Influence of Factors in Provision of Networked Services: An Empirical Study in India

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Introduction

Today, we live in a knowledge society, and knowledge is the most democratic source of power (Toffler, 1991). It is the main characteristic of future societies (Repanovici, 2006). Knowledge has been described as a fluid combination of actual experiences, values, and practical information (Dastgerdi, 2009). A knowledge society is one where knowledge is a cognitive asset and the primary source of production. Knowledge-based activities are the production, targeting, and orientation of knowledge (Reich, 1991). Education is the key for generating knowledge to sustain the social, political, and economic prosperity of a nation. Libraries have always existed at the juncture between knowledge consumption and knowledge creation (Kaser, 2009). Libraries exist to serve as many people as possible, disseminating information, preserving culture, and contributing to intellectual and social life (Iwhiwhu, 2008).

Education and libraries are inseparable. They are indivisible concepts, working for knowledge production, promotion, and dissemination. Education is a process of providing knowledge, skill, or competence to learners through optimal use of libraries and information services (Magara and Batambuze, 2009). As an integral part of academic institutions, the libraries are a hub of knowledge and information services (Mirza and Mahmood , 2009). The primary function of the academic library system is to serve students, researchers, faculty, and staff. Technology has created a host of opportunities for libraries to improve their services (Maddern, 1998). Technology has changed the entire concept of libraries from storage to access (Khalid, 2000). Moreover, technological change is not only in the way information is packaged, processed, stored, and disseminated, but also how users seek and access information (Anunobi and Okoye, 2008). A network is a conduit for information (Sawhney and Parikh, 2001). In the 1990s, the Internet connected networks to create a remarkable technology and it continues to transform higher education (Rosenberg, 2001). The academic community has long appreciated the potential of the Internet to expand access to information, facilitate communication, and promote human development (Dempsey, 2007) . Libraries have a role in helping people become masters of the technology that surrounds us (Kaser, 2009).

Networks are a commonly-used technology in the library. Networked information and the methods of storage, transmission, and retrieval are much different compared with traditional methods (Zhen, 1996). Libraries use networks for a variety of purposes, not only for in-house functions, but also remote services. The information stored and used in the library is largely network-based. Use of library services

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over a network is continuously growing. Users prefer networked information resources, rather than physical access (McClure, 2004). Libraries must be ready to provide Networked Services (NS). Academic libraries may encounter difficulty in managing, accessing, and using networked resources and services. The current state of NS is relatively primitive and tools to guide users to find items of significant interest are still inadequate (Sadowsky, 1993). There are many complicated interactions among technology, policy, organizations and people that require ongoing thought and clarification. (McClure, Bertot and Hert, 1999). Lack of infrastructure hampers the growth of libraries to meet the changing demands of the users (Shariful Islam and Nazmul Islam, 2007).

Many studies explore NS. In global perspective, Yavarkovsky (1993) and Strempel (1996) investigate NS in state libraries. Dempsey, et al. (1993), and Dempsey, Mumford, and Tuck (1994) introduce technologies and standards which are important for emerging networked library services. Kistner (1992) and Geldenhuys (1995) describe CD-ROM networks. Owen and Wiercx (1996) propose three basic models including the networked library model, co-operative network model, and knowledge environment model. Lakos (1997) discusses identifying library clients in the networked environment, and investigates possible links between identification and service assessment. Gessesse (1997) conducted a pilot programme on Internet-accessed CAS. Fletcher and Bertot (2000) and Razeq and Younis (2005) report a new role for the networked library in providing online information services. Taha (2007) investigated networked e-information services to support the e-learning process at UAE University. Using tools such as e-metrics and Measuring the Impact of Networked Electronic Services (MINES), libraries are working on evaluation of networked information services.

In the Indian context, various studies related to NS have been carried out. Ganesan and Srinivasulu (2002) describe network-based information services at IGM library, University of Hyderabad. NS has become more useful, simultaneously accessible, and available at an affordable cost. Vaishali and Dongre (2004) carried out a case study on electronic sources and services provided to users at Visvesvaraya National Institute of Technology Library, Nagpur. Vasishta (2007) undertook a case study on library automation and networked services at university libraries in North India. The survey findings conclude that most of the libraries are in a transitional stage. Kapoor and Goyal (2007) examine web-based OPACs in Indian academic libraries. Sivaraj, Esmail, and Kanakaraj (2008) emphasize networking in the electronic transmission of data to make resource sharing viable at engineering college libraries in Tamil Nadu. Moghaddam and Talawar (2008) conducted a case study on the use of scholarly electronic journals at the Indian Institute of Science (IISc) and found that high interest in electronic journals accessible round the clock. Mahajan (2009) reports that a document delivery service is being provided to users on demand at Punjab University Library.

Area of the Study

This study examines the influence of various factors in providing Networked Services (NS). The factors are Library Automation (LA), Network Infrastructure (NI), Computer Infrastructure (CI), Electronic Resources (ER), and Manpower (MA). These factors are defined as follows:

Library Automation (LA)

LA consists of the level of computerisation, integrated library software, installation and management of software, and functionalities such as acquisitions, cataloging, circulation, serials control, stock-verification, and article indexing.

Network Infrastructure (NI)

This encompasses Local Area Network (LAN) connectivity whether it is a dedicated line or a part of campus network, the media used, the spread of the campus network, Internet connectivity and bandwidth, etc.

Computer Infrastructure (CI)

This includes computer hardware, software, and electronic equipment (digital scanners, barcode scanners, printers, video players/recorders, and televisions).

Electronic Resources (ER)

ER refers to information packages made available in digital format. These consist of online journals, databases (e-journals), searchable datasets (CD-ROM databases), learning resources (CD-ROM, audio/videocassettes), etc.

Manpower (MA)

Two categories of employees are identified: professionals who hold a Library and Information Science (LISc) degree, and non-professionals.

Networked Services (NS)

The Internet is an integral part of library service (Bertot, 2004). Indeed, many NS are rendered through the Internet. Historically, there have been three primary services in use on the Internet: electronic mail, remote login, and file transfer (FTP) (Blumenfeld & Droms, 1992). NS are a rapidly growing environment and they facilitate communication among users and encourage the creation and dissemination of information (Abdullah and Gay, 1994).

NS are electronic information services that allow users to access library resources residing locally and on remote sites through networked media. NS are an important way to evaluate library performance. Shim, et al. (2001), define NS and their use in library settings. In this study, NS refers to all library services users can access using computer and network technologies. NS encompasses electronic data interchange between publishers and suppliers for acquisition of material, cataloguing, circulation, virtual reference, current awareness, online databases, multimedia databases, electronic thesis and dissertations (ETD), network communication services (Internet, e-mail, telephone, facsimile, video/teleconferencing, and videotext/teletext), e-learning, e-publishing (e-news, blogs), Web-based document delivery, support services, etc.

Research Hypothesis

Networked Services (NS) are not statistically associated with library automation, network infrastructure, computer infrastructure, electronic resources, or manpower.

Methodology

A questionnaire was used to collect data from administrators of the libraries of all National Institutes of Technology (NITs). These are centrally-funded, national institutions. Though the sample size was limited, reminders were sent to those administrators who failed to respond in time. Ultimately, all responses were received.

Data Collection

A methodology adopted for collecting data was questionnaire. A structured questionnaire method remained the primary source of collecting data. The collection of data for each factor was shown in Annexure 2-6. Data obtained through the questionnaire were quantified using numerical scales.

Justification for Multiple Numerical Scales

The questionnaire consists of 35 items covering both objective and descriptive information. It was rather difficult to fix a single numerical scale to extract the quantitative data. Hence, multiple numerical scales were used to quantify various factors (LA, NI, CI, ER, MA, and NS) among NIT Libraries in India. Distribution of numerical scales among factors is shown in Table 1.

Table 1. Distribution of Numerical Scales

Sl. No.	Factors	Scales				Score
		1 (Yes)	1 – 2	1 – 3	1 – 5	100%
1	LA	x	x	x		14
2	NI	x	x	x	x	20
3	CI	x	x		x	13
4	ER				x	15
5	MA			x	x	13
6	NS	x				25

The scales were used to depict the true picture at each NIT library while indicating the impact in terms of LA, NI, CI, ER, MA, and NS. The raw data (Appendix 1) obtained through questionnaire was normalised due to use of multiple scales and presented in Table 2.

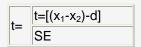Table 2. Normalised Data of Factors among the NIT Libraries

Sl. No.	NIT Libraries	NS	LA	NI	CI	ER	MA
1	MNNIT Allahabad	0.44	0.86	0.85	0.92	0.53	0.46
2	NIT Hamirpur	0.40	0.36	0.85	0.85	0.87	0.54
3	NIT Jalandhar	0.48	0.50	0.70	0.54	0.80	0.46
4	NIT Kurukshetra	0.56	0.71	0.55	0.77	0.73	0.38
5	NIT Srinagar	0.44	0.57	0.60	0.77	0.27	0.62
6	NIT Durgapur	0.68	0.71	0.60	0.77	0.47	0.62
7	NIT Jamshedpur	0.52	0.43	0.65	0.54	0.33	0.46
8	NIT Patna	0.12	0.29	0.60	0.46	0.07	0.23
9	NIT Rourkela	0.80	0.79	0.80	0.62	0.53	0.46
10	NIT Agartala	0.08	0.29	0.60	0.23	0.13	0.23
11	NIT Silchar	0.60	0.64	0.70	0.77	0.80	0.54
12	NIT Calicut	0.92	1.00	0.75	0.85	0.80	0.77
13	NIT Surathkal	0.76	1.00	0.75	0.77	0.47	0.69
14	NIT Tiruchirapalli	0.84	0.79	0.80	0.85	1.00	0.54
15	NIT Warangal	0.68	0.86	0.80	0.77	0.73	0.77
16	MNIT Jaipur	0.60	0.50	0.60	0.62	0.53	0.38
17	VNIT Nagpur	0.76	0.79	0.60	0.54	0.60	0.54
18	SVNIT Surat	0.64	0.86	0.75	0.85	0.87	0.54
19	MANIT Bhopal	0.36	0.43	0.45	0.62	0.67	0.69

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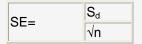| 20 | NIT Raipur | 0.04 | 0.07 | 0.75 | 0.38 | 0.07 | 0.38 |

Statistical Analysis

A statistical tool was applied to find the relationship between factors such as NS-LA, NS-NI, NS-CI, NS-ER, NS-MA among NIT libraries in India. The statistical tool used for this study is a Paired t-test. The test has been conducted using MINITAB R 14 software.

Paired t-test

A paired t-test is a statistical application used to compare two means based on paired samples (Elliott and Woodward, 2006). A paired t-test is used to determine if two populations are significantly different. For this test, an alpha of 0.05 is considered. The following formula was used for paired t-test:

$$t = \frac{t=[(x_1-x_2)-d]}{SE}$$

where x_1 is the mean of sample 1, x_2 is the mean of sample 2, d is the mean difference between paired values in the sample, and SE is the standard error. SE is given as

$$SE = \frac{S_d}{\sqrt{n}}$$

where S_d is the standard deviation of the sample difference and n is the sample size.

Results and Discussion

LA, NI, CI, ER, and MA were each comparaed to NS to find the significance between them.

Table 3 Paired t-test Statistics

Pairs	Factors	n	Mean	Std. Deviation	Std. Error of Mean
Pair 1	NS	20	0.536	0.248075	0.055471
	LA	20	0.6225	0.257127	0.057495
Pair 2	NS	20	0.536	0.248075	0.055471
	NI	20	0.6875	0.109874	0.024569
Pair 3	NS	20	0.536	0.248075	0.055471
	CI	20	0.6745	0.182338	0.040772
Pair 4	NS	20	0.536	0.248075	0.055471
	ER	20	0.5635	0.276335	0.06179
Pair 5	NS	20	0.536	0.248075	0.055471
	MA	20	0.515	0.15316	0.034248

Table 4 shows the p-value for each pair of tested factors at a level of significance of 0.05 and the confidence interval is shown in Table 4.

Table 4 Paired Samples

Paired Differences									
Pairs	Factors	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval for mean Difference		t	df	p-value
					Lower	Upper			
Pair 1	NS – LA	-0.086500	0.128934	0.028830	-0.146843	-0.026157	-3.00	19	0.007
Pair 2	NS – NI	-0.151500	0.242211	0.054160	-0.264858	-0.038142	-2.80	19	0.011
Pair 3	NS – CI	-0.138500	0.192361	0.043013	-0.228528	-0.048472	-3.22	19	0.005
Pair 4	NS – ER	-0.027500	0.215110	0.048100	-0.128175	0.073175	-0.57	19	0.574
Pair 5	NS – MA	0.021000	0.191143	0.042741	-0.068458	0.110458	0.49	19	0.629

Results of paired t-test on NS comparing other factors along with probability values are shown in Table 5.

Table 5 Null Hypothesis Statistics

Pairs	Factors	Probability Value	Probably Percentage of true	Rejection	Not Rejection
Pair 1	NS - LA	0.007	99.30%	x	
Pair 2	NS - NI	0.011	98.90%	x	
Pair 3	NS - CI	0.005	99.50%	x	
Pair 4	NS - ER	0.574	42.60%		x
Pair 5	NS - MA	0.629	37.10%		x
	Note: P-value is <0.05 of significance level.				

It is evident from Table 5 that three factors: LA, NI, and CI, are statistically significant in delivering NS. Pair 1 (NS-LA) indicates that LA is an important component for NS and they have a significant relationship. The t statistic is -3.00 with n-1 degrees of freedom. The p-value 0.007 associated with t is less than 0.05. Thus, there is a difference in means between factors. Hence, the null hypothesis is rejected. In this relationship, it can be stated that NIT Calicut and Surathkal possess more effective library automation processes and functions than other libraries, whereas NIT Raipur, Agartala, and Patna must improve in this respect.

Pair 2 (NS-NI) shows the relationship between NS and NI. The probability value represents 0.011 which is less than the significance level (0.05). Hence, the null hypothesis is rejected. With respect to connectivity, cables, type of connections, spread, and bandwidth among NIT libraries, the NIT Allahabad and Hamirpur have better infrastructure than other libraries. Bhopal and Kurukshetra have low-level infrastructure facilities.

Pair 3 (NS-CI) discloses the very close relationship of CI with NS. The p-value represents 0.005. They have a statistically strong relationship. Hence, the null hypothesis is rejected. The availability of CI at Allahabad is better, while Agartala, Raipur, and Patna have below average CI infrastructure.

Pair 4 (NS-ER) indicates the relationship between NS and ER. The p-value 0.574 is greater than 0.05. There is no significant relation between them. Hence, there is not enough evidence to reject the null hypothesis. NIT Tiruchirapalli has considerably ,pre e-resources than other libraries, whereas Raipur, Patna, and Agartala are again at the bottom.

Pair 5 (NS-MA) shows no relationship between NS and MA, with a probability value of 0.629. Hence, the null hypothesis is not rejected. NIT Calicut and Warangal have improved human resources, whereas Agartala, Patna, and Raipur are deficient.

Conclusion

Many services offered by the libraries are networked. The Internet opens up new avenues, and users are able to access NS locally or remotely. Academic libraries may find provision of NS difficult, due to inadequate automation, computer and network infrastructure, and human resources. Studies from the Indian perspective indicate that the majority of academic libraries there are in a transitional stage.

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Appendix. Data of Factors among the NIT Libraries

Sl. No.	Zones	Library	NS	LA	NI	CI	ER	MA
	North							
1		MNNIT Allahabad	11	12	17	12	8	6
2		NIT Hamirpur	10	5	17	11	13	7
3		NIT Jalandhar	12	7	14	7	12	6
4		NIT Kurukshetra	14	10	11	10	11	5
5		NIT Srinagar	11	8	12	10	4	8
	East							
6		NIT Durgapur	17	10	12	10	7	8
7		NIT Jamshedpur	13	6	13	7	5	6
8		NIT Patna	3	4	12	6	1	3
9		NIT Rourkela	20	11	16	8	8	6
	North East							
10		NIT Agartala	2	4	12	3	2	3
11		NIT Silchar	15	9	14	10	12	7
12		NIT Calicut	23	14	15	11	12	10
	South							
13		NIT Surathkal	19	14	15	10	7	9
14		NIT Tiruchirapalli	21	11	16	11	15	7
15		NIT Warangal	17	12	16	10	11	10
	West							
16		MNIT Jaipur	15	7	12	8	8	5
17		VNIT Nagpur	19	11	12	7	9	7
18		SVNIT Surat	16	12	15	11	13	7
	Central							
19		MANIT Bhopal	9	6	9	8	10	9
20		NIT Raipur	1	1	15	5	1	5