutions in and around Chennai. It is found that more significance was given to technological advancements towards sustainability. The study, envisages that technology enabled systems with positive environmental impact should be popularized more among LIS professionals.

Keywords

Sustainable development; Technological sustainability; Green computing; Green ware; LIS professionals.

.

Electronic access

The journal is available at www.jalis.in

Journal of Advances in Library and Information Science
ISSN: 2277-2219 Vol. 5. No.1. 2016. pp.01-11

INTRODUCTION

Library and information services have evolved itself to the changing trends with the introduction of computers, information and communication technology (ICT), computing technology etc. Format of user requirements, resources have forced the library community to change the format of services. But this evolution has a positive impact on user but simultaneously has negative impact on environment. This negative side of development is mostly due to production of e-waste. Life of technologies is inversely proportional to the quantum of e-waste produced. Thus, there is a need on study of technology that is comparatively sustainable and has positive approach towards resources management. This paper studies about the strategies, improvement of environment inside and outside library with indoor plants, green computing and green ware etc.

TECHNOLOGY AND SUSTAINABLE DEVELOPMENT

Sustainable Development is a continuous and long term development in common. Report on World Commission on Environment and Development: Our Common Future, Brundtland Bericht, (1987)[1] explained that " Development that meets the needs of the present without compromising the ability of future generations to meet their own needs". For example, floppy disks were replaced with compact discs thus left all the contents in those floppy became obsolete. Floppy discs and its readers becomes e-waste. Therefore all developments should definitely focus on wastes created out of that improvement. These wastes can be minimized by REUSE, RECYCLE and REDUCE (3Rs) (Sheryl, 2008)[2], wherever possible. Waste generation cannot be avoided but minimized by economic and efficient usage of resources through 3Rs and helps to reduce investment.

Technological sustainability can be even addressed with recent developments in Personal Access Devices (PDA). Most of the young generation library users prefer electronic format of resources. Advantages like multiple sharing, formats, flexibility, search ability, etc. makes it more user-friendly. In a survey, it has estimated that more than 50% of students use smart phone. Technically, smart phone can be considered as mini sized desk tops as it has most of the functionalities. This again reduces the need for installation of desktops in libraries as PDA's have added advantages like, personal device management,

storage management, time management, access control etc.
Most of the library administration software, database, and online resource providers like Thomson Reuters provide resources accessible through PDA devices. Compatibility not only for screen size but also with different Operating Systems (OS) like Windows, Android, MAC, etc.(Kalpana. T.M. & S. Gopalakrishnan, 2015)[3]

REVIEW OF LITERATURE

Libconomics is an interdisciplinary word meaning economics in library environment, or efficient usage of resources available to maximize its benefits (Kalpana. T.M & S. Gopalakrishnan, 2013)[4]. According to Khalid Mahmood shrinking of financial support from government is the reality (Khalid Mahmood, 2005)[5]. Unless some initiatives or special programs are taken up under special projects for selected libraries funds allotment are not increased relatively to the rise in price. But the cost of procurement is increasing for all resources globally. Hence fund raising, economic usage of available resources, implementation of cost effective technologies in libraries have become inevitable. With reference to Library environment, adapting sustainable practices suitably can bring in change. James and Suzanne LeRue (1991)[6] in an article on "The Green Librarian", explained in detail how librarians should be environmentally supportive at home and in the library. Trotte (2008)[7] in a paper entitled "Going for Green", discussed three environmentally friendly libraries and offered tips on how librarians could make their libraries greener. Sahavirta (2012)[8] in an article revealed that commitment to green values may increase environmental sustainability and help libraries to take a new and visible role in changing society. Divya and Vijayakumar (2013)[9] indicate that librarians should initiate green library movement.

Cloud computing and Virtualization

Cloud computing and virtualization minimizes the effect of e-storage on environment through centralized storage. Zhang discusses about the advantages and security features of cloud storage (Zhang et. al, 2010)[10]. Though, many decentralized storage servers can put a heavy investment burden, many commercial cloud service providers with competitive rating for storage has made it more economical and viable as they provide service through centralized servers. Cloud computing is storing of digital information in a more secured format externally and retrieved on demand through a network. Cloud Storage service provides data security from hacking, phishing etc in different stages and strategies. Open Security Architecture (OSA) in its technical manual points out that cloud computing can be more secured with users' participation. Subashini (2011)[11] surveys the security issues in service models of cloud computing. Zissis & Lekkas (2012)[12] addresses the cloud computing security issues. Data security issues and challenges can be overcome by multi-level authentication, access mapping, encryption, behavior analysis etc. (Kalpana. T.M & S.Gopalakrishnan, 2014)[13]

Green Computing

Green computing is acquisition, processing, storage and retrieval including hardware and software components in maximum efficiency with minimum energy utility, carbon foot print, emission of heat in production, usage, recyclability, biodegradability, safe disposability, reduced use of heavy, hazardous or precious metals etc. Shinde, Nalawade & Nalawade (2013)[14] describes recent implementations, approaches of green computing. Few software tools like DATAllegro, Kickfire has the capability to process exponentially more transactions with a smaller hardware footprint. Meanwhile, extreme data compression is currently being advertised by special DBMS like ParAccel, Vertica, which also results in minimized hardware, space, energy requirements.

Green ware

Green computing classified as green process and green product. Green process engages minimal fossil fuel in production of equipment, and the green product utilizes biodegradable, bio-safe raw materials for production. Mittal & Kaur (2013)[15] elaborates about green ware and safe e-waste management systems. Green ware is the concept of producing an electronic gadget in a more eco friendly process. This can be further explained in three ways namely
Process: manufacturing process, where the raw materials are standardized to green computing including distribution, packing etc.
Procedure: procedure of production, software and hardware development
Technology in production: from production, distribution and evaluation in usage etc

Green computing and green ware are those that use hardware and software that cater to the eco standards

and materials are fully biodegradable, easily available, and cost effective. Avoiding the usage of rare metals that are depleting, replacing it by substitutes with cost and process efficient material for production etc. focuses on sustainable development. Wipro launches green Personal Computer (PC) which is made up of fully bio degradable or recyclable materials, minimizes or eliminates the usage of hazardous materials or emissions

Green Libraries

The concepts of green libraries were popular and initiated in American libraries. Green Libraries are built with recycled materials to avoid land or ocean fill. Moreover, according to its location and direction of sunlight, reading area with natural sunlight and covered stack area are planned. Efficient water utilization, rain water harvesting, energy saving equipments, automated systems to reduce energy utilization, temperature control with green roof top, improved indoor air quality by indoor plants etc are factors considered in green libraries (Antonelli, 2011)[16]

METHODOLOGY

A pilot study was conducted for the purpose of this paper among LIS Professionals working in Higher Educational Institutions in and around Chennai. A structured questionnaire on a 5 point scale responses were distributed among 60 LIS Professionals. Data were analyzed with Statistical analytical package IBM SPSS

OBJECTIVES OF THE STUDY

- To evaluate the expertise on concept of technological sustainability, environmental sustainability among LIS Professionals
- Opinion, familiarity and interest towards environmental sustainability
- To examine the knowledge updating on recent trends and technological up gradations in other fields
- Awareness of green libraries, green computing and green ware among LIS professionals.
- Suitable technologies and its adaptability in libraries of higher educational institutions.
- If sustainability measures are made mandatory will it be fruitful
- Evaluation of opinion of working professionals on level of co-operation from management if such implementations are initiated by LIS Professionals

HYPOTHESES

- LIS professionals working in higher educational institutions are aware of recent updations in technologies and its significance
- There exists difference among on concepts of respondents on green computing and green libraries
- Different factors contribute environment friendly libraries
- Level of implementation depends on the support and managerial decisions of the parent institution

ANALYSIS AND DISCUSSION

A total of 60 questionnaires were distributed to the LIS professionals working in 40 select higher education institutions in and around Chennai. The institutions were classified based on their domain as *Engineering and Technology, Arts and Sciences, Medical sciences, and Multi domain Universities (Table 1).* Table 1 reveals that the response rate from respondents is 76.67 %.

Table 1: Quantum Of Questionnaire Distributed And Responses Received.

Sl. No.	Domain of Institutions	No. of Institutions	Distri-buted	Recei-ved	Percentage
1.	Engineering & Technology	15	25	20	80.00
2.	Arts & Science	10	15	13	86.67
3.	Medical Sciences*	10	10	08	80.00
4.	Multi domain Universities	5	10	6	60.00
	Total	40	60	47	76.67

**Medical Sciences includes Medical, Dental, Pharmacy and Nursing*

Further the study was classified based on gender, age, designation and experience which are shown in table 2.

Table 2: Demographic Details of respondents

Sl.No.	Description	Engineering & Technology	Arts & Science	Medical Sciences	Multi-domain Universities	Total
	Gender					
1	Male	12	4	7	5	28 (59.6)
2	Female	8	9	1	1	19 (40.4)
	Age (in yrs)					
1	21to 30	0	3	0	0	3 (6.4)
2	31 to 40	4	3	2	0	9 (19.1)
3	41 to 50	9	5	3	6	23 (48.9)
4	Above 50	7	2	3	0	12 (25.5)
	Designation					
1	Asst. Librarian	13	4	6	5	28 (59.6)
2	Librarian	7	9	2	1	19 (40.4)
	Years of Experience					
1	Below 5	0	2	0	0	2 (4.3)
2	6 to 10	3	5	3	5	16 (34.0)
3	11 to 15	6	2	2	1	11 (23.4)
4	16 to 20	4	2	2	0	8 (17.0)
5	Above 20	7	2	1	0	10(21.3)
	Total	20	13	8	6	47 (100.00)

59.6 % belongs to male and 40.4 % belongs to female aggregates to around 3:2 ratio. Further respondents were classified under designation as librarian and assistant librarian, 40.4% and 59.6 % respectively. It is inferred that in many organizational structure, two or more Assistant Librarians work under one Librarian and this may be the reason that Assistant Librarians are comparatively more. More than75% of respondents are in the age group of 41 and above and 21.3% of the respondents having more than 20 years of experience It is also interesting to note that, the maximum respondents of the asst. librarian (13) are from engineering and technology institutions, followed by medical sciences (6).

RELIABILITY ANALYSIS

Reliability analysis is a test on collected data to ensure that the data collected has reliable responses. The exploratory nature of the study has necessitated for data reliability analysis to check whether the items used in the measures are tapping to the same concept or not. Such test accomplished through the use of factor analysis. According to Coakes and Steed (2003)17, factor analysis is a data reduction technique used to reduce large number of variables to a smaller set of underlying set of similar factors to summarize the essential information essential in the variables. Two popular methods in factor analysis are Principal Components and Principal Axis Factoring. In this study, Principal components method is adapted and applied to all variables that have more variables for analysis.

Reliability is concerned with consistency of the variable. There are two identifiable aspects of this issue, namely external and internal reliability. Widely used method in estimating internal reliability is Cronbach's Alpha (α). The Formula used is

$$\alpha = \frac{K}{K-1}\left(1 - \frac{\sum_{i=1}^{K}\sigma_{Y_i}^2}{\sigma_X^2}\right)$$

A commonly accepted rules for describing internal consistency using Cronbach's Alpha (Cronbach, Lee J., and Shavelson R J., (2004)18 are α >= 0.9 (Excellent), 0.9 >= α >= 0.8 (Good), 0.8 >= α >= 0.7 (Acceptable), 0.7 >= α >= 0.6 (Questionable), 0.6 >= α >= 0.5 (Poor), 0.5 > α (Unacceptable). The data thus collected from LIS professionals, were analyzed on four concepts namely "Views on Sustainability", "Importance of sustainable development" "Awareness on Sustainable Development" and "Sustainable Development and Fund Generation". Under each concept, proportionate number of variables was taken up for obtaining the views of LIS professionals. The Concepts taken up for the study, variables and the Cronbach's Alpha value are shown in Table 3.

Table 3: Reliability analysis – Alpha Value

Sl. No	Concept	No. of Variables	Alpha Value
1.	Technological Sustainability	7	0.637
2.	Environmental Sustainability	7	0.707
3.	Green Computing and Green ware	10	0.783

Table 3 reveals that the Cronbach's Alpha value is almost 0.7 which confirms that the study is acceptable in nature. A total of 60 questionnaires were distributed to the LIS professionals working in various higher education institutions in and around Chennai.

Technological sustainability

Respondents views on sustainable development has been estimated based on five variables in a five point scale such as "Strongly Agree", "Agree", "No Comments", "Disagree" And "Strongly Disagree" and the responses are shown in table 4. Mean and Standard Deviation (Std.) were calculated based on a five point scale. The ranks were assigned accordingly based on the mean value.

Table 4: Technological sustainability

S.No	Description	SA	A	NC	D	SD	Mean	Std.	Rank
1.	Proprietary / commercial software lay economic stress on library budgets	22 (46.8)	22 (46.8)	2 (4.3)	1 (2.1)	0	4.38	0.677	1
2.	Annual maintenance contract is an additional recurring cost	18 (38.3)	27 (57.4)	1 (2.1)	1 (2.1)	0	4.32	0.629	5
3.	Open source software like KOHA, DSPACE etc. helps to automate libraries at minimum cost	18 (38.3)	21 (44.7)	2 (4.3)	5 (10.6)	1 (2.1)	4.06	1.030	7
4.	Cloud computing or cloud storage will bring down server, maintenance, infrastructure cost	22 (46.8)	20 (42.6)	5 (10.6)	0	0	4.36	0.673	3
5.	Digital compression technologies helps in economic storage	20 (42.6)	25 (53.2)	1 (2.1)	1 (2.1)	0	4.36	0.640	2
6.	Green Computing practices should be motivated to LIS professionals	18 (38.3)	27 (57.4)	2 (4.3)	0	0	4.34	0.562	4
7.	Virtualization of resources can save energy and server costs	16 (34.0)	25 (53.2)	4 (8.5)	2 (4.3)	0	4.17	0.761	6

(SA Strongly Agree; A Agree; NC No Comments; D Disagree; SD Strongly Disagree)

From the table 4, it can be inferred that commercial software and its annual maintenance cost are contributing to the financial stress on budgets and it is represented by 93.6 % and 95.7% of respondents respectively. Free open source software is gaining momentum to bring down these expenses. But for implementing and using this software with management co-operation, LIS professionals need expertise in technology and its implementation strategies.

Table 5: Technological Sustainability vs. Designation and Gender

Sl.No	Description	Male			Female			Librarian			Asst. Librarian		
		Mean	Std.	Rank	Mean	Std.	Rank	Mean	Std.	Rank	Mean	Std.	Rank
1	Proprietary / commercial software lay economic stress on library budgets	4.36	.559	1	4.42	.838	3	4.63	.496	1	4.21	.738	5
2	Annual	4.36	.678	2	4.26	.562	6	4.00	.667	7	4.54	.508	1

	maintenance contract is an additional recurring cost												
3	Open source software like KOHA, DSPACE etc. helps to automate libraries at minimum cost	4.21	.917	5	3.84	1.167	7	4.26	1.147	6	3.93	.940	6
4	Cloud computing or cloud storage will bring down server, maintenance, infrastructure cost	4.36	.678	2	4.37	.684	4	4.26	.653	5	4.43	.690	2
5	Digital compression technologies helps in economic storage	4.21	.686	4	4.58	.507	1	4.42	.607	3	4.32	.670	4
6	Green Computing practices should be motivated to LIS professionals	4.18	.548	6	4.58	.507	1	4.37	.597	4	4.32	.548	3
7	Virtualization of resources can save energy and server costs	4.11	.737	7	4.26	.806	5	4.58	.607	2	3.89	.737	7

For the visibility purpose category wise rank on Views on Sustainable Development were shown in Table 6.

Table 6: Category wise Rank on Technological Sustainability

Sl. No	Description	Gender		Designation	
		Male	Female	Librarian	Asst. Librarian
	Proprietary / commercial software lay economic stress on library budgets	1	3	1	5
	Annual maintenance contract is an additional recurring cost	2	6	7	1
	Open source software like KOHA, DSPACE etc. helps to automate libraries at minimum cost	5	7	6	6
	Cloud computing or cloud storage will bring down server, maintenance, infrastructure cost	2	4	5	2

	Digital compression technologies helps in economic storage	4	1	3	4
	Green Computing practices should be motivated to LIS professionals	6	1	4	3
	Virtualization of resources can save energy and server costs	7	5	2	7

Table 5 and 6 shows that there are exists difference in opinion about technological sustainability among designation and their gender. It can be inferred that there exists controversial knowledge on cloud computing, virtualization, open source software etc.

Environmental Sustainability

Responses for "Environmental Sustainability" has been estimated based on five variables in a five point scale such as "Strongly Agree", "Agree", "No Comments", "Disagree" And "Strongly Disagree" and the responses are shown in table 7. Mean and Standard Deviation (Std.) were calculated based on a five point scale. The ranks were assigned accordingly based on the mean and standard deviation values.

Table 7: Environmental Sustainability

S.No	Description	SA	A	NC	D	SD	Mean	Std.	Rank
	Indoor plants can help in keeping environment pollution free	25 (53.2)	20 (42.6)	1 (2.1)	1 (2.1)	0	4.47	0.654	1
	Indoor plants will help to maintain temperature	13 (27.7)	31 (66.0)	2 (4.3)	1 (2.1)	0	4.19	0.613	4
	Environment Friendly strategies implementation should be made mandatory in organizations	19 (40.4)	22 (46.8)	4 (8.5)	2 (4.3)	0	4.23	0.786	3
	Health hazards are caused by chemical pollutants	10 (21.3)	27 (57.4)	7 (14.9)	3 (6.4)	0	3.94	0.791	6
	Indoor plants will naturally absorb chemical emissions from building materials	14 (29.8)	25 (53.2)	4 (8.5)	3 (6.4)	1 (2.1)	4.00	0.956	5
	Indoor plants gives ornamental atmosphere and pleasant environment	14 (29.8)	32 (68.1)	0	1 (2.1)	0	4.26	0.570	2
	Indoor plants help in keeping library a pollution free environment and reduction in room temperature	7 (14.9)	32 (68.2)	3 (6.4)	5 (10.6	0	3.87	0.797	7

(SA Strongly Agree; A Agree; NC No Comments; D Disagree; SD Strongly Disagree)

For visibility purpose the category wise rank on Importance of Sustainable Development were shown in Table 8.

Table 8: Designation and Gender Wise classification of responses for Environmental Sustainability

Sl. No	Description	Male			Female			Librarian			Asst. Librarian		
		Mean	Std.	Rank	Mean	Std.	Rank	Mean	Std.	Rank	Mean	Std.	Rank
1.	Indoor plants can help in keeping environment pollution free	4.46	.693	1	4.47	.613	1	4.37	.496	2	4.54	.744	1
2.	Indoor plants will help to maintain temperature	4.14	.651	4	4.26	.562	3	4.26	.733	3	4.14	.525	4
3.	Environment Friendly strategies implementation should be made	4.21	.876	2	4.26	.653	4	4.11	.809	4	4.32	.772	3

	mandatory in organizations												
4.	Health hazards are caused by chemical pollutants	3.96	.793	7	3.99	.809	5	3.95	.970	6	3.93	.663	7
5.	Indoor plants will naturally absorb chemical emissions from building materials	4.14	.756	5	3.79	1.182	6	3.95	.705	5	4.04	1.105	6
6.	Indoor plants gives ornamental atmosphere and pleasant environment	4.14	.356	3	4.42	.769	2	4.42	.507	1	4.14	.591	5
7.	Indoor plants help in keeping library a pollution free environment and reduction in room temperature	4.00	.544	6	3.68	1.057	7	3.63	1.012	7	4.40	.576	2

From table 8, it is evident that all the respondents have indicated data unanimously without any gender or designation difference. Around 95.8 % of respondents have indicated that the indoor quality can be improved with indoor plants and ranked first. Mean for most of the variables are four and above shows that the respondents agree to the variables. Preferences differ for other variables and least significance was stated by female and librarians for indoor pollution control through plants. "Health hazards can be caused by chemical pollutants" was denoted as least preference by respondents of male and assistant librarian category.

Green Computing and Green Libraries

Awareness on Green Computing and Green Libraries has been ascertained from the LIS professionals and their opinion is tabulated in table 9

Table 9: Green Computing and Green Libraries

S. No	Particulars	SA	A	NC	D	SD	Mean	Std.	Rank
1.	Green Computing helps in reducing carbon foot and emissions	19 (40.4)	21 (44.7)	1 (2.1)	3 (6.4)	3 (6.4)	4.06	1.131	9
2.	Green computing reduces waste in production	20 (42.6)	22 (46.8)	2 (4.3)	1 (2.1)	2 (4.3)	4.21	.954	4
3.	Recycled and reused materials are used in production process in green computing	23 (48.9)	16 (34.0)	5 (10.6)	2 (4.3)	1 (2.1)	4.23	.960	3
4.	Components produced from environment friendly materials are called green ware	19 (40.4)	26 (55.3)	1 (2.1)	0	1 (2.1)	4.32	.726	1
5.	Introduction of green ware and green computing makes library more environment friendly	10 (21.3)	32 (68.3)	3 (6.4)	1 (2.1)	1 (2.1)	4.04	.751	10

6.	Green computing and green ware are adaptable in library environment	20 (42.6)	21 (44.7)	2 (4.3)	3 (6.4)	1 (2.1)	4.19	.947	6
7.	Awareness on green computing and green ware should be given to library professionals	13 (27.7)	28 (59.6)	4 (8.5)	2 (4.3)	0	4.11	.729	8
8.	Library professionals should be motivated to use green ware	19 (40.4)	19 (40.4)	7 (14.9)	1 (2.1)	1 (2.1)	4.15	.908	7
9.	Management co-operation helps to procure only green ware	19 (40.4)	21 (44.7)	5 (10.6)	1 (2.1)	1 (2.1)	4.19	.876	5
10.	Library professionals should initiate to bring green libraries	23 (48.9)	19 (40.4)	2 (4.3)	2 (4.3)	1 (2.1)	4.30	.907	2

(SA Strongly Agree; A Agree; NC No Comments; D Disagree; SD Strongly Disagree)

Table 10: Green Computing and Green Libraries Vs. Designation

Sl. No	Description	Librarian								Assistant Librarian							
		SA	A	NC	D	SD	Mean	Std.	Rank	SA	A	NC	D	SD	Mean	Std.	Rank
1.	Green Computing helps in reducing carbon foot and emissions	9	8	0	0	2	4.16	1.24	8	10	13	1	3	1	4.00	1.089	10
2.	Green computing reduces waste in libraries	11	6	1	0	1	4.37	1.012	4	9	16	1	1	1	4.11	.916	7
3.	Recycled and reused materials are used in production process in green computing should be utilized in libraries	8	7	3	1	0	4.16	.898	7	15	9	2	1	1	4.29	1.013	1
4.	Components produced from environment friendly materials are green ware	8	11	0	0	0	4.42	.507	2	11	15	1	0	1	4.25	.844	2
5.	Introduction of green ware and green computing makes library more environment	4	12	2	0	1	3.95	.911	10	6	20	1	1	0	4.11	.629	5

	friendly																
6.	Green computing and green ware are adaptable in library environment	11	7	0	1	0	4.47	.772	1	9	14	2	2	1	4.00	1.018	9
7.	Awareness on green computing and green ware should be given to library professionals	6	10	2	1	0	4.11	.809	9	7	18	2	1	0	4.11	.685	6
8.	Library professionals should be motivated to use green ware	7	9	3	0	0	4.21	.713	5	12	10	4	1	1	4.11	1.031	8
9.	Management co-operation helps to procure only green ware	7	9	3	0	0	4.21	.713	5	12	12	2	1	1	4.18	.983	4
10.	Library professionals should initiate to bring green libraries	13	4	0	1	1	4.42	1.121	3	10	15	2	1	0	4.21	.738	3

From the responses, librarians have ranked that "green computing are adaptable in library environment" and assistant librarians have preferred in recycling and reusing of resources. Librarians and assistant librarian have indicated similarly for "components produced from environment friendly materials are green ware" and "library professionals should initiate to bring green libraries". Mean value for almost all the responses are above 4.00 and this denotes that librarians and assistant librarians show their awareness and initiation by LIS professionals will bring a positive change in libraries.

FINDINGS:

The following are some of the findings

- LIS professionals are aware of the term technological sustainability and almost 95.7 % of respondents have shown positive approach towards its implementation with management co-operation.
- 99.4 % of respondents shows that cloud computing, digital compression like data mining and data warehousing and virtualization will reduce the stress on e-storage.
- LIS professionals accept the fact that indoor plants will help to improve quality of indoors in libraries and it can be made mandatory. The mean value for all 7 variables are 4.00 and above.
- Green computing and green need to be initiated by LIS professionals to bring in green libraries and its positive impact on environment with overall mean for 10 variables as 4.18.

CONCLUSION

Library professionals focus on services and user's comforts but creates physical and e-waste. It is the duty of professionals to be environmentally conscious and advance services with apt technologies to cater the users. Awareness and updations on recent inventions should be popularized among LIS professionals that could help to adapt suitably in libraries with positive carbon foot print and minimized e-waste, space management, energy utilization etc. From the study, it could be inferred that LIS professionals are aware of advancement in technologies and if supported by management of parent institutions, it can be implemented aptly.

REFERENCES:

[1]. Brundtland Bericht (1987): A Report on World Commission on Environment and Development: Our Common Future

[2]. Einesberg, Sheryl, (2008): The 3R's still rule. The Green Life; A Journal of Sorts. Retrieved from http://www.nrdc.org/thisgreenlife/0802.asp

[3]. Kalpana.T.M, & Gopalakrishnan.S (2015). Network, Sustainability and Security of Libraries on Smart Phones, Mehdi Khosrow-Pour ed., Encyclopedia of Information Science and Technology, 3rd ed.. IGI Global, 3860-3869 p.

[4]. Kalpana.T.M, & Gopalakrishnan.S (2013). Self Sustainability in Academic Libraries in Digital Era. Thanuskodi ed., Challenges in Academic Libraries in Digital Era. IGI Global, 47-67p.

[5]. Khalid Mahmood, A. H., Syed Jalaluddin Haider. (2005). Fund Raising in Pakistani Libraries : perceptions of Library Readers. *The International Information and Library Review*, 37, 117-125.

[6]. LeRue, James and Suzanne LeRue,(1991): The green librarian, *Wilson Library Bulletin*, Vol. 65 27-33p.

[7]. Trotter, Dorthy Waterfill (2008): Going for the green, *American Libraries,* Vol. 39 (4) 40-43p.

[8]. Sahavirta, Harri (2012), "Showing the green way: advocating green values and image in a Finnish public library", *IFLA Journal* Vol. 38,(3) 239-242p.

[9]. Divya, P.I and Vijayakumar,K.P(2013), "Green libraries for sustainable development. New information technology interfaces in libraries and information centers", KLA National Seminar Souvenir:

[10]. Zhang, Shuai et. al. (2010), Cloud computing research and development trend, Second International Conference On Future Networks.

[11]. Subhashini, V and Kavitha ,S (2011): A survey on security issues in service delivery models of cloud computing, *Journal of Network and Computer Applications,* Vol 34. 1-11 p.

[12]. Zissis, Dimitrios & Lekkas, Dimitrios (2012): Addressing cloud computing security issues, Future Generation Computer Systems, Vol 28 583-592 p.

[13]. Kalpana.T.M, & Gopalakrishnan.S (2014): Cloud computing and Virtualization technologies in libraries, in Sangeeta N. Dhamdhere ed., Encyclopedia of Information Science and Technology, 3rd ed.. IGI Global, 3860-3869 p.

[14]. Shinde, Sharmila; Nalawade, Simantini & Nalawade, Ajay (2013): Green Computing: Go Green and Save Energy, *International Journal of Advanced Research in Computer Science and Software Engineering,* Vol 3(7) 1033-1037p.

[15]. Mittal, Pardeep; Kaur, Navdeep (2013): Green Computing : Need and implementation, *International Journal of Advanced Research in Computer Engineering & Technology*, Vol. 2(3), 1200-1203

[16]. Antonelli, Monika (2008): The green library movement: An overview and beyond, *Electronic Green Journal* Issue, Vol. 27, ISSN: 1076-7975

[17]. Coakes, S J and Steed, L G (2003), SPSS Analysis without Anguish. John Wiley & Sons.

[18]. Cronbach, Lee, J and Shavelson, R J. My Current thoughts on Coefficient Alpha and Successor Procedures. Educational and Pschological Measurement 64(3): 391-418(2004).