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Contents

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Editorial

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Over the last four years, the World Digital Libraries, an international journal has, relentlessly worked towards digital library development in this part of the world. Some noted experts in the field from overseas have also shared their views as how they have adopted and developed digital libraries in their countries. Varieties of novel and effective mechanisms to reduce barriers and promote the production, access, and use of digital information have been discussed in past WDL issues through descriptions of different models and tools such as open-source software, federated open data networks, open-access journals, and collaborative websites. Besides, special emphasis was given on case studies from India and abroad, where implementation of DL strategies and software are vividly described. Thus each issue was a mix of articles on planning, strategic implementation, and technical aspects of digital library development.

WDL also highlighted several issues pertaining to digital library developments including digitally networked open institutional repositories for scientific information, strategies to DL implementation, management of multilingual contents, electronic resources and knowledge management, online education system, e-learning, improved searching in DL repositories, etc, in most of the recent issues. There are several challenges faced in managing DL and providing effective access to and using scientific data and information. Through different articles, WDL has shown that such challenges can be overcome through a sustained focus and joint action.

Addressing some of these issues, a few digital library experts have contributed in this issue. A total of five papers are being published in this WDL issue. The first paper by Hemantha Kumar *et al.*, is to evaluate India's contribution to ranking web of world repositories, ranking web of India's universities, hospitals, business schools and research centres. The web indicators are used here to measure the global visibility and impact of the scientific repositories.

Veeramani *et al.* in their paper presented the need for library professionals to develop ICT skills as library services are more IT (Information Technology) centric now. In this regard, the authors highlighted the results of a study carried out in Kuwait academic libraries. In their paper, Md. Roknuzzaman *et al.* highlighted a modular approach to knowledge management education in DL learning environment. This paper is based on a review of the scientific literature of the field,

and a mini-case analysis of the 'International Master in Digital Library Learning' programme – which includes a module on 'Information and Knowledge Management'. Prof. Nieuwenhuysen shared DL developments in the context of academic and scientific information services based on his own experience, published literature and empirical research communications. Finally, Dr Chawdhury discussed importance of virtual space to cater to the information needs of digital natives. In a case study she has measured perceptions of undergraduate students at the University of Technology, Sydney, while using a virtual learning environment. Such platform makes learning process more interactive through sharing of digital contents among faculty and students.

I hope that readers will find this issue interesting and useful.

India's Contribution to Ranking Web of World Repositories: a case study

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Abstract

The present study attempts to evaluate India's contribution to Ranking Web of World Repositories by making it the main source from data collection to highlight the present scenario of these repositories. There are 334 Universities, 10 Hospitals, 130 Business Schools, and 47 Research Centres repository developed so far in the world. The OpenMED National Informatics Centre–India occupies 118th place in the top 800 world repositories.

Keywords

Open Access Initiative, Ranking Web of World Repositories

Introduction

The aim of this ranking is to support Open Access Initiatives and therefore the free access to scientific publications in an electronic form and to other academic material. The web indicators are used here to measure the global visibility and impact of the scientific repositories.

We encourage the web publication as a way to communicate both formal and informal scholar material, maintaining the high standards of quality of the peer review processes. Websites reach much larger potential audiences, offering access to scientific knowledge to researchers and institutions located in developing countries and also to third parties (economic, industrial, political or cultural stakeholders) in their own community. [1]

We intend to motivate both institutions and scholars to have a web presence that reflect their activities accurately. The ranking of repositories should be considered jointly with the sister rankings of universities, research centres, business schools, and hospitals.

Objective of the Study

The main objective of the study is to evaluate India's contribution to ranking web of world repositories, ranking web of India's universities, hospitals, business schools, and research centres.

Methodology

The study was carried out in following steps.

Step 1: Ranking web of world repositories was selected as the main source for data collection.

Step 2: The search was confirmed to India's contribution to universities, hospitals, business schools and research centres by country in India.

Step 3: The data was analyzed and conclusions were drawn and presented in the form of tables and charts.

Repositories Methodology

The main objective is to promote the Open Access Initiatives. One of the most promising ways to distribute the research output of the universities and research centres is to deposit scientific papers and related material at institutional or disciplinary repositories using as basis the data from the Registry of Open Access Repositories (ROAR) and the Directory of Open Access Repositories (OpenDOAR).

With the aim to improve visibility of repositories and good practices in their web publication we have extracted the following quantitative web indicators from the most important search engines.

- **Size (S)**. Number of pages recovered from the four largest engines: Google, Yahoo, Live Search, and Exalead.
- **Visibility (V).** The total number of unique external links received (in links) by a site can be only confidently obtained from Yahoo Search, and Exalead.
- **Rich Files (R)**. Only the number of text files in Acrobat format (*.pdf*) extracted from Google and Yahoo are considered.
- **Scholar (Sc)**. Using Google Scholar database we calculate the mean of the normalized total number of papers and those (recent papers) published between 2001 and 2008.[2]

[1] Jan R and Khan N A. 2010. Development of Disciplinary Repositories: A Case Study of OpenDOAR, 7th Convention PLANNER - 2010, Tezpur University, Assam, ©INFLIBNET Centre, Ahmedabad, February 18–20.

[2] <http://repositories.webometrics.info> accessed on 15 September 2010.

Webometrics rank		
Visibility (External inlinks) **50%**	Size (web pages)	**20%**
	Rich Files	**15%**
	Scholar	**15%**

Ranking Web of World Universities

It covers more than 20,000 higher education institutions worldwide**.** We intend to motivate both institutions and scholars to have a web presence that reflect their activities accurately.

Ranking Web of World Universities by country

Continent	Countries	Universities	%
Africa	47	649	3.38
America	41	6 971	36.27
Asia, Middle East	45	6 471	33.67
Europe	54	4 975	25.90
Oceania	12	149	0.78
Total	199	19 215	100

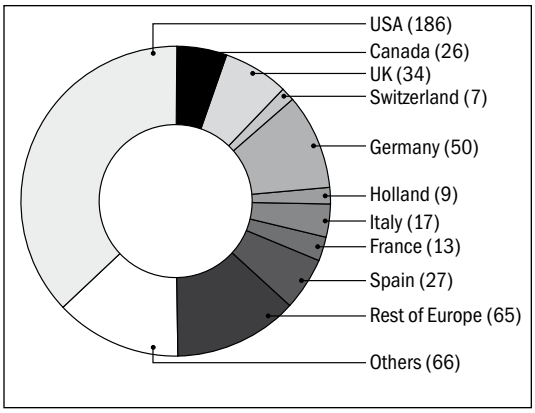
For each country all the higher education institutions ranked below **12,000th** position are included.

World Web of Ranking in Universities

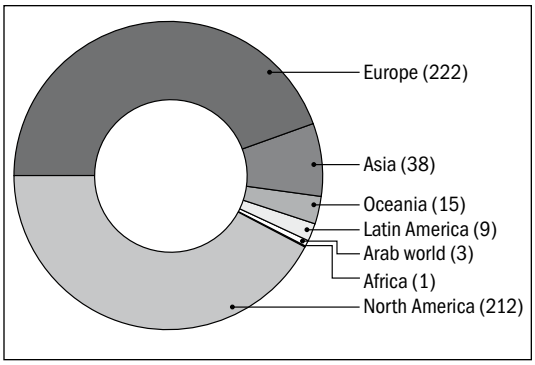
The following graphics show the distribution by country of the universities that rank under the 200th and 500th position respectively according to our web ranking.[3]

Ranking Web of World Hospitals

The Cybermetrics Lab published the Webometrics Ranking of World Hospitals from a purely academic point of view and as such it should be used. The web indicators applied does not measure the quality of patient's treatment and health care offered by the hospitals. So please be aware that if you are looking for the best place to treat a health condition this ranking is not appropriate for such a search (there is now almost 18,000 hospitals worldwide).



Distribution by country of the universities



Distribution by region of the university

World Web of Ranking in Hospitals

This graph shows the proportion of hospitals grouped by country that has been included in the Top 200 of the Webometrics Ranking of

[3] <http://repositories.webometrics.info> accessed on 15 September 2010.

Continent	Countries	Hospitals	%
Africa	58	512	3.92
America	52	5 022	38.41
Asia, Middle East	47	3 456	26.43
Europe	57	3 988	30.50
Oceania	26	96	0.74
Total	240	13 074	100

For each country all the institutions ranked below 2,000**th** position are included.

Rank of Hospitals by in India

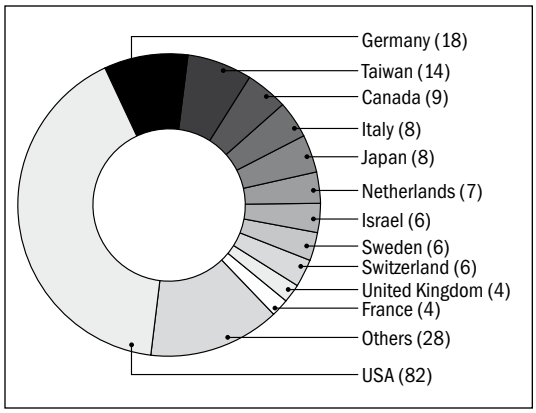
World rank	Hospitals	Position			
		Size	Visibility	Rich Files	Scholar
306	Laparoscopy Hospital	517	636	700	136
408	Amrita Institute of Medical Sciences and Research Centre	682	623	1 117	236
522	Aravind Eye Care System	1 026	1 240	619	162
709	Sankara Nethralaya Hospital	1 866	533	1 342	862
955	Sir Ganga Ram Hospital	2 416	1 428	1 955	270
1199	LRS Institute of Tuberculosis and Respiratory Diseases	3 105	6 287	890	32
1205	Tata Memorial Centre	1 482	2 184	395	1 349
1216	Apollo Hospitals	1 495	813	4 120	2 103
1246	Sri Ramachandra University and Medical Centre	1 102	3 147	2 680	212
1305	Fortis Healthcare	743	2 460	1 483	862

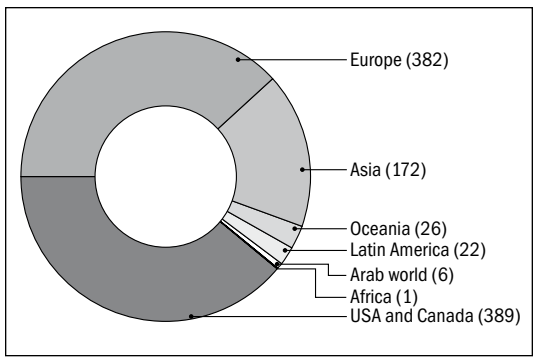
For each country only the institutions ranked below the 2000th position are included.

World Hospitals. It is clear the predominant position of the North American hospitals and their commitment to the publication on the web.

When we grouped the hospitals from the Top 1000 according to the continent they belong to, USA and Canada shared the same percentage of hospitals as Europe, which shows that the

[4] <http://repositories.webometrics.info> accessed on 15 September 2010.





latter ones are improving their results and contents in the web.[4]

Ranking Web of World Business Schools

The aim of this ranking is to promote the web presence of business schools and MBA granting institutions worldwide. For searching for business or executive education, our ranking offers the largest coverage, with more than 1500 institutions all over the world listed in the Directory. Web presence measures the activity and visibility of the institutions and it is a good indicator of impact and prestige. The rank summarizes the global performance of the schools, provides information for candidate students and scholars, and reflects the commitment to the dissemination of knowledge.

Ranking Web of World Research Centres

Ranking web of World Research Centres has been extensively revised and updated. Now we offer the classification of the Top 4000 institutions ranked according to their activities and visibility in the web. Rank summarizes the global performance of the institutes and centres, provides information for candidate researchers, and reflects the commitment to the dissemination of scientific knowledge.

Continent	Countries	Business schools	%
Africa	58	28	1.97
America	51	448	31.42
Asia, Middle East	47	305	21.39
Europe	55	586	41.09
Oceania	25	59	4.13
Total	236	1 426	100

Continent	Countries	Research centres	%
Africa	58	512	3.92
America	52	5 022	38.41
Asia, Middle East	47	3 456	26.43
Europe	57	3 988	30.50
Oceania	26	96	0.74
Total	240	13 074	100

Only institutions ranked below the **2,500th** position are showed.[5]

[5] <http://repositories.webometrics.info> accessed on 15 September 2010.

Ranking Web of World Countries in Size by Domain[6]

Rank	Country	National Domain	.com	.net	.org	Others	Total
1	USA	987 625	22 430 000	878 000	1 280 000	395 107	25 970 732
2	Japan	1 510 000	384 000	53 000	7 190	21 976	1 976 166
3	UK	1 159 321	651 000	70 300	59 600	24 799	1 965 019
4	China	420 000	861 000	58 700	39 200	35 128	1 414 028
5	Germany	646 000	260 000	47 500	121 000	59 795	1 134 295
6	Korea	514 000	314 000	138 000	30 400	2 065	998 465
7	Russian	858 100	57 600	7 520	7 680	20 796	951 696
8	Poland	719 500	48 300	12 300	28 800	11 896	820 796
9	Canada	355 500	345 000	17 600	60 500	14 257	792 857
10	France	293 000	243 000	33 900	105 000	43 770	718 670
11	Israel	70 000	524 000	1 260	5 860	941	602 061
12	Australia	444 000	45 400	4 340	13 700	2 917	510 357
13	Italy	295 000	68 000	14 100	56 500	30 601	464 201
14	Czech	292 000	87 100	58 600	16 000	10 025	463 725
15	Spain	179 000	135 000	60 500	36 500	38 580	449 580
16	Netherlands	141 000	224 000	12 800	46 600	17 214	441 614
17	Sweden	273 000	55 100	5 650	76 600	12 508	422 858
18	India	1 35 000	243 000	4 720	16 800	2 135	401 655
19	Taiwan	249 000	85 000	28 200	5 720	26 960	394 880
20	Ukraine	213 000	53 300	31 900	15 500	13 483	327 183
21	Romania	221 000	38 900	20 900	20 200	5 964	306 964
22	Turkey	71 950	156 000	22 300	26 100	6 559	282 909
23	Brazil	214 000	41 800	2 300	12 800	1 926	272 826
24	Mexico	171 000	51 500	1 310	2 300	1 262	227 372
25	Hungary	185 000	15 800	2 470	9 110	3 787	216 167
26	Singapore	51 200	148 000	1 340	2 140	440	203 120
27	Thailand	121 000	58 700	10 500	9 990	1 303	201 493
28	Norway	162 000	20 100	3 400	11 400	1 404	198 304
29	Belgium	127 000	22 500	4 240	17 500	15 953	187 193
30	Hong Kong	65 500	89 300	4 000	4 790	2 486	166 076

Rank	Country	National Domain	.com	.net	.org	Others	Total
31	Switzerland	113 000	20 200	2 510	21 900	6 194	163 804
32	Indonesia	72 400	69 400	1 280	11 200	1 322	155 602
33	Finland	120 000	19 800	6 410	6 290	2 069	154 569
34	Austria	114 000	13 700	3 160	8 960	2 620	142 440
35	Bulgaria	50 200	56 800	12 500	8 950	5 276	133 726
36	Estonia	113 500	12 000	2 420	3 190	1 946	133 056
37	Malaysia	79 050	42 700	2 400	4 830	1 255	130 235
38	Latvia	102 500	14 000	797	1 250	2 280	120 827
39	Denmark	93 700	15 200	1 860	4 660	3 565	118 985
40	Ireland	64 450	44 100	2 350	3 360	894	115 154
41	Macedonia	69 200	32 200	1 050	6 750	2 302	111 502
42	Luxembourg	40 750	7 250	959	1 540	60 523	111 022
43	Iceland	90 250	11 500	3 250	3 800	169	108 969
44	New Zealand	98 100	7 850	400	2 250	261	108 861
45	South Africa	76 300	25 000	1 780	4 810	530	108 420
46	Argentina	70 950	28 700	2 140	1 940	523	104 253
47	Azerbaijan	74 700	14 100	4 890	5 340	3 853	102 883
48	Georgia	79 350	12 400	1 890	3 670	587	97 897
49	Saudi Arabia	19 500	61 200	11 100	3 080	1 483	96 363
50	Tuvalu	95 600	3	——	——	192	95 795

Conclusion

India becomes an active contributor to global Open Access Initiatives by establishing open access archives, institutional repositories, document specific repositories, and subject specific repositories,[6] and India has contributed to 334 universities included in Ranking Web of World Repositories (Indian Institute of Technology-Bombay is at 478 place in World Rank), 130 business schools (Indian School of Business-Gachibowli is at 71 place in World Rank), 10 Hospitals (Laparoscopy Hospital is at 306 place in World Rank), 47 Research Centres (ERNET-India is at 33 place in World Rank) and lastly in 18th place is India's Size of Domain (National Domain is 135 000).

[6] Srinivasa V, Hemanth Kumar GH and Yethiraju BN. 2010. Open Access Resources: A case study of Indian contribution to Health Science in DOAJ and OpenDOAR, First International Conference LIBER 2010, Rev. Jacob Memorial Christian College, Ambiliakkai (Dindigul), October 7–8.

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Jan R and Khan N A. 2010. **Development of Disciplinary Repositories: A Case Study of OpenDOAR**, 7th Convention PLANNER - 2010, Tezpur University, Assam, ©INFLIBNET Centre, Ahmedabad, February 18–20.

Details available at <http://repositories.webometrics.info> last accessed on 15 September 2010.

Srinivasa V, Hemanth Kumar G H, and Yethiraju B N. 2010. **Open Access Resources: A case study of Indian contribution to Health Science in DOAJ and OpenDOAR**, First International Conference LIBER 2010, Rev. Jacob Memorial Christian College, Ambiliakkai (Dindigul), October 7–8.

APPENDIX - 1

Rank of Universities by states in India

World rank	Universities	Position			
		Size	Visibility	Rich files	Scholar
478	Indian Institute of Technology Bombay	396	848	282	496
604	Indian Institute of Science Bengaluru	617	1 106	518	265
739	Indian Institute of Technology Kanpur	668	1 266	540	612
1027	Indian Institute of Technology Madras	591	1 506	1 004	1 170
1137	Tata Institute of Fundamental Research	1 393	1 466	902	1 217
1431	International Institute of Information Technology Hyderabad	1 660	1 897	1 279	1 256
1487	University of Delhi	1 858	2 398	2 131	256
1587	Indian Institute of Technology Delhi	2 248	1 974	1 317	1 497
1828	Indian Institute of Technology Kharagpur	2 878	2 503	1 172	1 708
1981	Indira Gandhi National Open University	2 333	2 620	1 576	2 106
1988	Indian Statistical Institute Kolkata	3 327	3 052	1 169	1 491
2226	Indian Institute of Management Ahmedabad	3 280	2 121	3 836	1 830
2237	National Institute of Technology Calicut	1 129	3 796	2 109	2 162
2404	Amrita University	2 452	2 300	2 388	3 858
2436	Birla Institute of Technology and Science Pilani	3 951	3 426	1 399	2 209
2452	Anna University Chennai	3 798	2 295	2 246	3 254
2526	Indian School of Business Hyderabad	1 771	3 025	4 201	2 274
2702	Indian Statistical Institute Bengaluru	3 299	4 650	2 033	1 315
2854	University of Pune*	4 470	3 560	2 185	2 469
3018	Jawaharlal Nehru University	2 821	3 290	3 642	3 538
3175	Indian Institute of Management Kozhikode	3 288	4 925	4 340	1 271
3229	Indian Institute of Management Calcutta	3 800	3 520	3 770	3 226
3279	National Institute of Technology Rourkela	3 270	6 807	3 432	610
3295	Indian Institute of Information Technology Allahabad	3 561	6 101	2 197	2 172

World rank	Universities	Position			
		Size	Visibility	Rich files	Scholar
3323	Cochin University of Science and Technology	3963	5 297	4 579	1 010
3346	University of Mumbai	4 193	3 668	3 996	2 991
3455	Indian Institute of Management Bengaluru	6 126	2 640	4 659	3 845
3761	University of Hyderabad	3 717	4 280	3 465	4 318
3896	Visveswaraiah Technological University	5 428	4 580	2 894	3 634
3904	National Institute of Technology Tiruchirappalli	3 872	3 707	4 203	5 625
3921	Indian Institute of Technology Roorkee *	4 769	4 756	3 496	3 390
4043	Banaras Hindu University	4 353	4 712	2 647	5 091
4050	Indian Institute of Technology Guwahati	6 823	3 081	4 991	4 720
4072	Panjab University *	4 029	5 255	4 635	2 984
4101	Institute for Financial Management and Research Chennai	3 981	5 995	3 771	2 741
4159	Amity University *	3 470	5 305	3 882	4 178
4188	Jawaharlal Nehru Centre for Advanced Scientific Research	3 366	6 054	3 529	3 623
4205	Xavier Institute of Management Bhubaneswar	3 794	6 633	3 272	2 907
4269	Indian Statistical Institute Delhi	6 342	7 257	2 564	1 648
4371	Indira Gandhi Institute of Development and Research	5 750	5 640	5 814	2 045
4442	University of Kerala *	4 953	4 620	3 871	5 405
4464	Indian Institute of Management Lucknow	6 703	4 328	4 031	4 486
4484	Osmania University Hyderabad	4 975	5 266	3 696	4 475
4844	Indian Institute of Information Technology and Management Kerala	5 850	4 185	5 440	6 354
4872	Maharshi Dayanand University *	8 116	2 860	7 799	7 050
4931	National Law School of India University	6 038	6 624	4 123	3 269
5052	Amrita Institute of Medical Sciences	5 394	4 888	8 355	4 470
5115	Manipal Academy of Higher Education	4 573	5 182	7 336	5 341

World rank	Universities	Position			
		Size	Visibility	Rich files	Scholar
5121	National Institute of Technology Karnataka	3 527	7 342	5 421	3 874
5226	Dhirubai Ambani Institute of Information and Communication Technology	5 679	8 197	3 107	3 220
5270	Jawaharlal Nehru Technological University	6 158	4 330	5 137	8 570
5293	Annamalai University	3 684	5 874	3 907	9 063
5343	Andhra University	5 759	5 708	5 382	5 253
5445	Guru Gobind Singh Indraprastha University *	6 215	6 998	4 130	4 103
5455	Jadavpur University	5 129	5 260	3 714	10 216
5465	International Institute of Information Technology Bengaluru	6 148	6 116	6 541	4 032
5597	Birla Institute of Technology Mesra Ranchi	7 803	5 688	6 954	3 869
5605	Kerala Agricultural University	7 128	5 121	5 394	6 493
5620	All India Institute of Medical Sciences	5 233	4 980	4 986	10 216
5677	Institute of Technology Banaras Hindu University	7 403	4 088	7 440	7 977
5814	Bharathiar University *	6 407	7 031	5 214	4 345
5833	Tamil Nadu Agricultural University	4 967	7 167	5 699	4 943
5863	S R M University (Institute of Science and Technology) *	7 037	5 847	3 935	7 603
5896	Maharaja Sayajirao University of Baroda	5 447	7 041	6 007	4 832
5970	Indian Institute of Finance	6 071	7 723	4 072	4 916
6030	Tamil Nadu Dr M G R Medical University	7 817	8 207	6 070	2 467
6035	Bharathidasan University	5 441	7 303	6 280	4 743
6077	Fergusson College Pune	6 249	3 260	17 298	10 216
6086	Bengal Engineering and Science University	5 219	7 463	3 989	6 836
6285	Jain University *	7 672	3 932	10 345	10 216
6293	Vellore Institute of Technology	5 488	6 175	5 695	9 063
6359	West Bengal University of Technology *	5 643	8 168	4 107	6 004
6494	University of Madras	9 546	5 405	6 728	6 539

World rank	Universities	Position			
		Size	Visibility	Rich files	Scholar
6494	Tata Institute of Social Sciences	7 719	5 843	6 344	7 443
6494	Pondicherry University*	7 245	8 690	5 617	3 381
6518	Saha Institute of Nuclear Physics	7 558	9 414	3 053	4 017
6522	Management Development Institute	7 263	5 196	9 050	8 258
6527	North Eastern Hill University	6 577	9 510	7 369	2 220
6531	Sri Sathya Sai Central Trust Prasanthi Nilayam	11 740	2 783	14 273	10 216
6548	Devi Ahilya Vishwavidyalaya Indore	6 222	8 596	3 618	5 878
6569	Sastra University	5 900	6 781	5 571	8 570
6732	Kurukshetra University	7 344	8 188	4 178	5 815
6738	Model Engineering College	6 176	7 339	5 970	6 988
6754	University of Calcutta	5 371	6 334	8 298	9 063
6801	Gandhi Institute of Technology and Management	6 899	6 556	6 178	8 570
6814	Karunya University*	7 640	6 943	5 902	6 780
6860	Indian Institute of Foreign Trade	6 044	6 385	7 642	9 063
6890	Sri Venkateswara College of Engineering	6 763	8 961	4 618	5 038
6962	NMIMS University	5 174	7 103	6 396	10 216
6985	Uttar Pradesh Technical University*	6 453	6 972	8 045	7 253
6997	Srishti School of Art Design and Technology	5 773	7 145	11 260	5 976
7008	Loyola College Chennai	6 781	7 780	5 112	7 603
7013	Indian Agricultural Research Institute	7 425	8 923	8 560	3 174
7040	Dev Sanskriti Vishwavidyalaya	8 686	5 602	11 087	6 836
7097	Shivaji University*	7 132	9 350	4 816	4 667
7099	University of Mysore	5 877	8 414	7 240	5 760
7141	Indian Institute of Technology Guwahati	8 191	8 046	6 472	5 150
7145	Sree Narayana Gurukulam College of Engineering	10 483	11 547	4 612	1 151
7145	University of Calicut	10 757	6 958	9 277	4 033
7255	Rajiv Gandhi University of Health Sciences	4 492	8 677	5 669	9 063
7282	Gujarat University	7 956	7 016	9 292	6 255

World rank	Universities	Position			
		Size	Visibility	Rich files	Scholar
7302	Guru Nanak Dev Engineering College	6 069	11 648	3 896	3 303
7346	Vishwakarma Institute of Technology Pune	7 138	8 809	4 515	6 988
7353	Govind Ballabh Pant University of Agriculture and Technology	8 773	6 748	5 196	10 216
7358	International Institute for Population Sciences	10 774	6 776	8 227	5 367
7388	Indian Institute of Management Indore	8 465	5 662	9 322	10 216
7409	College of Engineering Thiruvananthapuram	10 752	8 117	8 143	3 660
7421	Thiagarajar College of Engineering	5 247	8 568	8 297	6 733
7432	University of Rajasthan Jaipur	7 489	9 064	6 734	4 745
7488	Indian Council of Forestry Research and Education*	7 813	8 294	5 550	7 113
7507	Maulana Azad National Institute of Technology Bhopal	6 091	8 409	6 366	8 258
7523	Indian Institute of Information Technology and Management Gwalior	6 849	9 207	6 971	5 111
7533	Kannur University	7 837	8 624	8 076	4 823
7549	Sardar Patel University	6 615	8 897	9 652	4 654
7559	Sikkim Manipal University of Health Medical and Technological Sciences	12 458	3 775	15 488	10 216
7561	Aligarh Muslim University	6 389	7 052	11 539	7 977
7574	Indian Railways Institute of Civil Engineering Pune	3 587	12 442	2 923	5 668
7622	Madras School of Economics	7 991	9 795	8 936	3 082
7645	Jaypee Institute of Information Technology University Noida	11 290	8 869	5 229	4 224
7657	Mahatma Gandhi University*	9 195	5 811	9 412	10 216
7707	National Institute of Public Finance and Policy	11 380	9 698	7 093	2 501
7736	Anna University Coimbatore	11 389	7 426	7 272	5 503
7749	Punjab Technical University	10 973	6 550	7 454	7 749
7815	Tezpur University	8 133	9 174	4 432	7 253

World rank	Universities	Position			
		Size	Visibility	Rich files	Scholar
7824	Delhi College of Engineering	6 281	8 345	9 097	7 329
7859	Birla Institute of Technology and Science Goa Campus	8 509	7 692	6 688	8 570
7872	Motilal Nehru National Institute of Technology	8 282	9 617	5 647	5 150
7943	Punjabi University	8 284	8 192	6 753	7 749
7946	Christian Medical College Vellore*	10 590	5 577	10 529	10 216
7956	University of Delhi Faculty of Management Studies	6 693	8 452	7 920	7 977
7982	Dr Babasaheb Ambedkar Marathwada University	6 886	10 095	5 139	6 167
7982	Assam Agricultural University	10 761	6 354	8 492	9 063
7987	Nagarjuna University	8 441	7 897	7 987	7 603
8007	Indian Institute of Technology Central Organization	9 510	5 530	13 385	10 216
8062	Jamia Hamdard*	7 339	7 719	9 067	9 063
8093	North Maharashtra University	6 786	9 935	5 629	6 539
8145	Visva Bharati Santiniketan	7 454	7 751	8 126	10 216
8160	Vidyasagar University	10 106	10 807	8 555	2 218
8190	Xavier Labour Relations Institute in India	7 210	7 639	9 325	10 216
8203	Sri Ramachandra University (Sri Ramachandra Medical College and Research Institute)*	6 686	9 955	10 969	4 305
8223	R V S College of Pharmaceutical Sciences	8 091	6 232	14 863	10 216
8231	Hemchandracharya North Gujarat University	6 808	10 010	6 287	6 354
8260	Delhi School of Economics	11 643	8 549	11 291	3 723
8276	Postgraduate Institute of Medical Education and Research Chandigarh	9 132	7 116	8 707	10 216
8283	Malaviya National Institute of Technology	8 185	9 514	5 582	7 113
8295	Sardar Vallabhbhai Patel National Police Academy	10 820	7 211	8 803	7 749
8338	Institute of Management Technology Ghaziabad	10 503	6 255	12 555	9 063

World rank	Universities	Position			
		Size	Visibility	Rich files	Scholar
8412	M S Ramaiah Institute of Technology	6 807	9 400	6 940	8 570
8417	Netaji Subhas Institute of Technology	8 613	8 703	5 430	10 216
8452	Maharashtra University of Health Science	6 951	10 050	6 622	6 780
8521	University of Jammu	6 736	10 407	6 249	6 836
8557	Indian Institute of Forest Management Bhopal	8 215	10 230	7 734	5 124
8594	Indian School of Mines Dhanbad	10 806	8 258	7 002	8 258
8629	Pravara Rural University	7 176	9 842	9 516	6 054
8638	Allahabad Agricultural Institute Deemed University	9 247	10 385	6 768	4 850
8724	National Institute of Technology Durgapur	7 982	9 326	5 919	10 216
8735	Kakatiya University*	9 392	7 955	9 862	9 063
8764	Saurashtra University	7 727	9 707	8 274	7 050
8764	Goa University	9 077	9 273	5 135	10 216
8854	Himachal Pradesh University	10 288	8 120	10 436	7 749
8879	Indian Institute of Mass Communication	10 629	6 986	11 875	10 216
8898	Lovely Professional University	8 335	10 424	6 238	6 836
8905	Center for Environmental Planning and Technology State University	10 037	8 631	6 360	10 216
8912	Madurai Kamaraj University*	10 135	7 934	8 669	10 216
8924	Sree Chitra Tirunal Institute for Medical Sciences and Technology	7 622	11 165	8 855	4 499
8984	Velagapudi Ramakrishna Siddhartha Engineering College	9 058	10 240	6 418	6 685
9084	Jamia Millia Islamia	7 643	12 155	7 716	3 838
9149	Sardar Vallabhbhai National Institute of Technology Surat	10 495	8 849	8 883	7 977
9168	Alagappa University*	9 666	10 193	5 992	7 443
9199	Chhattisgarh Swami Vivekanand Technical University	8 580	11 374	7 141	5 111
9199	Acharya N G Ranga Agricultural University	10 662	9 653	9 069	5 920
9205	Punjab Engineering College	8 524	8 941	9 358	10 216

World rank	Universities	Position			
		Size	Visibility	Rich files	Scholar
9243	Christ University Bengaluru	8 183	10 073	8 403	7 749
9264	St Aloysius College Mangalore	10 247	8 512	8 722	10 216
9388	PSG College of Technology	15 987	7 764	10 079	5 815
9388	Bharati Vidyapeeth University	9 387	7 962	13 897	10 216
9418	University of Kashmir	8 541	10 324	10 189	6 447
9433	Himachal Pradesh Agricultural University	8 492	12 241	5 109	5 521
9476	Chitkara University	9 952	8 563	10 431	10 216
9499	Nirma University of Science and Technology	8 912	10 440	6 704	8 570
9504	Mangalore University	9 085	8 645	11 915	10 216
9518	Rashtriya Sanskrit Sansthan	7 723	10 101	9 192	9 063
9563	Kalasalingam University	8 577	11 336	7 474	6 054
9563	Sri Sathya Sai University	10 720	7 564	16 434	9 063
9583	National Institute of Pharmaceutical Education and Research*	11 695	9 650	7 052	7 749
9583	Lucknow University	9 324	9 163	9 515	10 216
9593	Punjab Agricultural University Ludhiana	9 763	9 245	9 867	9 063
9600	Dr Bhim Rao Ambedkar Open University	9 973	9 595	6 944	10 216
9648	Dr Harisingh Gour University Sagar (University of Saugar)	8 818	10 257	6 613	10 216
9685	Barkatullah University	8 220	10 112	9 408	9 063
9709	Ganpat University*	12 874	7 929	10 390	10 216
9724	International Institute of Information Technology Pune	10 080	8 552	12 165	10 216
9738	University of Mumbai Department of Chemical Technology	10 176	9 839	8 350	8 570
9738	Institute of Rural Management Anand	9 631	9 081	12 167	9 063
9759	Banasthali University*	10 656	9 480	7 391	10 216
9759	Saveetha University	9 478	8 798	12 495	10 216
9762	Dr Bhim Rao Ambedkar National Institute of Technology	10 032	10 398	7 978	7 443
9762	University of Agricultural Sciences Bengaluru	12 003	11 520	8 948	3 669

World rank	Universities	Position			
		Size	Visibility	Rich files	Scholar
9786	Tamil Nadu Open University	9 596	11 203	5 605	7 749
9802	Amravati University	9 580	10 771	7 713	7 050
9825	Dean's College of Technology Pantnagar	7 151	9 849	12 239	10 216
9841	Sanjay Gandhi Postgraduate Institute of Medical Sciences	9 026	10 094	7 770	10 216
9844	Institute of Technology and Management	9 072	12 503	8 647	3 865
9844	Dayananda Sagar College of Engineering	11 167	9 293	7 982	10 216
9868	Pandit Deendayal Petroleum University	8 428	10 253	8 344	10 216
9926	Gujarat Technological University	8 570	10 882	7 721	8 570
9932	Anna University Tiruchirappalli	10 972	10 616	8 182	6 539
9965	National Institute of Technology Silchar	12 037	9 923	8 931	6 988
9986	Dronacharya College of Engineering	8 306	12 865	8 741	4 062
10018	Government College of Engineering Pune	10 547	9 321	9 899	10 216
10024	Indian Institute of Science Education and Research Kolkata	7 546	12 039	9 098	6 012
10049	Gujarat Ayurved University	12 010	10 345	11 445	5 309
10097	CCS Haryana Agricultural University	12 144	11 900	9 078	3 718
10120	Department of Microbiology and BioTechnology Centre Maharaja Sayajirao University of Baroda	13 522	7 526	14 424	10 216
10149	Delhi Technological University	8 467	10 497	9 001	10 216
10154	Karnatak University	11 539	10 034	11 725	6 354
10162	National University of Educational Planning and Administration	11 560	11 364	9 907	4 541
10196	Lal Bahadur Shastri National Academy of Administration	9 268	10 646	7 321	10 216
10307	Nitte Education Trust	10 596	10 302	7 451	10 216
10360	Assam University	12 449	9 801	9 120	8 570
10364	University of Burdwan	9 890	11 026	9 034	7 603
10370	Bengaluru University	9 916	11 028	9 018	7 603
10370	Veermata Jijabai Technological Institute	9 901	11 042	6 180	10 216
10397	King George Medical University	8 631	11 235	7 232	10 216
10401	University of Kalyani	10 369	10 422	9 144	9 063

World rank	Universities	Position			
		Size	Visibility	Rich files	Scholar
10405	Chaitanya Bharathi Institute of Technology	10 870	12 558	6 784	4 817
10441	Symbiosis International University	12 582	8 853	11 987	10 216
10449	G H Patel College of Engineering and Technology	9 836	12 736	6 102	5 713
10470	Rajiv Gandhi National Institute of Youth Development	12 419	10 656	10 049	6 215
10484	Biju Patnaik University of Technology*	13 554	9 238	12 956	7 603
10503	Sinhgad College of Pharmacy	9 661	10 070	11 399	10 216
10518	Chhatrapati Shahu Ji Maharaj University Kanpur	11 960	9 439	10 670	10 216
10573	Guru Jambheshwar University Hisar	11 361	10 706	8 263	8 570
10577	Goa College of Engineering	12 216	10 943	9 394	6 354
10595	Guru Nanak Dev University	12 033	9 682	9 794	10 216
10611	Nagpur University*	9 500	11 614	8 292	7 977
10641	Karnataka State Open University	9 948	10 684	8 818	10 216
10667	Shri Mata Vaishno Devi University	8 635	13 211	8 025	5 166
10685	Mohan Lal Sukhadia University	9 127	12 093	6 718	8 570
10688	Shreemati Nathibai Damodar Thackersey Women's University	7 841	12 783	6 809	7 749
10698	Tamil Nadu Veterinary and Animal Sciences University*	10 865	12 158	8 706	5 461
10698	Vishwakarma Institute of Information Technology Pune	11 191	10 723	7 290	10 216
10709	Jaypee University of Information Technology Waknaghat	10 585	10 904	10 187	7 977
10728	International School of Information Management	12 187	10 614	10 705	7 113
10761	Anand Agricultural University	10 095	11 280	7 134	10 216
10767	Institute of Human Resources Development	10 794	9 983	13 352	9 063
10785	Indian Law Institute	12 421	11 215	8 550	6 836
10785	Mahatma Gandhi Antarrashtriya Hindi Vishwavidyalaya	10 476	12 010	8 866	6 309

World rank	Universities	Position			
		Size	Visibility	Rich files	Scholar
10795	Makhanlal Chaturvedi National University of Journalism	10 669	11 408	7 856	8 570
10828	Gandhigram Rural University	10 722	11 450	9 809	7 113
10828	West Bengal National University of Juridical Sciences	12 819	9 951	11 354	8 570
10841	Gauhati University	7 920	12 364	6 551	10 216
10853	Madhya Pradesh Bhoj Open University	11 933	11 019	6 419	10 216
10853	National Institute of Technology Warangal	12 489	10 105	9 124	10 216
10902	Siddaganga Institute of Technology	11 693	10 950	7 087	10 216
10915	Goa Institute of Management	10 844	10 354	10 991	10 216
10932	Maulana Azad National Urdu University	10 884	10 897	8 302	10 216
10966	Akkineni Nageswara Rao College	9 726	10 048	15 015	10 216
10969	Coimbatore Institute of Technology	9 712	10 269	14 036	10 216
10969	Rajasthan Technical University	10 839	11 488	7 595	9 063
10969	Maulana Azad Medical College	9 630	11 912	6 680	10 216
10994	Gulbarga University	11 028	10 255	11 765	10 216
11004	Nitte University	11 083	11 302	10 523	7 443
11004	Singhania University*	12 724	9 706	11 637	10 216
11027	Mar Athanasius College of Engineering	9 978	12 017	10 032	6 836
11027	Dayalbagh Educational Institute	11 266	11 339	10 924	7 050
11083	Rani Durgavati Vishwavidyalaya Jabalpur	11 697	11 482	9 582	7 329
11103	Madras Christian College	9 337	10 877	12 623	10 216
11118	Indian Institute of Public Administration	11 664	12 813	6 008	6 561
11121	Jamal Mohamed College Autonomous	11 447	11 862	8 506	7 603
11126	Teri University	10 930	11 926	8 246	8 258
11147	Sona College of Technology	8 298	11 946	9 902	10 216
11235	Institute of Management Technology Nagpur	11 711	10 569	11 387	10 216
11258	Bhavnagar University	11 256	10 746	11 133	10 216
11263	Sri Krishnadevaraya University	12 422	11 890	8 056	7 603
11263	Symbiosis Institute of International Business	9 670	11 422	10 708	10 216

World rank	Universities	Position			
		Size	Visibility	Rich files	Scholar
11282	Siksha O Anusandhan University	12 475	10 759	11 752	8 570
11292	Kongu Engineering College	10 708	12 212	8 354	8 258
11300	Mar Athanasios College for Advanced Studies*	10 496	13 130	10 590	4 890
11300	Government Medical College and Hospital Chandigarh	8 904	11 956	9 799	10 216
11305	Sikkim Manipal University Distance Education*	13 161	9 491	15 175	10 216
11322	Sri Venkateswara University	12 066	11 259	9 501	9 063
11326	Osmania University	8 625	10 679	17 514	10 216
11332	University of North Bengal Darjeeling	11 833	10 927	11 506	9 063
11343	Indian Veterinary Research Institute	10 682	11 284	11 873	9 063
11350	Manipur University	12 146	11 789	9 054	7 749
11350	Jiwaji University	9 386	11 843	9 930	10 216
11361	Indian Railways Institute of Mechanical and Electrical Engineering	13 017	11 232	7 434	10 216
11368	Mepco Schlenk Engineering College	11 116	11 279	9 743	10 216
11386	Padmashree Dr D Y Patil University*	10 898	11 224	12 110	9 063
11398	National Institute of Technology Kurukshetra	10 302	12 443	8 010	8 570
11405	Shri Ramdeobaba Kamla Nehru Engineering College	12 666	10 437	11 810	10 216
11418	College of Agribusiness Management	15 504	9 022	13 613	10 216
11434	Birla Institute of Management Technology	12 012	10 694	11 626	10 216
11440	Maharashtra Animal and Fishery Sciences University	8 841	12 175	9 768	10 216
11459	Madras Institute of Technology	9 976	10 957	14 233	10 216
11483	College of Engineering Chengannur	9 937	11 479	11 687	10 216
11496	Gokhale Institute of Politics and Economics	12 652	12 912	8 972	5 207
11500	Harcourt Butler Technological Institute	11 280	12 293	7 282	9 063
11505	Jaypee Institute of Engineering and Technology	13 209	11 077	11 521	7 977

World rank	Universities	Position			
		Size	Visibility	Rich files	Scholar
11512	Gurukula Kangri Vishwavidyalaya	10 981	12 159	9 015	8 570
11523	Vishwakarma Institute of Management	14 488	9 832	12 414	10 216
11528	Hidayatullah National Law University Raipur	10 764	12 690	8 083	7 749
11541	KIIT University Kalinga Institute of Industrial Technology	10 943	11 524	10 223	10 216
11558	Xavier Institute of Social Service Ranchi	12 527	10 967	10 445	10 216
11636	Asia-Pacific Institute of Management Delhi	10 071	11 826	10 967	10 216
11643	Indian Institute of Space Science and Technology	13 043	11 054	11 461	9 063
11648	Sardar Patel College of Engineering	9 856	11 958	12 295	9 063
11648	Jain Group of Institutions Bengaluru	12 015	11 013	11 937	10 216
11661	National Law Institute University	12 707	11 540	11 255	8 258
11666	Ramakrishna Mission Vivekananda University	8 551	13 900	11 428	5 461
11675	Mahatma Jyotiba Phule Rohilkhand University	10 549	12 509	7 365	10 216
11692	University of Agricultural Sciences Dharwad	12 971	10 921	11 032	10 216
11713	Yashwantrao Chavan Maharashtra Open University	13 449	10 281	13 910	10 216
11718	Uttarakhand Technical University	11 512	12 577	10 568	6 733
11741	Guru Ghasidas University	11 376	11 883	10 889	9 063
11762	Rajiv Ghandi Technical University	13 665	9 609	17 514	10 216
11802	National Law University Jodhpur	11 852	11 187	12 587	10 216
11805	S C T College of Engineering Pappanamcode	12 721	11 175	11 216	10 216
11856	Muffakham Jah College of Engineering and Technology	12 067	12 685	11 557	6 244
11856	Rajarambapu Institute of Technology	12 813	12 485	8 159	8 258
11879	North Eastern Regional Institute of Science and Technology	12 946	11 485	10 028	10 216
11879	National Institute of Technology Srinagar	9 819	12 822	10 659	8 570

World rank	Universities	Position			
		Size	Visibility	Rich files	Scholar
11919	K S Rangasamy College of Arts and Science	10 243	14 309	9 703	4 914
11924	Shri Vile Parle Kelvani Mandal	10,795	12,195	10,274	10,216
11924	Bankura Christian College	10 974	11 371	14 470	10 216
11936	Ajay Kumar Garg Engineering College	12 406	12 284	11 065	7 603
11936	Nalsar University of Law Hyderabad*	11 907	11 806	12 209	9 063
11945	Jagannath Institute for Technology and Management	11 183	12 181	11 344	9 063
11960	Mahatma Phule Agricultural University	11 701	12 337	8 384	10 216
11991	Al-Ameen College of Pharmacy	12 956	11 176	12 525	10 216

* See <http://repositories.webometrics.info> accessed on 15 September 2010.

APPENDIX - 2

Rank of Business Schools by States in India

World rank	Business School	Position			
		Size	Visibility	Rich Files	Scholar
71	Indian School of Business Gachibowli	32	117	206	95
77	Indian Institute of Management Ahmedabad	111	68	165	57
128	Indian Institute of Management Calcutta	146	159	174	183
139	Indian Institute of Management Kozhikode	107	267	224	26
169	Indian Institute of Management Bengaluru	317	98	239	242
226	Xavier Institute of Management Bhubaneswar	144	393	145	146
242	Indian Institute of Planning and Management	304	114	620	639
263	Indian Institute of Management Lucknow	356	225	196	290
355	Management Development Institute Gurgaon	403	287	513	519
361	Indian Institute of Finance	320	479	167	313
367	Indian Institute of Foreign Trade	316	384	399	567
371	Jamnalal Bajaj Institute of Management Studies	688	100	988	639
385	Administrative Staff College of India	217	625	421	231
417	Indian Institute of Management Indore	494	328	530	639
430	University of Delhi Faculty of Management Studies	355	536	410	495
442	Xavier Labour Relations Institute School of Business and Human Resources	398	473	522	639
447	Indian Institute of Information Technology and Management	367	610	375	329
504	Madras School of Economics	464	677	515	167
512	Institute of Management Technology Ghaziabad	666	369	780	567
592	Indian Institute of Technology Shailesh J. Mehta School of Management	511	719	506	477

World rank	Business School	Position			
		Size	Visibility	Rich Files	Scholar
65	Symbiosis International University Symbiosis Centre for Management and Human Resource Development	565	726	644	639
686	Goa Institute of Management	683	700	653	639
690	Indian Institute of Science Department of Management Studies	643	833	325	437
715	Bharathidasan Institute of Management	823	682	649	538
724	Training and Advanced Studies in Management and Communications	602	849	693	567
740	Indian Institute of Social Welfare and Business Management	789	743	512	639
742	Institute of Management Technology Nagpur	765	738	690	639
752	Asia-Pacific Institute of Management Delhi	620	861	652	639
772	International Business School	998	582	1 075	639
772	Symbiosis International University Institute of Management Studies	644	885	561	639
777	Symbiosis International University Symbiosis Institute of Business Management	953	630	968	639
792	Islamic Commerce Educational Society Punjab Group Colleges	1 174	452	1 229	639
845	Aegis School of Business and Telecommunication	799	898	545	639
849	Indian Institute of Technology Madras DOMS IIT Madras	865	879	344	639
853	Foundation for Organizational Research and Education School of Management	911	800	866	639
862	Indian Business Academy	869	872	833	538
866	Namtech Business School	566	1 059	998	639
879	University of Pune Deccan Education Society Institute of Management Development and Research	873	869	1 038	639
892	Indian Institute of Information Technology MBA Program	593	1 079	1 085	639
896	Panjab University University Business School	835	960	842	639

World rank	Business School	Position			
		Size	Visibility	Rich Files	Scholar
899	Symbiosis International University Symbiosis Institute of Operations Management	732	1 026	855	639
906	Nirma University Institute of Management	861	977	597	639
912	Indus World School of Business	933	882	1 218	639
933	SMOT Corporate Business School	645	1 123	1 155	639
936	National Insurance Academy School of Management Pune	921	982	853	567
938	Galgotias Business School	1 076	825	1 122	639
947	AICAR Business School	1 085	829	1 090	639
971	Mats Institute of Management and Entrepreneurship	1 075	873	1 100	639
982	Centre for Management Development India	958	1 015	804	639
983	Bharati Vidyapeeth University Institute of Management and Research New Delhi	831	1 096	864	639
990	Pearl School of Business	907	1 053	1 012	639
991	Jansons School of Business	818	1 149	840	435
992	Park Global School of Business Excellence	1 012	1 012	646	639
997	Maharishi Institute of Management	1 122	868	1 221	639
1011	Cosmic Business School Management and Technology Education	821	1 137	805	639
1014	Thiagarajar School of Management	882	1 116	711	639
1015	Taxila School of Technology and Management	664	1 203	1 248	639
1021	Indian Institute of Management Training Pune	1 048	1 009	825	639
1021	Chennai Business School	741	1 169	1 216	639
1027	Indore Management Institute and Research Center	697	1 200	1 036	639
1030	Institute of Management and Development	870	1 136	787	639
1044	Hierank Business School	1 130	933	1 266	639
1057	International School of Business and Media	1 183	908	1 102	639
1061	Ganpat University V M Patel Institute of Management	1 045	1 058	901	639

World rank	Business School	Position			
		Size	Visibility	Rich Files	Scholar
1065	Osmania University Department of Business Management	943	1 177	636	437
1078	Praxis Business School	898	1 164	1 071	639
1079	Jaypee Institute of Information Technology University Jaypee Business School	1 141	1 051	799	423
1081	University of Pune Department of Management Sciences	1 003	1 130	775	639
1086	IBSAR Institute of Business Studies and Research	1 035	1 109	836	639
1087	Institute of Productivity and Management	965	1 138	957	639
1088	Indian Institute of Planning and Management School of Management Kansbahal	1 137	1 018	1 048	639
1090	Indian School of Business Management and Administration	728	1 252	1 175	639
1094	Tilak Raj Chadha Institute of Management and Technology	801	1 230	910	639
1095	Indian Institute of Commerce and Trade Lucknow	1 256	891	1 185	639
1097	Siva Sivani Institute of Management	928	1 173	1 031	639
1118	Accman Institute of Management	1 000	1 182	911	639
1134	India University Tripura Institute of Chartered Financial Analysts	1 381	715	1 287	639
1137	Management Institute of Durgapur	986	1 197	1 333	639
1149	Army Institute of Management and Technology	1 203	1 106	701	639
1150	Institute of Professional Education and Research	1 013	1 215	896	639
1152	Acharya Institute of Management and Sciences	1 073	1 175	1 267	639
1153	Pailan College of Management and Technology	1 088	1 193	872	567
1155	Regional College of Management	924	1 285	633	639
1156	International School of Management Excellence Bengaluru	1 182	1 125	850	639

World rank	Business School	Position			
		Size	Visibility	Rich Files	Scholar
1172	Delhi Business School	1 009	1 248	1 044	639
1174	Swami Vivekanand Group of Institutes Swami V School of Management	1 255	1 081	951	639
1176	Synetic Business School	960	1 300	826	567
1189	Times Business School	1 273	1 091	1 169	639
1191	Asia Graduate School of Business	990	1 307	1 086	495
1195	Kochi International Business School	984	1 302	1 070	567
1198	Eastern Institute of Management	1 090	1 241	1 184	639
1205	GNA Institute of Management and Technology	1 046	1 284	1 097	639
1212	University of Kerala Institute of Management	1 177	1 227	740	639
1213	International School of Business	1 107	1 255	1 248	639
1219	Deccan School of Management Department of Hospital Management	1 169	1 254	868	538
1249	Mumbai School of Business	1 056	1 333	1 108	639
1250	Osmania University ICBM School of Business Excellence	1 250	1 216	1 130	639
1256	JK Business School	1 157	1 311	891	639
1267	KIIT University Bhubaneswar School of Rural Management	1 284	1 220	1 081	639
1272	SSN School of Management and Computer Applications	1 209	1 295	1 025	639
1275	University of Hyderabad School of Management Studies	1 087	1 369	759	639
1276	KIIT University Bhubaneswar School of Management	1 240	1 276	1 094	639
1279	Krupajal Business School	1 027	1 386	1 223	639
1287	Vinayaka Centennial Canadian Business School	1 171	1 326	1 167	639
1291	Alliance Business Academy	1 384	1 090	1 287	639
1295	University of Aarhus Asian School of Business	894	1 442	1 112	567
1298	Center for Entrepreneurship and Small Business Management	1 166	1 355	1 034	639

World rank	Business School	Position			
		Size	Visibility	Rich Files	Scholar
1301	Indian Institute of Planning and Management New Delhi	1 405	1 048	1 333	639
1308	Institute of Management Studies	1 218	1 341	1 271	639
1312	B K School of Business Management	1 323	1 273	1 218	639
1316	Institute for Integrated Learning In Management Graduate School of Management	1 432	1 000	1 264	639
1320	Adarsh Business School	1 193	1 377	1 106	639
1334	Bharathiar School of Management and Entrepreneur Development	1 176	1 401	1 030	639
1338	Global Business School	1 330	1 323	1 182	639
1341	Jalgaon Institute of Management and Research	1 275	1 375	1 001	639
1346	A S Patil College of Commerce Management Program	1 220	1 397	1 271	639
1364	University of Jammu Business School	1 341	1 349	1 198	639
1379	Symbiosis International University Symbiosis Institute of International Business	1 286	1 413	917	639
1382	Deccan School of Management	1 243	1 436	1 333	639
1383	School of Business Logistics	1 404	1 262	1 248	639
1388	Natwarlal Maniklal Dala Institute of Gondia Management Department	1 318	1 416	1 241	639
1400	Happy Valley Business School	1 351	1 412	1 173	639
1407	IBMR Business School	1 412	1 308	1 333	639
1411	Gandikota Business School	1 356	1 417	1 271	639
1419	Kaizen School of Business Management	1 331	1 449	1 333	639
1420	Indian Institute of Planning and Management Mumbai	1 454	1 275	1 333	639
1423	Indian Institute of Business Management	1 386	1 413	1 333	639
1432	Hindu College MBA	1 395	1 420	1 251	639
1440	Institute of Cooperative Management Kerala	1 391	1 439	1 333	639
1441	Indra Narain Jain Trust Business School	1 408	1 405	1 333	639

APPENDIX - 3

Rank of Research Centers by States in India

World Rank	Research Centres	Position			
		Size	Visibility	Rich files	Scholar
33	ERNET India	64	123	21	36
189	Indian Academy of Sciences	92	693	660	17
216	National Informatics Centre Karnataka	199	204	331	1 062
327	Institute for Development and Research in Banking Technology India	284	632	2 018	28
673	International Crops Research Institute for the Semi-Arid Tropics	885	883	937	495
689	Energy and Resources Institute India	1 238	619	716	1 166
702	Indian Council of Medical Research	940	1 250	1 089	161
720	National Institute of Science Communication and Information Resources	664	2 118	844	60
796	Information and Library Network Centre	1 135	1 361	1 508	135
891	Inter-University Centre for Astronomy and Astrophysics	1 139	1 208	548	1 113
987	Centre for Development of Advanced Computing	1 096	680	2 242	1 604
999	Institute of Mathematical Sciences	1 112	1 893	419	915
1020	National Institute of Oceanography India	1 016	1 978	2 179	123
1152	Indian Institute of Astrophysics	1 148	2 758	997	194
1163	National Centre for Radio Astrophysics India	1 285	2 687	423	560
1229	Council of Scientific and Industrial Research	1 602	886	845	3 236
1394	National Aerospace Laboratories	1 318	3 217	1 351	189
1431	National Centre for Biological Sciences	865	2 226	517	2 462
1440	Indian Space Research Organization	2 102	589	3 217	3 077
1502	Indian Council of Agricultural Research	2 059	1 127	1 315	2 655
1581	Jawaharlal Nehru Centre for Advanced Scientific Research	1 141	2 629	941	1 521
1627	Institute of Physics Bhubaneswar	1 845	2 672	675	1 311

World Rank	Research Centres	Position			
		Size	Visibility	Rich files	Scholar
1665	India Meteorological Department*	1 364	1 189	1 960	3 586
1709	Indira Gandhi Institute of Development Research	2 198	2 458	1 854	654
1732	Bhabha Atomic Research Centre	2 549	2 148	2 204	676
1743	Raman Research Institute	1 844	3 108	1 727	457
1767	Institut Français de Pondichery	1 100	1 816	1 911	2 852
1796	National Council of Educational Research and Training	2 724	1 587	2 683	1 394
1804	Asian and Pacific Centre for Transfer of Technology	2 788	1 639	1 117	2 559
1874	Chennai Mathematical Institute	1 865	2 492	1 312	1 787
1889	Homi Bhabha Centre for Science Education	1 891	1 616	3 255	2 096
1966	Institute of Microbial Technology	1 525	2 340	1 335	2 686
2032	Indian Agricultural Statistics Research Institute	2 297	2 895	1 259	1 430
2070	Department of Biotechnology Ministry of Science and Technology	3 071	1 491	1 268	3 825
2089	Variable Energy Cyclotron Centre	2 182	3 842	276	2 523
2095	M S Swaminathan Research Foundation	3 084	1 548	2 722	2 301
2140	Institute of Genomics and Integrative Biology	2 690	934	4 296	4 289
2147	Wildlife Institute of India	2 807	2 580	2 015	1 283
2156	S N Bose National Centre for Basic Science	2 268	3 362	576	2 394
2160	Institute of Company Secretaries of India	2 096	3 219	800	2 358
2187	Defence Research and Development Organisation	1 439	2 331	2 194	2 971
2338	Centre for Mathematical Modelling and Computer Simulation	2 229	3 289	1 933	1 521
2428	National Institute of Agricultural Extension Management	2 184	3 616	1 019	2 447
2433	Centre for Development Studies Trivandrum	3 156	3 350	2 914	730
2445	Maharaja Sayajirao University of Baroda	2 117	3 094	1 952	2 287
2464	Institute of Technology Banaras Hindu University	2 996	1 683	2 687	3 825
2498	Indian Institute of Tropical Meteorology	2 705	3 764	1 681	1 279

Analysis of Information Technology Application in Academic Libraries in Kuwait

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Abstract

The paper presents the need for library professionals to be adept with skills in information and communication technology as library services are more Information Technology (IT) centric, especially in educational institutions. Application of IT in academic environment in Kuwait has increased gradually in the recent decades. This paper is designed to measure the use of IT in the academic libraries of Kuwait with an ulterior objective to establish some correlation between quality in libraries and use of IT. It highlights the use of hardware/software facilities in academic libraries and also the access of networks, information services, and problems in IT applications. The analysis of the data represents the extent and the level of IT application applied by the academic librarians in Kuwait.

Keywords

Information technology, IT application, Librarians, Academic libraries, Libraries, Kuwait

Introduction

This study was conducted by the author in some of the major universities and academic institutions of Kuwait. Based on the author's visit to some of the major libraries and the exhaustive conversation with the personnel there, it was an arduous task to access their overall situation and the information services. As far as it can be determined, the library and information sector is not commensurate with the general development of the country. Undoubtedly, lack of technology for effective flow of information is a major hindrance to R&D. The author believes that this can be solved if there is a more positive attitude towards information dissemination. It should be viewed as one of the important facets for national development and should be integrated with socioeconomic development plans. When the priorities in developmental plans are set, the value attributed for decision-makers to IT is clearly reflected in the budget allocations for the establishment and development of information education programmes. These efforts will undoubtedly enable the country to meet the challenges of the information era in the next millennium. As said by John F. Budd, the dissemination of knowledge is one of the cornerstones of civilization.

Development and use of IT enable the libraries not only to offer their clientele the appropriate information available within their libraries but also access to information of other libraries, both local and outstations *(M Masoom Raza & Amar Nath, 2007).* In this age, library and information centres are greatly responsible for providing latest info to their users to improve the quality of education in the country. And this cannot be done without effective IT services in the library. To meet the current requirements, library professionals must be able to perform various tasks coping up with the changes in technological environment.

Need for the Study

Today's academic libraries are confronted with challenges on several fronts: Information availability, rising costs, mega bookstores, online information providers, multimedia products, document delivery services, and other competitive sources of information. These challenges are apparently threatening the role of the libraries and also their survival. With evolving technological innovations, variety and abundance of information that is becoming available to information users, the academic libraries are coming under intense pressure. The products/ services introduced in library should also match the requirements of intended users. The present study highlights the application of IT in academic libraries of Kuwait.

Objectives of the Study

The primary objective of this study is to understand the nature of IT-supported resources, facilities and services provided in the academic libraries. The main objectives are as follows:

- Survey the academic institutions with regard to the background information about library infrastructure and librarians; to know the status of IT based resources, facilities and services provided by the academic libraries;
- Identify the types of IT based service possessed by the librarians under study; and
- To know the impact of IT on library functions as perceived by library professionals and users;

Methodology

This article is based on the questionnaire survey conducted in various academic institutions of Kuwait. The opinions of librarians regarding IT application were elicited using a structured questionnaire, followed up with an interview. Opinions on different issues pertaining to the library housekeeping operations were sought

from the respondent libraries. The questionnaires were mailed to 128 respondents in the country, out of which 102 respondents (79.69%) were received duly filled with all the relevant information requested in the questionnaire. However, geographically the scope of the study is limited to only academic institutions located in the country. The following Table 1 gives some of the institutions for example taken for the proposed study.

Analysis of Data and Discussion

Details of questionnaires distributed to librarians and the responses received

The current study received 102 completed responses from librarians, which constitutes primary data for analysis and interpretation of 128 mailed questionnaires. This resulted in 79.69% response rate. The distribution of responses is shown in Table 2.

Table 1 List of libraries that participated in this study

SL No.	Name of the Institutions	SL No.	Name of the Institutions
1	Kuwait University	11	College of Engineering and Petroleum
2	Kuwait Maastricht Business School	12	College of Mathematics and Computer Science
3	College of Sharia and Islamic Studies	13	Box Hill College
4	American University of the Middle East (AUM)	14	Kuwait Health Sciences Center
5	Gulf Centre for University Education	15	Society of Engineering & Petroleum (SEP)
6	Australian College of Kuwait (ACK)	16	Weston Reserve University
7	Universal Institute, Kuwait	17	American International School of Kuwait
8	Arab Open University - Kuwait	18	The British School of Kuwait
9	Gulf University for Science and Technology (GUST)	19	The English Academy
10	American University of Kuwait (AUK)	20	The Oxford Academy

Table 2 Details of questionnaires distributed to librarians and the responses received

SL No.	Types of Academic Institutions	Questionnaires distributed	Responded	% of Responses
1	Government Colleges	2	0	0.00
2	Private Aided Colleges	11	9	8.82
3	Private Unaided Colleges	97	78	76.47
4	University Constituent Colleges	5	4	3.92
5	Minority Institutions	13	11	10.79
Total		**128**	**102**	**100.00**

Table 2 indicates that 78 out of 102 are from private colleges, and 11 are from minority institutions, 9 are from private aided colleges, 4 are from university constituent colleges; these represent 76.47%, 10.79%, 3.92% and 8.82% of the total respondents respectively. It may be observed that a large majority are the private unaided colleges.

Distribution of librarians according to their experience

Table 3 explains that 28 (27.45%) librarians are in the range of 6-10 years experience, 22 (21.57%) librarians are in the experience range of 21-25 years and 14 (13.73%) respondents are in the experience range of 16-20 years. Similarly, 12 (11.76%) have experience less than 5 years and it is the same for the range of 11-15 years. Around 14 (13.73%) respondents fall in the category of more than 26 years.

Information resource collection: print and digital

Print and electronic documents are broadly considered for interpretation. The documents available in respondent libraries are summarized in Table 4.

Table 4 points out that, 37 (36.27%) libraries have a collection that ranges from 10,001-20,000 books. Similarly, 20 (19.61%)

Table 3 Distribution of librarians according to their experience

Sl No.	Experience	No of Staff	Percentage %
1	< 5	12	11.76
2	6 to 10	28	27.45
3	11 to 15	12	11.76
4	16 to 20	14	13.73
5	21 to 25	22	21.57
6	26 and above	14	13.73
Total		**102**	**100.00**

Table 4 Information resource collection: print and digital

Print collection				**Electronic digital collection**		
SL No.	**No. of Documents**	**No. of Libraries**	**%**	**No. of Documents**	**No. of Libraries**	**%**
1	< 10000	20	19.61	< 1000	68	66.67
2	10001 to 20000	37	36.27	1001 to 2000	21	20.59
3	20001 to 30000	15	14.71	2001 to 3000	3	2.94
4	30001 to 40000	3	2.94	3001 to 4000	3	2.94
5	40001 to 50000	15	14.71	4001 to 5000	2	1.96
6	50001 and above	12	11.76	5001 and above	5	4.9
Total		**102**	**100.00**	**Total**	**102**	**100.00**

libraries have less than 10,000 books. 15 (14.71%) libraries possess a collection that normally ranges from 20,001-30,000 and 40,001-50,000 books. However, 12 (11.76%) libraries had a collection range between 50,001 and above books while only in 3 (2.94%) libraries the collection range was from 30,001-40,000 books.

It is also observed from Table 4 that, for 68 (66.67%) libraries the collection of electronic documents is less than 1,000. Similarly, 21 (20.59%) libraries have a collection which ranges from 1,001-2,000 electronic documents. However, in each of the 3 (2.94%) libraries the collection range is from 2,001-3,000 and 3,001-4,000 electronic documents respectively while in 5 (4.90%) libraries the collection ranges from 5,000 and above electronic documents. Only 2 (1.96%) libraries have a collection range from 4,001-5,000 electronic documents.

Availability of electronic gadgets and other accessories in libraries

The various service implications in libraries, depending on both software and hardware, are essential along with some basic functions, without which it cannot perform smoothly. Keeping in mind the first objective of this paper,

Table 5 Availability of electronic gadgets and other accessories in libraries

SL#	Description	No. of college Libraries	Percentage n=102
I. Computers			
1	Pentium-IV	78	76.47
2	Pentium-III	24	23.53
3	Pentium-II	10	9.81
II. Printers			
4	Inkjet printer	43	42.16
5	DeskJet Printer	33	32.35
6	Dot matrix printer	29	28.43
7	Laser printer	17	16.67
III. Barcode Reader / Printers			
8	Barcode reader	80	78.43
9	Barcode printer	53	51.96
IV. Scanners			
10	Document scanner	52	50.98
11	Scanner (OCR)	49	48.04
V. Others			
12	CD NET (CD-ROM Tower)	79	77.45
13	CD-ROM/ DVD Drives	79	77.45
14	UPS (online/Offline)	88	86.27

Note: Total percentage will not be hundred because responses are more than one

the researcher wants to know the infrastructural facilities available for automation. Here, the investigator has made an attempt to find out the electronic gadgets and other accessories available at different libraries under study. The findings are presented in Table 5.

Computers & Printers: Table 5 indicates that, 78 (76.47%) libraries are using P-IV systems; similarly 24 (23.53%) libraries are using P-III systems, only 10 (9.81%) libraries are using P-II systems. While to observe the collection of different kind of printers in the respondent libraries, there are 43 (42.16%) libraries using Inkjet printers, 33 (32.35%) using DeskJet printers, whereas 29 (28.43) are using Dot matrix printers and only 17 (16.67) use Laser printers.

Barcode Reader/scanner/printers: Among the respondent libraries, 80 (78.43%) are using Barcode readers and 53 (51.96%) libraries are using Barcode printers. There are 52 (50.98%) libraries using Document scanners, and only 49 (48.04%) libraries use OCR scanners. Around 79 (77.45%) libraries are using CD-NET (CD-ROM Tower) and CD-ROM/ DVD Drives and 88 (86.27%) libraries have UPS facility available in the respondent libraries.

Software facilities available in libraries

There are various utility softwares, normally used in any system including DOS, Windows, and Linux. Here, the investigator has made an attempt to collect the data relating to the utility and library software packages used by the librarians. The data so collected is analyzed and presented in Table 6.

Operating system: Among the total respondents, 46 (45.10%) libraries are using Windows 2000 Professional, 22 (21.57%) libraries are using Windows XP, and 15 (14.71%) libraries are using Windows 2003, whereas only 7 (6.86%) are using Windows 98 and Linux operating systems. The rest 12 libraries are using other operating systems.

LM Software packages: Table 6 indicates that, majority of respondents are (32; 31.37%) using Symphony whereas 20 libraries are using EasyLib. It was interestingly Observed that 8 libraries are using in-house software, 5 libraries are using Netlib, and the other 5 are using

Table 6 Software facilities available in libraries

Sl No.	Description	No. of College Libraries	Percentage n=102
16	Windows XP	22	21.57
17	Windows 2003	15	14.71
18	Windows 98	7	6.86
19	Linux	7	6.86
20	Other Operating System	12	11.76
II. LM Software Packages			
1	Symphony	32	31.37
2	EasyLib	20	19.61
3	In-house	8	7.84
7	Ie-Lib	2	1.96
8	E-Granthalaya	2	1.96
10	Libsuite	1	0.98
12	Virtua Library System	1	0.98
13	Pal Pup	1	0.98
14	NewGenLib	1	0.98
15	Libsys	1	0.98
16	YLAS	1	0.98
17	IOZEN	1	0.98
18	Lib-Manager	1	0.98

Note: Total percentage will not be hundred because responses are more than one

Smart Campus. Similarly, 3 libraries are using LIMS software, followed by Ie-Lib, E-Granthalaya, SOUL software packages which are used by 2 libraries. Single installations software like the Libsuite, SLIM++, Chancellor, Pal Pup, Virtua, NewGenLib, Libsys, YLAS, IOZEN and Lib-Manager are used in the remaining libraries.

Technology based infrastructure and services

The various service implications in libraries, that depends on both hardware and software is essential along with some basic component, without which it cannot function smoothly.

***Network*:** Table 7 explains that, 88 (86.27%) libraries are networked and 14 (13.73%) libraries are not networked.

Types of network: Out of 88, there are 67 (76.14%) libraries in Local Area Network (LAN) facility and 21 (23.86%) libraries are having Wide Area Network (WAN) facility.

Consortia: Further Table 7 exhibits that, 88 (86.27%) libraries were under consortia and 14 (13.73%) libraries were not under consortia.

***Types of consortia*:** It is evident that 86.27% of libraries have joined the DELNET consortia. Similarly, 42.26% of libraries are INDEST members.

Automation: Out of 102 respondent libraries 88 (86.27%) libraries are automated and remaining 14 libraries are without automated house keeping operations.

Services provided at libraries

The college libraries are considered as the service agencies to academic and research community as well as to the other users. The faculty, scholars and the students have been offered with different services in their libraries through manual and computerized retrieval system.

Table 8 depicts the library and information services provided by college libraries in all manners, i.e., manual, mechanized, and computerized. Around 75 libraries provide reference and interlibrary loan services manually. There are 88 libraries which provide orientation service and 18 libraries provide consultancy service, bibliographic service and 14 libraries lending service manually. No library provides CAS/SDI, indexing and translation services. All the libraries provide mechanized photocopy service. Three libraries provide mechanized microfilm reader service to its users; whereas 45 libraries are providing audio-video service and 42 libraries are providing computerized CAS/SDI service and online service. Multimedia service and CD-ROM search service are being provided by 88 libraries, respectively. No library provides automated translation service and technical communication service.

Status of computerized housekeeping operations in libraries

Library automation means not only entering and reading the data on the computer, but the different functional areas of a library also

Table 7 IT-based equipment and facilities

Networking status		Types of networking		Status of consortia		Status of Automation		Types of library consortia					
								DELNET		INDEST		BOTH	
Yes	No	LAN	WAN	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
88 (86.27)	14 (13.73)	21 (20.59)	67 (65.69)	88 (86.27)	14 (13.73)	88 (86.27)	14 (13.73)	81 (86.27)	21 (13.73)	43 (42.16)	59 (57.84)	43 (42.16)	59 (57.84)
102 (100.00)		102 (100.00)		102 (100.00)		102 (100.00)		102 (100)		102 (100)		102 (100)	

Table 8 Services provided at libraries

SL No.	Descriptions	No. of Libraries	%
I. Manual			
1	Reference service	75	73.53
2	Landing service	14	13.73
3	CAS/SDI	-	0.00
4	Indexing service	-	0.00
5	Abstraction service	-	0.00
6	Bibliographic service	18	17.65
7	Inter-library lone service	75	73.53
8	Reprographic service	102	100.00
9	Press clipping service	88	86.27
10	Translation service	-	0.00
11	Consultancy service	18	17.65
12	Orientation of users	88	86.27
II. Mechanized			
13	Photocopying service	102	100.00
14	Microfilming	-	0.00
15	Microfilm reader	03	2.94
16	Audio–video service	45	44.12
III. Computerized			
17	Lending service	88	86.27
18	CAS/SDI	42	41.18
19	Automated translating	-	0.00
20	Multi-media service	88	86.27
21	E-Mail	88	86.27
22	Teleconferencing	-	0.00
23	Hypermedia	12	11.76
24	Online searching	42	41.18
25	CD-ROM Searching	88	86.27
26	Technical communication	-	0.00

Note: Total percentage will not be hundred because responses are more than one

should be automated. Hence, the investigator made an attempt to collect data from automating the functional areas of the library. The information obtained is summarized and presented in Table 9.

Table 9 Status of computerized housekeeping operations in libraries

SL No.	Modules	No. of Libraries	Percentage n=102
1	Administrative Module	88	86.27
2	Catalogue	88	86.27
3	Circulation	88	86.27
4	OPAC	80	78.43
5	Web OPAC	23	22.55
6	Acquisition	22	21.57
7	Serials Control	19	18.63
8	Stock Verification	80	78.43

Note: Total percentage will not be hundred because responses are more than one

Table 9 exhibits that, the administrative module, cataloguing and circulation module are functioning in 86.27% of the respondent libraries and 80 libraries are using OPAC module functions and stock verification, respectively. Around 23 libraries are using WEB OPAC module functions. The other automated module functions like in 22 (25%) libraries data acquisition are used, while 19 (21.59%) libraries employ serials control module. The reasons could be attributed to different practices followed by respondent libraries.

Impact of IT application

Table 10 presents the respondents' view on the impact of IT application on different college libraries. Nine variables were identified and the librarians were asked to rank them in ascending order. About 88 libraries rated improved access

to library collection as number one. The second ranked variable was unanimously allotted to improving the speed of technical processing and making a document available faster to the end users by all the college libraries. The third rank was given to offering improved resource sharing among member library, followed by improving cooperation to participate and utilize national and international database through computer networks/Internet and so on.

Conclusion

The significance of IT lies in its role as a catalytic agent. Today, there is no area which has not been influenced by information technology. IT mainly helps to provide timely information and facilitates real-time access to remote databases. The importance of information lies in its accessibility and application by users for productivity and decision-making. Technology remains one of the primary drivers of change in the ways that people work, seek information, communicate, and entertain themselves. In an academic environment, no unit has been transformed by technology than our very own library. The libraries need to reorganize their physical space to make technology-enabled resources both more readily available and widely used. Library and information professionals should add new IT skills to their current capabilities in order to help users overcome their anxieties about the new world of networked and digitized information, and assist them to navigate through it. In this regard, college librarians have to be serious in developing their own proficiency as well as must find out how to develop the professional competency, in general. Since the users are more prone to on-line and electronically delivered services, the growing role of the librarian in colleges would lie in information counselling, training, advising users on services and information products appropriate to their needs and how best to use them. This is a time that necessitates innovative ways of thinking about services, collections, information access and also our role as academic librarians. Being prepared to manage changes can furnish us with the ability to flourish abundantly.

Table 10 Impact of IT application in college libraries

SL No.	Impact of IT Application	No. of Librarians	% N=102	Rank
1	Improves access to library collection	88	86.27	I
2	Improves the speed of technical processing and make a document available faster to the end users	87	85.29	II
3	Helps to offer improved resource sharing among member libraries	86	84.31	III
4	Improves co-operation to participate and utilize national and international database through computer networks/Internet	85	83.33	IV
5	Improves the prestige and visibility power of library	80	78.43	V
6	Improve the quality of existing library services	79	77.45	VI
7	Provides update and comprehensive information to the library and users	68	66.67	VII
8	Reduces housekeeping work of the library	60	58.82	VIII
9	Reduces the number of library professionals/ non professionals staff required	42	41.18	IX

Note: Total percentage will not be hundred because responses are more than one

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Abstract

Knowledge management (KM) is one of the most engaging subjects in the modern knowledge-based economy, and many academic and professional disciplines have adopted KM education into their course programmes. Library and Information Science (LIS) is another academic discipline that has a lot to gain by incorporating the principles of KM. This paper aims to suggest a modular approach to KM education in the realm of Digital Library (DL) learning. This paper is based on a review of the scientific literature of the field, and a mini-case analysis of the 'International Master in Digital Library Learning' (DILL) programme – which includes a module on 'Information and Knowledge Management' (IKM). The study describes emerging notions of DL and KM, and explores the current state of DL learning and KM education in Library and Information Science (LIS). It analyses a mini-case, and shows that the IKM module of DILL comprises dimensions of content, context, people, process and technology. Finally, this paper proposes a framework of KM specialization in the DILL programme which consists of four modules based on the four major perspectives of KM; information, technology, business, and human.

Keywords

Knowledge management (KM), KM education, Digital library (DL), DL learning, Library and information science (LIS)

Introduction

The overwhelming growth of digital technologies and their applications in library science and information systems have transformed traditional scope of librarianship into digital librarianship. Although the history of digital libraries is now approximately twenty years long (Candela, Castelli, and Pagano 2011), the concept can be traced back to Licklider's (1965) 'Library of the future' and Lancaster's (1978) 'paperless library'. By the end of the 1980s digital libraries were barely a part of the landscape of librarianship, information science, or computer science, but by the end of the 1990s, research, practical developments, and general interest in digital libraries exploded globally (Saracevic and Covi 2000). Emerging trends DL, as well as the existing shortage of professional librarians with the expertise in digital technologies have demanded for learning digital librarianship. A number of studies have examined KM education for DL as a sub-field of Library and Information Science (LIS) curriculum (Spink and Cool 1999; Saracevic and Dalbello 2001; Pomerantz et al. 2006; Ma, O'Brien and Clegg 2006, 2008).

Another significant innovation of the 1990s was the emergence of knowledge management (KM). The early emphasis in KM was on information systems, and then the focus shifted towards organizational development, intellectual capital management, and competence management. Towards the end of the 1990s, social learning, organizational sensibility, and systemic innovation and change management became prominent themes in KM (Tuomi 2002). Thus, KM has emerged as an interdisciplinary field of education, research, and professional practice in a number of disciplines such as information systems, business and management, library and information science, human resource management, cognitive science, and more.

LIS is the field that is most directly affected by the emergence and growth of KM. LIS is historically linked to KM in the sense that the core of LIS is managing explicit knowledge and data. Recent studies have confirmed that LIS is the leading discipline for academic programmes in KM (Saito 2007; Sutton 2007). Although a number of studies have suggested new types of course content and curriculum in KM for LIS (Reardon 1998; Todd and Southon 2000; Chaudhry and Higgins 2003), none has developed a framework of KM education for DL. This paper hopes to minimize this gap of research.

Objectives of the Study

The main objective of this paper is to develop a framework for KM education in DL learning. The specific objectives are:

- To describe the emerging fields of DL and KM;
- To explore the current state of DL learning offered by LIS schools;
- To examine LIS-based KM academic programmes;
- To analyse the "Information and Knowledge Management" (IKM) module of an 'International Master in Digital Library Learning' programme; and
- To suggest a modular approach to KM education in DL learning.

Methodology

The methodology used for this paper is a review of the scientific literature, followed by an analysis of a mini case, 'International Master in Digital Library Learning', and the authors' own viewpoints. The review includes studies related to digital libraries and knowledge management, specifically the educational aspects of these two emerging fields. We have selected the 'International Master in Digital Library Learning' programme offered by Oslo University College (Norway) in conjunction with Tallinn University (Estonia), and Parma University (Italy) as the case under consideration. The reasoning behind selecting this programme is that its international nature and the inclusion of KM content in it will accord a more holistic review. The case analysis

is based on the data available to the public in the programme homepage, and an e-mail interview of two key people related to the programme.

Digital Library (DL) Learning

Digital library: an overview of the concept

Digital libraries can be viewed from different perspectives; Fox et al (1995) observes that the term digital library implies different things to different people, ranging from the simple act of transferring traditional libraries to an online medium to digital libraries with a space in which people communicate, share, and produce new knowledge, and knowledge products. In the first textbook on the topic, Lesk (1997) characterizes digital libraries as "organized collections of digital information", while Miksa and Doty (1994) suggest that a digital library might well be called a digital information system, or a digital publishing system. Arms (2000) defines a DL as a managed collection of information, with associated services, where information is stored in digital formats and is accessible over a network. In fact, DL systems have greatly evolved since their earliest appearance. According to Candela, Castelli, and Pagano (2011), modern digital libraries have become complex networked systems able to support communication and collaboration among different worldwide distributed communities, dealing with digital objects. Such objects comprise not only the digital counterpart of printed documents, but also images, video, programs, and any other kind of multimedia objects a community may define as appropriate to its working and communication needs.

DL education in LIS

In recent years, education in DL has increased in graduate level curricula at LIS schools. Chu's (2006) study confirms that one of the most frequent new course titles in LIS schools is 'Digital Libraries'. In the late nineties, Spink and Cool (1999) identified 20 institutions, including 12 in the USA, 2 in Australia, and 1 each in Brazil, Canada, Malaysia, New Zealand, Singapore, and the UK, that offered DL education. A majority of the institutions (16) offering DL courses were within Library and/or Information Science related departments. Two years later, Saracevic and Dalbello (2001) found that, of the 56 LIS programmes accredited by the American Library Association (ALA), 47 (89%) included DL in some form or to some degree in their curriculum. Liu's (2004) survey of DL education identified 20 of the 36 LIS schools as having ALA accredited DL programmes, and the rest of the programmes were computer science or LIS programmes in Europe, South America or Asia. The subject analysis of online course syllabi based upon the occurrences of topics, offered by 30 LIS schools in 12 countries, shows that there exists some emerging qualifications in LIS programs indicating new roles for librarians in the web and digital environment (Kousha and Abdoli 2008). This study, however, finds a remarkable gap between required job qualifications and LIS course contents in "digital libraries" with only 0.9% of subject occurrences in LIS programmes.

IFLA World Guide to Library, Archive and Information Science Education (Schniederjurgen 2007) enlisted 1,033 LIS-related schools/departments. The analysis of only available course contents of 433 schools/departments shows that the title "digital library" appears in 94 programmes with high concentration at postgraduate level 65 (69%), followed by undergraduate 25 (27%), diploma 2 (2%) and certificate course 2(2%). Ma, O'Brien, and Clegg's (2008) study mentions that by the end of 2006 (based on module titles shown on-line), 28% (5/18) of all universities with accredited programmes by CILIP (the Chartered Institute of Library and Information Professionals) in the UK and over 60% (34/56) of all library schools accredited by ALA in the USA and Canada are offering specific DL education.

DL course content and curriculum areas

The content of DL courses varies from school to school depending on the concept of DL as adopted by the schools, and the discipline within which the schools are offering DL education. One of the earlier studies suggested seven major areas of DL curriculum: theoretical and historical foundations; technical infrastructure of the digital library; knowledge organization in digital libraries; collection development and maintenance; information access and utilization of digital libraries; social, economic and policy issues; and professional issues (Spink and Cool 1999). The DL has a connection to KM, and hence, the content of DL suggested by Saracevic and Dalbello (2001) includes KM comprising, among others, standards, document structure

Table 1 Topics in digital library education

Module	Core Topics	Related Topics
Module 1	Overview	——
Module 2	Collection Development	a) Digitization; b) Document and E-Publishing Mark-up
Module 3	Digital Objects	a) Text Resources; b) Multimedia; c) File Formats, Transformation
Module 4	Information/ Knowledge Organization	a) Metadata, Harvesting, Cataloguing; b) Ontology, Classification, Categorization; c) Vocabulary Control; d) Bibliographic, Bibliometrics, Webbiographics
Module 5	Architecture (Agents, Mediators)	a) Interoperability; b) Sustainability; c) Interface Design, Usability Assessment; d) Search Engines & IR; e) Identifiers, Handles; f) Info Summarization, Visualization; g) Recommender System; h) Applications; i) Web-publishing; j) Security
Module 6	Space (Conceptual, Geographic, 2/3D, VR)	a) Storage; b) Repositories Archives
Module 7	Services (Searching, Linking, Browsing, Annotating, etc.)	a) Information Needs, Relevance, Evaluation; b) Search Strategy, Information Seeking Behaviour; c) Reference Services; d) Routing, Community, Filtering; d) Sharing, Networking, Interchange
Module 8	Archiving, Preservation, Integrity	——
Module 9	Project Management	a) DL Development for a Specific Domain; b) DL Project Examples; c) DL Evaluation; d) Legal Issues; e) Cost/ Economic Issues; f) Social Issues; g) Future DLs
Module 10	DL Education & Research	——

Source Adapted from Pomerantz et al. (2006)

and electronic texts, preservation, and community building and social context as the contents of digital library courses offered by LIS schools. Liu (2004) proposed a DL curriculum covering the areas of history and definitions of DL, building and organizing DLs, integrating and interoperating digital information, policy and legal issues in DLs, interface design and services, DL evaluation, collaboration and global perspectives on DLs, and the future of DLs in society. A more comprehensive and a modular approach of the DL curriculum was recommended by Pomerantz et al. (2006) which included 10 modules with both 'core' and 'related' topics in DL as shown in Table 1.

Education for Knowledge Management (KM)

The concept of KM

Although there is no commonly agreed upon definition of knowledge and its management, it is generally agreed that there is a continuum of data, information, and knowledge. Thus, KM deals with the management of data, information, and knowledge. According to Abell and Oxbrow (2001), KM is the creation and subsequent management of an environment which encourages knowledge to be created, shared, learnt, enhanced, and organized for the benefit of the organization and its customers. Southon and Todd (2001) explored a wide spectrum of notions regarding KM such as:

- A renaming of information management,
- An extension of information management,
- Very broad programme of which information management was only a part, and
- A poorly defined and problematic phenomenon.

Southon and Todd (2001) further identified some characteristics of KM contrasted substantially with those of information management (IM). KM is described in terms of people-centred characteristics: sharing, understanding, intellectual capital, enabling people, interacting, using-in essence, an 'organizational being' construct; whereas IM is described with largely technical, service-oriented terms: organising information, processes and systems, access to and provision of information retrieval, an 'organisational doing' construct. Thus, IM is concerned with the management of only explicit information and/or knowledge, while KM is related to both explicit and tacit knowledge.

KM education in LIS

The academic side of KM is multifaceted, and hence *Sutton* (2007) raised the question, "where does KM fit in the academy?" He, however, finds no boundary or restriction for the departments,

Table 2 KM Master's programmes offered by different schools/departments

Coordinating school/department	Master's in KM	Concentration in KM	Total
Library and information science	11	3	14
Computer science, information systems	7	4	11
Management, business, public administration	4	4	8
Engineering	3	1	4
Education	3	n/a	3
Total	28	12	40

Source Saito (2007), p.107.

schools or faculties where KM can be taught or practiced.

Analysing 40 KM Master's programmes, as mentioned in Table 2, Saito (2007) identified that the highest number of programmes (14) were offered by the schools of LIS, followed by the schools of computer science and/ or information systems (11), Management/ business/public administration (8), Engineering (4), and Education (3). The result of a survey of homepages (only in English) of 300 LIS schools from around the world conducted by Roknuzzaman and Umemoto (2009) shows that only 37 (12.3%) schools offered KM education, ranging from simply one course or module in KM to full-fledged Master's or Doctoral programmes. A year later, these authors extended their survey and found that out of 600 LIS schools, 106 (17.7%) schools provided 140 KM programmes or offered KM in courses in different degree programmes (Roknuzzaman and Umemoto 2010). The survey also shows that the diffusion of KM education was high at a master's degree programmes, offering 65% of the KM programmes or courses. The background motivations of LIS schools in adopting KM education was their response to the natural evolution of the information field, the expansion of the LIS domain, and their response to the demands of graduates with KM skills, and ensuring academic competition.

KM course content and curriculum areas

One of the earlier frameworks of the content of real KM courses as suggested by Reardon (1998) consists of nine major areas of study including

Table 3 Curriculum areas and topics in KM Courses

Curriculum Areas	Topics
1. Foundations	Definitions and complexity of knowledge; Forms of knowledge (tacit, explicit); Sources of knowledge; Knowledge workers; Intellectual capital; Knowledge-based organizations; KM process; KM enablers; Knowledge sharing models.
2. Technology	Overview of commonly used technologies; Selection and design considerations for KM enabling technologies; KM architecture; KM tools and applications; Collaboration; Business Intelligence; Document Management Systems; Intranets/Portals/ Websites.
3. Process (Codification)	Knowledge audit; Capturing and acquisition of knowledge; Knowledge mapping; Organization and categorization of knowledge resources; Developing and maintaining knowledge repositories; Search and retrieval, use, and re-use of knowledge
4. Applications	Case studies and success stories of KM application in consulting firms and IT companies; Considerations for KM applications in different sectors and industries; Implementing a KM project in an organization.
5. Strategies	Integrating knowledge into organizational work to gain leverage from organizational knowledge resources; Steps for sustaining the KM work; Institutionalization of KM activities; Human resources and support (role and responsibilities of knowledge professionals); Measurement of knowledge assets.

Source Adapted from Chaudhry and Higgins (2001)

IT, electronic resources, communications technology, management, information management, research skills, transferable skills, knowledge studies, and behavioural studies. Chaudhry and Higgins (2003, 2001) categorized the frequently listed KM topics into five main curriculum areas as shown in Table 3.

Chaudhry and Higgins (2003, 2001) also showed the differences in perspectives and emphasis in the course contents and curriculum areas varying from more technology-oriented courses in computing schools to management oriented in LIS and business schools. These authors Brogan, Hingston, and Wilson (2001) have found strong support for knowledge computing, knowledge management foundations, and knowledge management practices as a KM course content. The categories of KM subjects featured in KM Masters courses offered by Australian universities include organization and management, technological applications, information organization and retrieval, business (especially e-business), and sociology of knowledge and learning (Ferguson and Hider 2006). The content analysis of available courses of LIS-based KM Master's programmes shows that KM curricula consist of the following six clusters: KM Foundation, Information/Content Management, Information Systems/ Computing Information Technology (IT), Business and Management, Human and Organizational Behaviour, and Miscellaneous (Roknuzzaman and Umemoto 2010). This content analysis further indicates that LIS schools concentrate more on IT and information than on business and human perspectives of KM.

Incorporation of KM into Digital Library Learning: a case analysis

In 2007, the International Master in *Digital Library Learning* (DILL) – a two-year Master Programme for information professionals who intend to work in the complex world of digital libraries – was developed in cooperation between Oslo University College (Norway), Tallinn University (Estonia), and Parma University (Italy). The first semester of DILL is offered at the campus of Oslo University College in Oslo, Norway. The second semester will be offered at Tallinn University in Tallinn, Estonia. The third semester will be offered at Parma University in Parma, Italy. The fourth semester involves writing a Master's thesis. Table 4 summarizes the structure of DILL program, which includes six modules.

The pedagogical approach

The module of 'Information and Knowledge Management' (IKM) in DILL programme

Table 4 Structure of DILL programme

Semester	Modules
First Semester	Research Methods and Theory of Science (15 ECTS) Digital Documents (15 ECTS)
Second Semester	Information and Knowledge Management (15 ECTS); Human Resource Management (15 ECTS)
Third Semester	Access to Digital Libraries (15 ECTS) Users and Usage of Digital Libraries (15 ECTS)
Fourth Semester	Writing the Master's thesis

Source DILL programme's homepage

integrates both IM and KM, and it follows a social constructivist approach to learning. It means that a student, as a learner, is responsible for constructing his/her own meaning and interpretations. Knowledge cannot be transmitted to learners but must be constructed by learners through active engagement with others and the material world. Learning is a social activity (a collaborative experience) and the key to learning is for the learner to find multiple ways to link new information to previous experience. Teachers will no longer focus on the subject matter – creating and re-creating lessons, delivering repetitive lectures – but focus much more on coaching and tutoring activities.

IKM course content in DILL

The objectives of the IKM module are to provide students with indepth systematic knowledge and clear understanding of the nature and value, current practice and research on the information and knowledge management field; to make them understand IKM concepts, models, practices, technology, tools, and applications; to demonstrate a broad understanding of the changing role of information professionals in initiating and supporting the IKM initiatives in organizations; and to make them aware of the integration between IM and KM field. The module of IKM covers all major dimensions of KM; including the typology of information and knowledge, the identification of information/ knowledge needs, and the acquisition, discovery, storage, organization, sharing, use and application of information/knowledge in the organizational context. One of the interviewees reported that they integrated the following dimensions or meta-categories into the IKM module:

- *Contents*- contain aspects of information resources management.
- *Context*- includes aspects of organizational and environmental issues affecting organizational information behaviour.
- *Process*- includes activities connected to information management (seeking, retrieval, scanning, and service).
- *People*- contain co-operational aspects, networks, individual level.
- *Technology* - includes technological aspects, systems, and databases

Thus, the IKM module incorporates a combination of skills and competencies related to information management, IT, business, human and organization skills, interpersonal and communication skills, personal behavioural skills, transferable skills, cognitive/ intellectual skills, and intercultural competencies.

Table 5 A modular approach to KM education in DL learning

SL	Modules	Topics
1	Information	Fundamentals of information and knowledge management Organization of information and knowledge in a digital environment
2	Technology	KM tools and technologies KM systems for DL
3	Business	Business/competitive intelligence E-publishing, e-commerce, and KM
4	Human	Organizational learning and human capital management Management of innovative knowledge services for DL users

The Proposed Framework of KM Education for DL Learning

The case analysis shows that the 'International Master in Digital Library Learning' includes only a module of 'Information and Knowledge Management'. KM is a broad domain that includes content from a number of fields, including LIS, IT, business and management, and human resources, among others. We strongly believe that a holistic approach to KM education is the need to prepare DL professionals to work in the digital age, which would require multi-dimensional knowledge. Roknuzzaman and Umemoto (2009, 2010) explored four major perspectives of KM from the cluster analysis of KM Master's programmes such as information, technology, business, and human perspectives. These perspectives of KM can also constitute the modules of KM education in the field of DL learning. In addition, the case analysis and the review of literature suggest what the important contents of KM education are. Thus, we propose four modules of KM and eight relevant topics for KM specialization in the Master's of DL, as mentioned in Table 5.

Conclusion

As a sub-field of both computer science and library science, DL is technology-oriented and deals with articulated or explicit knowledge. KM, on the other hand, is business and human-centric and deals with both explicit and tacit knowledge. Although DL and KM are two different fields, they bear some significant overlapping in the areas of their objectives, contents, people, processes and technology (Roknuzzaman, Kanai and Umemoto 2009). Some of the aspects of KM, especially content management, knowledge discovery and data mining, and information architecture are being practiced in DL. However, DL professionals require a wide range of skills and competencies related to strategic management of information, IT management, business process management, and human capital management to work in knowledge-intensive organizations like a DL. The proposed modular approach to KM education is a preliminary framework, and certainly this would enhance the skills and competencies of DL professionals. We hope to develop a more comprehensive and empirically tested framework of KM education for DL learning in our future work.

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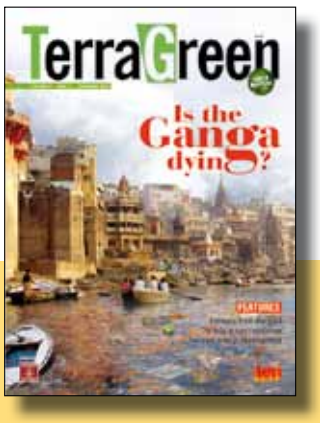

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Abstract

This contribution offers a brief and broad view on a core function of digital libraries; to support their users in discovering the most relevant information. We consider developers and managers of Information Sources, and Information Services, and examine how they can improve information discovery.

The paper is mainly based on experience, published literature and empirical research, in the context of academic and scientific information services. The following aspects of digital libraries are considered: from print to digital, disintermediation, the online catalogue, digital search, federated search, merging of databases, link generators, advanced commercial discovery services, the importance of freely available discovery services, open access, enhancing subject retrieval, searching via images, web and search engine optimization, the social web, and information literacy of users. Many relations exist among these topics.

As the information landscape continues to evolve faster than ever, continual adaptation is a must for (digital) libraries.

Keywords

Information retrieval, information discovery, disintermediation, federated search, meta-search, aggregation, internet

Introduction

This contribution is based on an invited paper presented at the International Conference on Digital Library Management 2011 (Nieuwenhuysen 2011).

Information discovery is quite important. The quantity of information in digital form is growing fast. Furthermore, information sources are scattered, and without a single simple discovery and access point in a dynamic digital network environment. The problem remains assisting users in information discovery and, in this period of global transition, providing users with access to information in printed and in electronic format. Here, we focus on the discovery phase. More concretely, we consider (as shown in Figure 1) producers, creators, authors, developers, and managers of information sources as well as developers and managers of information services. How can they improve information discovery for existing and potential users?

This is a broad question that touches on most activities that have a direct impact on the interaction with users of one's products and services, and in light of the continual evolution of technology, answers to the question are not straightforward. There is no complete agreement on the ways to make fast progress. Decisions depend on the goals of the local organization and, of course, on the available budgets.

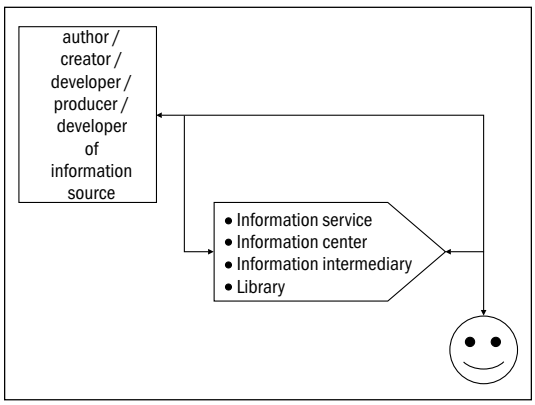

Figure 1 Basic flow chart of information in the context of digital libraries.

Findings, Views, Recommendations, and Suggestions

The paper below gives a sequence of topics that deserve the attention of developers and managers of information sources (in column), and of information services (in column 2) in order to improve information discovery by users. The text as a whole can be seen as a very brief and limited check-list or to-do list.

For information producers

To start with, creators / developers / producers / managers of information sources are considered. The term 'information sources' can be replaced with the term 'digital libraries', as the word 'library' has, for our purpose at the moment, the same meaning as an information source.

For information services

Secondly, developers / managers / directors of information services are addressed. They form an intermediate actor between information sources and users. Besides 'information services' we can also use the term 'digital libraries' in which the word 'library' has the particular meaning of an intermediate information service, and not as a source.

A distinction should be made here between discovering information sources relevant to the user's needs, and that are available – in principle – in the world, but are not necessarily immediately and directly available from the local library collection; and discovering information sources that are available almost immediately – and directly from the local library. The distinction between the two aspects and meanings of 'digital library' as made above is far from sharp in practical reality, but at least some distinction is reasonable.

From Print to Digital

We see a fast transition from classical print media towards digital media. In many cases this offers advantages. In an outline of a strategy for academic libraries by Lewis (2007), part one is titled 'Complete The Migration From Print To Electronic'. This may seem like forcing an open door for readers interested in digital libraries, as most professionals and users agree on the topic anyway. However, in reality acceptance of this transition with all its consequences is far from accepted.

For information producers

Producers of printed publications can and should make the transition to print + electronic, or to electronic only, in case the version that is printed before delivery does not offer a significant added value.

However, I observe the following:

- Small publishers and also some readers show a lack of interest in the electronic version, which is only seen as a by-product of the 'real' printed version.

Mainly small publishers lack time, funds, interest, experience and skills to develop a high quality electronic version.

They also lack a broad vision, in the sense that they see an electronic version as simply the same as the print version, but not yet printed. Electronic means ideally also interoperable; embedded in a huge worldwide digital environment where links and comments can be just as useful as the primary text, and where searching is replacing browsing as the way that potential users reveal information and decide to use it. Furthermore, it becomes possible to expand publications with large amounts of related data, images, and even video that cannot be printed.

For information services

Shift the emphasis from service based on printed sources to services based on electronic sources, sooner rather than later. In an analogous way, it should be realized at the same time that the digital medium is radically different and that collection building is only the first step in organizing access to information, much more so than in a classical non-digital environment.

Disintermediation

As a client in digital libraries and also in related services, one is forced in some way or another to rely on the assistance of an intermediary in order to reach one's goal – be it obtaining some information or service that is not so straightforward to provide.

The intermediary is in many cases quite friendly, even delighted that someone is interested in the service offered and is even more delighted that this forms an opportunity to show interest, knowledge, expertise, devotion, and a professional attitude and to personally meet a user of the service provided. Many service providers see this even as the most essential and most satisfying core aspect of their job.

This happened of course in classical physical libraries, but also in more up-to-date information environments where digital electronic systems are implemented. Is this acceptable or even desirable? This is a real question, as not everyone agrees on the answer.

On the other hand, I am also confronted many times with services where human intermediaries are almost absent. This often occurs increasingly. This has become possible since digital systems have been introduced and refined, in an increasing number of services, including libraries. Disintermediation is a phenomenon that we observe all over society, including information services. This is caused or 'made possible' by increasing access by end-users

to digital information systems, growth in digital online information services, and increasing ease of use of those systems.

For information producers

Incorporation of information in systems that do not require intermediates (anymore) seems to become a condition for survival as a producer. A prominent example is the increasing usage of digital systems through the Internet and the reluctance to use intermediates such as a library, to discover, collect and use information sources. This has created worried librarians in recent years. Of course there are exceptions, mainly when the digital format is not (yet) suitable as a medium to use the information, when the physical non-digital format offers significant value.

For information services

Information services have to cope with disintermediation. In a more positive way, we can say that disintermediation should be welcomed and embraced, as it allows saving money. Information services should still add value to the flow of information from source to user. The money that can be saved with disintermediation can and should be spent, for instance on increasing the collection of sources that are offered to users and to enhance the quality of information discovery and access systems. So it turns out that disintermediation is a complicated concept: intermediation becomes less visible in the physical world, but becomes more important and more costly behind the scenes, in the back office, to offer user friendly and efficient information services, that can compete with the omnipresent popular systems available free of charge through the internet, independent of an extra intermediate.

The Online Catalogue

Classical online catalogues are criticized for many reasons (see for instance Wang & Lim, 2009): Their user interfaces are less inviting than the interfaces of the popular WWW search engines. Their user interfaces do not follow the de facto standards imposed by the popular WWW search engines. Most do not offer spell checking of queries and relevance ranking in the result lists, which are common and well appreciated features of popular WWW search engines. They continue to fulfil mainly and only their classical role, but they hardly contribute to solve the problem of information discovery in the present information landscape that is primarily digital and networked. In other words, their scope is quite limited. Most do not exploit social network features that become popular in many other information and communication systems (this aspect has tackled briefly in the coming section). Many extensions of catalogues can increase their efficiency as discovery systems (see below for topics in this domain).

For information producers

See that the metadata of your information product can be downloaded / harvested and merged into online catalogue databases.

For information services

Consider integrating your local online catalogue in a federated search system (see below) as one of the target databases. Or consider extending your catalogue database with other relevant databases by merging them all into a larger database that can serve as a discovery tool that offers a larger view than the limited view on the local collection.

Consider managing your catalogue NOT as a discovery system (anymore) but only as a delivery tool, mainly to check if a discovered, known item is available from the local collection. In this way, money can be saved by spending less work on enhancing subject access (see below).

Digital Search

Simple and fast searching to discover the most relevant information items sounds easier than it is in reality. Evolution in search is still going

on. It is not a solved problem but consists of many, open problems. Search systems should be adapted to the information source, to the client computer system used (including not only relatively big common computers, but also a growing number of even more mobile devices) and to the type of user or even to the one concrete particular user, and so on. More and more, search influences determine what and how we read, learn, buy, and believe. The book on search interfaces by Morville & Callender (2010) sheds more light on the topic.

For information producers

Of course, see that your information product can be searched well by a more or less internal, dedicated system. Perhaps more important in these days of the omnipresent digital network is to see that your information product can be discovered through external discovery systems. These can rely on federated search or on merging into a big database (see below).

For information services

See that externally available search systems are exploited well by your user community. Offer them explicitly to users. In a library context, we work mainly with bibliographic databases (see Figure 2). These days this is a well accepted practice and one of the main functions of an information centre. Therefore we mention this only as an introduction. We must realize that this fights fragmentation of sources, but does not solve the problem completely. Other, additional approaches can be useful, as discussed below.

Federated Search

By definition, federated search systems form a gateway between the user and several target databases that are searched in one action (see for instance Morville & Callender, 2010; Nieuwenhuysen, 2010a; Pradhan et al., 2011).

This offers many advantages. For instance, federated searching can hide complexities of different user interfaces from the user, can increase coverage in the discovery phase by adding up the coverage of the target databases, and can save the user time.

For information producers

See that your information product can be searched efficiently through external federated search systems, independent of the local, internal search system that you manage and offer to users. Compliance with relevant standards can improve the situation.

For information services

Point your users to external existing federated search services on the WWW, which are available free of charge. Here a limitation is of course that these do not include target databases that are only commercially available at a price. Nevertheless these federated search services can be quite useful; examples are federated search systems to find descriptions of books and concrete books for sale (see for instance Nieuwenhuysen 2008, 2010b). Consider implementing a local federated search system for your users, hoping that the databases that you offer anyway (see above) are used more often and more effectively.

Merging of Databases

An alternative for federated searching is *a priori* merging of databases into a larger database (see for instance Nieuwenhuysen 2010a). This approach is increasingly chosen, as computer memory becomes cheaper. In-house application by an information service can offer an interesting service for their local or institutional users. Also public information discovery services have applied this approach; a particular successful example is Google Scholar that provides a discovery tool for scholarly, academic, scientific information.

For information producers

Do not see your information product as stand alone, but foresee the wish of information

services to incorporate it in a bigger system. Therefore follow standards and agreements. Take into account that specific value added to your product may not be exploited well in federated search or in a merged system, so that money spent on this may not be well exploited later by some users.

For information services

Consider this approach to enhance the discovery system that you develop and offer to your users. This can go in two directions: 1. A database that you produce can be made available to a bigger external database. A classic example is formed by the many libraries that contribute their bibliographic metadata with holdings to one or several bigger unions catalogues.

2. An external database can be incorporated in your local, internal discovery system. For example, a big bibliographic database on journal articles can be integrated into the local search system besides the classical local public access catalogue.

Merging databases can also be useful besides the strict context of information discovery; namely for the later phase of information delivery. This creates a knowledge base of a link generator that gathers information about the location and availability of discovered, known information items. For example, at the Vrije Universiteit Brussel, the DOAJ database of open access scholarly journal articles is regularly harvested and merged into the local link generator knowledge base (see below about link generators).

Link Generators

After information discovery, a link generator with its knowledge base can come into the game, to bring the user closer to related information or to a related service (see for instance Nieuwenhuysen et al., 2005 and Figures 2 and 3). Strictly speaking, a link generator plays a role mainly after the discovery phase, in the delivery phase, but the distinction between those phases is not sharp. For instance, a link generator can extend the discovery phase by pointing directly to items that contain a citation to the item that has already been found; this can lead to further interesting discoveries. Search systems should work seamlessly together with your link generator, as drawn in Figure 2.

For information producers

See that your information products function well with link generators. Depending on the type of information product, it can play a role either as a source or as a target (of hyperlinks). For example, a bibliographic database should be able to work well as a source of information that can be fed to a link generator to generate a link to a suitable, desirable target URL on the WWW.

A full-text database should allow so-called deep linking as a target, so that the link generator can generate a direct link that allows the user to extract directly a record from the target database. More generally and besides the strict context of link generators, ideally a permanent link (permalink) exists that offers a user direct access to an item in the collection of information that you produce.

For information services

Besides discovery systems, implementing a link generator is an efficient method to bring to users fast related information (There are no Fig 2 and 3). This should significantly increase access to digital sources, which is welcome in view of the high costs involved in making sources available. Therefore, the investments in discovery systems together with a link generator can be easily justified.

Advanced Commercial Discovery Services

Several companies offer advanced discovery services that can replace and extend more classical and more limited catalogues. A term that is often used in this context is ‘next-generation library catalogues’. This is a broad concept, as it includes extensions of the database contents that

are offered in the catalogue, and innovations in the user interface and the search technology to exploit the database.

So these 'next-gen' catalogues have evolved already far away from classical catalogues. Furthermore, the word catalogue sounds antique or obsolete for many young users of WWW information services. Therefore the term 'information discovery service' is also used often for the systems.

Extending the contents offered is done mainly by collocating existing bibliographic databases into a bigger merged database to obtain a huge panoramic discovery system. One claimed advantage is that this works faster than federated search, since the number of indexes that have to be checked is reduced. Producers of these systems/services include EBSCO Publishing, Ex Libris, Innovative Interfaces, OCLC, and Serials Solutions.

In parallel, we see various innovations in the user interface and search technology (see for instance Nieuwenhuysen, 2006, mer, 2011, Pradhan et al. 2011). Many aspects of this progress have their roots in information systems that are not closely related to libraries. This evolution is mentioned in the context of the new commercial discovery services, because many librarians and users are confronted mainly with new systems that are offered commercially. However, software in this area is also available free of charge to be implemented as replacement of a library public access catalogue or as an additional interface to the contents of an existing catalogue. A few of these systems are mentioned by Pradhan et al. 2011.

This evolution towards extensions of classical catalogues, towards "discovery systems" has become the subject of many research publications and reviews, for example Wang & Lim, 2009; Joint, 2010; Wisniewski, 2010; Luther & Kelly, 2011; Žumer, 2011, Pradhan et al. 2011. Recent comments on these upcoming systems by librarians range from enthusiastic (Wisniewski, 2010) to sceptical (Joint, 2010). These discovery systems rely on underlying smaller commercial discovery systems, often produced by other companies. Therefore some bottlenecks and pitfalls hamper such systems.

Each discovery system must negotiate deals with a bewildering array of metadata-database producers to obtain the permission to use these products as underlying databases. Collecting the metadata for a significant part of the relevant publications for a research library is a great challenge for managers and for technicians of such discovery systems; therefore the costs involved are high, and continuous updating is required. It is hard to compete with Google and Google Scholar which it offers free of charge on the public internet.

For information producers

Merging databases into a 'next-generation catalogue' can indeed lead to a greater and more attractive discovery system. So producers of a database should take this relatively new trend into account.

For information services

Applying such relatively new discovery systems can be considered, if the required funds are available. However, the rising power of freely available information services should also be considered in this context, as discussed below.

The Importance of Freely Available Discovery Services

Besides the various discovery systems mentioned above that can be implemented by a digital library service, many great discovery systems have become available relatively recently, which offer high coverage, a user friendly interface, and all this free of charge to everyone. This leads to 'the declining value of subscription-based abstracting and indexing services' (Chen, 2010). The following are examples: the popular general WWW search systems, led by Google since a few years ago. More specialized but

similar systems devoted to scholarly information, such as Google Scholar (see Figure 2). This is a relatively 'new kid on the block'. The system provides good coverage (see for instance Olsen Larsen & von Ins, 2010); it is increasingly used by students and researchers as a discovery system: 'It appears that Google Scholar has supplanted the traditional library bibliographic database as a means of subject searching for journal full-text.' (Joint, 2010). The famous system dedicated to biomedical information sources, named PubMed. Federated search systems to find book descriptions and concrete book copies available for sale, such as addall.com and bookfinder.com (see for instance Nieuwenhuysen 2008, 2010b).

For information producers

See that your primary information products can be discovered with those popular search and discovery systems.

For information services

Offer such discovery systems explicitly to your users, even though strictly speaking there is no need for this, as they are available to anyone free of charge by definition. If additional systems are desirable for your users and if budgets are available, then implement other discovery systems as described above.

Implement a link generator with the free discovery systems that you offer to your users, such as Google Scholar (see Figure 2) and PubMed from which the (meta) data are at least partially harvested and merged into Google Scholar. In this way you can provide added value that is not available for all common users who are not related to your organization. This was realized very soon at the Vrije Universiteit Brussel (see for instance Nieuwenhuysen et al. 2005). Be careful in relying on interesting, attractive systems that are now available free of charge, but which are evolving fast together with the evolution in technology and business management.

Open Access

Open access to information (publications) is growing as idea and strategy, as well as in practice. Open access increases usage and the number of citations received (Gregory et al. 2010). More collections of open access files are welcome, but creators and service providers should foresee that this is only the start of an evolution. Open access to empirically collected data on which the publications are based was not applicable without computer based storage and retrieval services, but recently this extended form of open access has become a reality (see for instance Stuart, 2010). Linking open access documents with other items in the WWW can generate added value that has not been present in classical library collections; other items can be information about authors, similar work, comments, reviews, corrections, data, and citations and so on.

For information producers

Authors, creators of information sources, individuals as well as organizations should consider making their information freely available in open access. Furthermore, they should even consider making available in open access the data collected during their research, perhaps together with suitable open access software to interpret the computer-readable data (see for instance Stuart, 2010). The institutional open access repository has mainly been accepted as an idea and in practice by institutions of higher education. But also other organizations and even persons are interested in making information available through the WWW. Up to now most use a WWW site for this aim. However, most sites do not guarantee stability. But creating an individual, independent repository for each and every organization and person would not be efficient. Therefore, institutional repositories that started in higher education can perhaps be extended towards other users (see for instance Badhusha, 2008,

who mentions this idea). However, this is not yet well explored. Do public repositories have a future? In a more general way, digital libraries should seriously consider the general problem of instability of large parts of the WWW and should contribute to the creation and maintenance of more stable platforms for future storage and retrieval of information.

For information services

Assist authors in making their creations available in open access, on a server computer managed in their own organization or on an external open access server. In higher education, integrate an open access repository in the workflow and in academic bibliographies and even in biographies of staff members. Point users of information to open access sources, besides other more costly publications; this can make users more aware of the basic idea and advantages of open access. Incorporate and apply open access discovery services, besides more traditional, classical discovery services that are costly. Expand your role, besides providing access to publications / information, also include providing access to data, knowing that data will be coupled more and more with 'information' in the digital environment.

Enhancing Subject Retrieval

Many producers of information sources as well as information services spend a large part of their personnel time budget in the addition of subject descriptions to the information sources that they make available. However, the digital evolution makes it easier and more efficient to discover information at several sources in one action, as explained above, by using federated search or by using merged databases like Google Scholar. A standard on subject descriptions does not exist, so added subject metadata are often not exploited well in wide ranging information discovery actions.

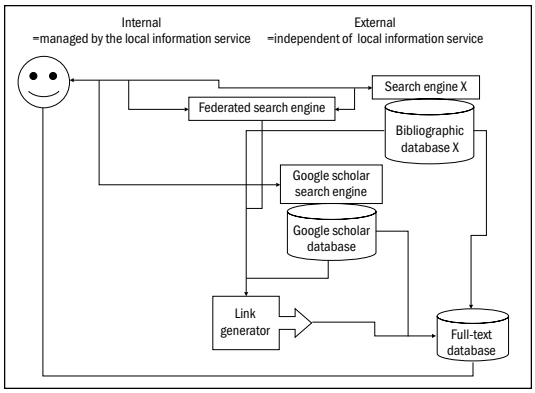

Figure 2 Some information discovery systems and the flow of information.

Problem to be solved	Federated search system or merging into 1 database	Link resolver = Link generator
How to allow a user to discover information, by exploiting many information sources in 1 action?	!	–
How to bring a user from some discovered, known information to additional, related information>	–	!

Figure 3 A system to discover information and a link generator that could function in synergy.

For information producers

The low value of added metadata in many contemporary discovery actions, mentioned above, should be taken into account in creating information products. An on-going investigation of information retrieval from the WWW through images (Nieuwenhuysen 2010c) brings me to a few small points in the following:

When an information product includes significant graphical elements (images, pictures, photos, graphs) it is important to realize that image searching is applied as one among many retrieval methods and takes this into account by optimizing your source for this way of retrieval. For instance consider avoiding container file

formats that hide the images, or in other words, consider applying a file format for your contents that keeps images separated from other elements, namely in connected image files, and optimize the names of these image files for retrieval through general search engines (such as google.com), as well as through image search engines (such as images.google.com).

Automatic expansion of a search query to increase recall by adding search terms in the user's initial query is applied by many retrieval systems. However, in most cases this decreases precision. This can be quite frustrating for the user who has to cope with many false hits. Therefore, this approach should be applied with care.

For information services

Information services should consider shifting a part of their budget spent on subject descriptions to collection development or other activities. This is related to the decline of the local catalogue as the main system for information discovery, as discussed above. The local catalogue can still serve mainly as a system to access known information items, discovered by other means discussed elsewhere in this text; for this more limited purpose, extensive subject descriptions are not needed.

Searching via Images

I have been investigating the efficiency of information discovery by searching for images on the WWW. Some findings have been published (Nieuwenhuysen, 2010c). In practical tests, precision of retrieval is much lower than the theoretical maximum, due to classical, basic information retrieval problems and imperfect systems; nevertheless, this way of searching deserves a place besides more classical searching of words occurring in text.

For information producers

If you create information sources that contain significant images, then work in such a way that precision and recall in WWW image searching is optimized. Some simple practical approaches can help (see above and Nieuwenhuysen, 2010c).

For information services

Point users to WWW image search systems besides more classical text search systems and inform users about their limitations and suitability for particular purposes.

Web and Search Engine Optimization

If it is not on the Web, then it does not exist. We can formulate this even sharper: if it cannot be discovered by a popular search engine, then it does not exist. With our perspective of information professionals, this can make us sad, because popular search engines do not always deliver the most relevant information sources. But we have to face this reality. Producing information sources and offering information services is not enough. Our creations should be implemented in such a way that they can be discovered and used. This is a hard truth in face of the fierce competition on the WWW. I have investigated how well a simple personal digital library that I develop can be discovered and how intensely it is accessed through the WWW. The findings show that an optimistic view is justified (Nieuwenhuysen 2010d). But in any case, optimization for search engines is important.

For information producers

Producing a source is not sufficient. See that it is discovered by potential users, in spite of the fierce competition on the WWW. Many guidelines in this context are available (see for instance Nieuwenhuysen 2010d). In particular, search engine optimization for academic texts is the research domain of Beal et al. (2010). Assess in which way and how intensively your information products are discovered and used. Many guidelines exist for this (see for instance Plaza, 2010, Nieuwenhuysen, 2010d).

For information services

The recommendations for information producers can also be considered by information services. For instance, when we consider the production of an institutional repository as a task of an information service, then creation is not sufficient. In my opinion, much effort is spent on creating repositories while discovery mechanisms for those sources are somewhat neglected, as if this works automatically, in some invisible magical way. Up to now the creators have to rely mainly on general WWW search engines that work far away, almost without explicit communication with the creators of the harvested sources.

The Social Web

This is one aspect of what is named by many with the umbrella term 'Web 2.0'. I do not like or approve this popular name, mainly because there is no sharp transition from a version 1.0 that was never given this name, to a version 2.0; related to this, the transition is not defined clearly at all. In particular the increasingly social aspects of the WWW do not show a sharp transition. A few aspects of WWW systems that we can name now 'social' are not popular or fashionable, but probably more important in a professional, academic environment than other more visible and popular systems. Here I think for instance of book reviews invited and offered free of charge by the online bookshop Amazon, and citation / link analysis offered free of charge and exploited in ranking of search results by Google Scholar. Many information users spend considerable time these days on WWW sites where social interaction, immersion, traces of other users are quite prominent; famous examples are Facebook and Twitter for explicit social interaction, Flickr for still images and YouTube for video. A consequence is that these users expect some form of added value in information systems in the form of social interactions. In other words, they can experience systems without social interaction as silent, sterile and not hospitable. Besides the obvious positive aspects of services with social interaction, we can see somewhat of a contradiction on the one hand we can see these as social aspects, relying on contributions of the crowd, the worldwide community. On the other hand mainly big, large companies and their computer systems have enough power and financial means to exploit such contributions in the form of an interesting service of an appreciable size. Anyway, digital libraries should take this evolution into account (see for instance Hart, 2010).

For information producers

Producers of information systems can exploit the social aspects of the WWW. Mainly the big players with many items and many users can take advantage of their scale. Some invite comments and reviews by users, such as online shops and map systems. Others exploit the links among items in the WWW to reveal relations between items and the relative importance of items; Google Web Search and Google Scholar are again prominent examples here.

For information services

An information service works in most cases for a more limited number of users than the big worldwide public information systems. Therefore exploiting social aspects is less straightforward. Nevertheless, developments in software allow even implementations on a small scale, for instance in an online public access catalogue, as mentioned above. Can this lead to success stories? This deserves at least our attention.

Information Literacy of Users

Efficient information discovery by users does not function completely automatically. A suitable level of information literacy is required and this depends of course on the user's environment,

needs and aims. Assisting users in continually upgrading their level of information literacy is desirable. Motivations for this include the speed of evolution of the information landscape; individual and separate systems become more user friendly, but as a whole the scattered and dynamic information landscape can be considered as more complex and dynamic than ever before.

For information producers

Try to avoid the need to upgrade the level of information literacy of potential users. For instance: user interfaces should be made user friendly; bibliographic databases should be structured in such a way that they can easily and optimally be incorporated in federated search systems and in link resolvers (see above); information produced should be incorporated in a WWW site that can be easily accessed, discovered and harvested by common, popular search engines; the content of the information products should be structured in such a way that the full text as well as the images and other elements can be harvested fully by search engines (see above on search engine optimization and on image searching).

For information services

Many information services make efforts to upgrade information literacy of their users and potential users. However, the information professionals active in this way see information as quite important and central in their professional life, while users see information only as an element needed to make progress, as only one part of the puzzle in their head. This can hamper communication and efficiency. As a didactic approach, I recommend to challenge users with realistic and directly relevant problems, so that they learn how an efficient method of information discovery can help them in solving these problems. In other words, I prefer the method of problem-oriented learning and not some teaching that puts information in the centre. I have been working in this way for many years in the university courses for which I have been responsible. Finding information on a particular subject/topic is not a final and significant aim for most users. Badke (2010a) has recently supported this view. As a summary I give the following quotes: 'Information as tool, not destination' and 'Research is not about a topic. It's about a problem.' In educational settings, upgrading information literacy cannot be achieved simply and efficiently in some additional course, but it must be a key component in all educational activities. This does not diminish the role and responsibility of librarians; on the contrary they should contribute to a more fundamental and more efficient approach.

Concluding Remarks

The topics listed above are heavily interrelated. This is already indicated in several places in the text. For example, the trend towards disintermediation and the growing need to upgrade the level of information literacy of everyone may seem like a contradiction, but in my view it is only a paradox. Even upgrading information literacy can be increased by exploiting digital systems without the physical presence of a teaching intermediary. More concretely, I think here of digital e-learning systems that become more interactive, personal and sophisticated. Even better, we can hope that more digital tutorials and feedback mechanisms are incorporated in the digital information systems, as a synergy of information source, information system and meta-information about both.

We work in the era of fast evolution, mainly from print to electronic/digital, leading to digital libraries. This offers attractive opportunities. However, the prefix 'digital' or 'electronic' or 'virtual' does not indicate that less efforts are needed to assure efficient discovery and delivery

of information. The broad overview above illustrates this. Budgets should go up, but in practice they are stable even declining (see Figure 4). In practice, I observe that many information centres cannot cope well with all the changing challenges. Of course, mainly small centres in relatively poor environments are frustrated. Setting up and keeping up-to-date a digital library infrastructure to deal with the present day digital information environment is unrealistic for small players in the field. An obvious approach to this problem is co-operation among organizations, but in practice this seems hard to achieve. We recognize that information is not accessed anymore in local, physical libraries, but through worldwide digital networks. The next logical step seems to replace several small local infrastructures and local expert personnel with larger systems and concentrated experts that serve a larger community. This model is already adapted by big players in the information industry and many of these are quite successful, while libraries see them as growing competitors.

The challenges faced by libraries, as outlined above, occur together with the related evolution to an exploding quantity of information that can be accessed by anyone through the Internet and WWW. The amount of information that can only be accessed through libraries is relatively constant. Of course we can argue that libraries offer information of higher quality than the 'noise' freely available on the Internet. But even this argument is losing value in view of the open access movement. As a consequence the ratio of the information that must be accessed through libraries to the totality of public information is decreasing (see Figure 4). This evolution does not help in advocating libraries. Decision makers and higher management are well aware of this evolution and that contributes probably to the decline of budgets mentioned above.

The observations mentioned above should not make us pessimistic, but should give us a realistic view on the present day situation of digital libraries. Even optimism is justified, as the world of information has never been more exciting and possibilities seem endless. But in any case drastic changes must be accepted and dealt with. Libraries have been seen for centuries as stable and important organizations. Now let us forget the word 'stable' and let us keep the word 'important'.

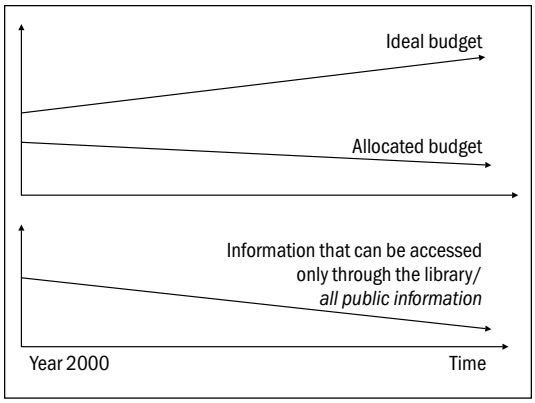

Figure 4 Some aspects of evolution relevant for information centres/libraries.

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Digital Natives and Virtual Learning Environment: A Case Study

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Abstract

Higher educational institutions have realized the importance of virtual space to cater to the information needs of digital natives. They have now extended their physical boundaries towards the design of virtual space to support teaching and learning.

This paper reports study that aimed to find out as to how BA Communications (Major in Information and Media) undergraduate students at University of Technology Sydney (UTS), Australia use a virtual learning environment. It aims to identify the students' perceptions of the usefulness of VLEs (Virtual Learning Environments) in relation to one of their major subjects Information Cultures. A simple open-ended questionnaire was designed and distributed among students to gather information about the features of UTS Online, a VLE used at UTS, in relation to the subject. This paper only focuses on students' feedback on the usefulness of UTS Online with regard to the subject.

UTS Online is a platform where the learning process becomes more interactive and engaging as the students and lecturer can interact constructively with each other through the digital content in a specifically designed learning environment.

Keywords

Digital libraries, virtual learning environments, online learning environments, digital natives, higher education, VLEs

Introduction

Higher education is facing a renaissance in terms of its approaches to teaching and learning. Approaches to education are often non-linear and students expect flexibility and support embedded in their courses. Therefore, new approaches should be adopted in higher education to enhance teaching and learning. In other words, Weiler (2005) mentioned that the Internet has become the students' first source of information, whether it be for personal, academic, or professional. It is a challenge to keep students motivated, who are called the *digital natives* (Prensky 2001). 'A virtual learning environment is a collection of integrated tools enabling the management of online learning, providing a delivery mechanism, student tracking, assessment and access to resources' (JISC 2005). Therefore, virtual learning environments (VLEs) are very important in terms of teaching and learning in higher education. However, VLEs need to be responsive to market forces and provide more flexible approaches to learning. Governments have recognised the need for a greatly widened 'mass' access to higher education and also the need to equip national workforces with the 'lifelong learning' skills which will be useful to provide the responsiveness and flexibility required for an ever-accelerating rate of change (Stiles 2000a).

This paper aims to find out how BA Communications Major in Information and Media undergraduate students at the University of Technology, Sydney, Australia, use a virtual learning environment in relation to one of their major subjects *Information Cultures*. It also aims to identify the students' perceptions of the usefulness of VLEs in relation to the subject. Data was collected through an open-ended questionnaire where the students were encouraged to provide open statements and suggestions with regard to different aspects of UTS Online in relation to the teaching-learning of the chosen subject.

Virtual Learning Environment and Digital Natives

Development of new learning strategies involve the development of student-centric learning activities and seek to develop not just the student understanding of content but also develop their broader interpersonal, communication and intellectual skills (De Lange, Jackling, and Gut, *et al.* 2006). Higher education institutions have realized the importance of virtual space to cater to the information needs of the digital natives. They have now extended their physical boundaries towards the design of virtual space to support teaching and learning.

Kalay (2004) mentions that a virtual learning environment will explore new possibilities to support the University's mission of education, socialization, and acculturation. Also the virtual learning environments explore the impact of ICT on the relationships between people, their activities, and the environments they inhabit, within the context of higher education. Reeves (2000) focuses on the need and prospects for alternative assessment approaches, viz., cognitive assessment, performance assessment, and portfolio assessment, in virtual learning environments in the context of higher education. Williams and Jacobs (2004) emphasize on the potential of blogs as a transformational technology for teaching and learning.

Research findings have direct implications on the creation, development, and delivery of online instruction (Johnson, Aragon, Shaik, *et al.* 2000). Therefore, identification and implementation of new communication strategies are required to facilitate learner/instructor communication in virtual learning environment. It also gives a better understanding of learners' levels of comfort and confidence with the educational structure and also if there is need to develop specific strategies; and most importantly, educational practitioners should be aware of the limitations of online programs(Johnson, Aragon, Shaik, *et al.* 2000).

Other research findings (Keller 2007) show that the contextual factor of culture was powerful in influencing acceptance of virtual learning environments, positively as well as negatively. Keller (2007) identified high degrees of performance expectancy, results demonstrability and social influence affected acceptance of virtual learning environments positively; interestingly, students' learning styles did not have any impact on acceptance of virtual learning environments. However, research findings emphasize that culture is an important factor to consider in the implementation of virtual learning environments (Keller 2007).

Research (Garrison and Kanuka 2004) shows the transformative potential of blended learning to support deep and meaningful knowledge culture in the context of higher education. Garrison and Kanuka (2004) conclude that blended learning is consistent with the values of traditional higher education institutions and has the potential to enhance both the effectiveness and efficiency of meaningful learning experiences. The study shows awareness of information available on the Internet, access to the World Wide Web, age, perceived effectiveness, and usefulness of ICT are the important factors in determining learners' use of the Internet in a virtual learning environment (Lee, Hong, and Ling, *et al.* 2001). They also stress that the success of virtual learning environments depend on the adequate skills and attitudes of learners. Whitsed (2006) recommends the building of a ''technology lab' for further experimentation and research into wikis, blogs and related tools in higher education. Along that line, Boulos, Maramba, and Wheeler, *et al.* (2006) stress that an adequate user base must be present in order to experiment and evaluate Web 2.0 applications. Parker and Chao (2007) mention that educational institutions can familiarize their students with the simple technologies that make collaborative networks possible because today's students will not only manage business innovations of the future, but in many cases will also drive them. Evans (2006) stresses that educators need to teach what wikis and other social software may mean to business, not just as a phenomenon, but also as a skill (Evans 2006). Therefore, educators can better prepare students to make innovative uses of collaborative software tool by incorporating wikis into the classroom (Parker and Chao 2007).

Our students today are *digital natives* because they all are 'native speakers' of the digital language of computers, video games and the Internet which are integral parts of their lives (Prensky 2001). As a result of this ubiquitous digital environment, today's students think and process information fundamentally differently from their predecessors (Prensky 2001). They prefer multi-tasking and instant access to information. They are living in the age of web 2.0 world where social networking and text messaging are the preferred channels for sharing and communicating ideas. Digital natives are now making their way into the workplace and live with the technology, they have different understanding and expectations of technology in a business environment (Cunningham 2010). They want learning that is 'fast-paced, multimedia, multimodal, interactive, and digital' (Richter Anderson-Inman, and Frisbee, *et al.* 2007: 20). However, Bennett, Maton, and Kervin *et al.* (2008) argue that digital natives may know how to use technology, but lack a critical understanding of the media. Learning to teach digital natives will need to have the desire to engage them in the learning process (Gaston 2006).

Digital natives are the drivers of change who explore the new digital world (Cabanero-Johnson and Berge 2009). They also stress that digital natives' preference for technology-mediated forms of learning supports their unique way of thinking. 'Validated course content, formal and informal knowledge contributions from peers and experts alike, networked knowledge coming from web resources and the internet enrich the learner's ability beyond

measure to experience the world and know it better and more intimately' (Cabanero-Johnson and Berge 2009: 296).

VLEs use internet technology for communication and dissemination of information with the aim of enhancing learning (Seale and Mence 2001). Therefore, it is important to leverage this technology to increase digital natives' engagement in relation to teaching and learning and ultimately to improve the learning outcomes.

Virtual Learning Environment at the University of Technology Sydney (UTS Online) and the Structure of the Subject

At UTS (University of Technology Sydney), Australia, students are encouraged to mirror contemporary learning and teaching strategies that emphasize independent and collaborative learning in both physical and virtual learning spaces. Therefore, it is important to know how students perceive and utilize the virtual learning space in UTS settings. Virtual learning space at UTS (UTS Online) builds on the Blackboard 8.0 software, also called a Learning Management System (LMS), and it is the interface between lecturer and students which can be used to support teaching and learning (http://www.iml.uts.edu.au/learnteach/utsonline/index.html). UTS Online provides a 'one-stop-shop' for subject description, course materials, threaded asynchronous discussion board, announcements, email (group or selected), reading lists, virtual classroom, synchronous/asynchronous lecture (podcast), reading lists, digital drop box, blogs, wikis, survey tools, file repository, web links, and so on to enhance teaching and learning at UTS as well as to provide flexibility, adaptability and time in virtual space amongst students, between students and teaching staff, and also amongst teaching staff. UTS Online encompasses interactive and multimedia features to shape digital natives' self-paced confident learning experience.

Following are some typical features of UTS Online:

- *Discussion board:* Threaded discussion is the forum where students can have their discussions about the subject with other students. They share the resources and ideas of the subject. Students also use the space for their discussions on assignments, projects, etc.
- *Synchronous vs. Asynchronous:* A synchronous lecture streamed live through the online classroom whereas asynchronous lecture is pre-recorded. Therefore, asynchronous lecture allows students to take in the material at different times. Synchronous events are often archived for students who are unable to participate at the time of the broadcast.
- *Document management:* Documents can be organized in different ways. UTS Online provides shared and private, or permission based, areas for coursework and other materials.
- *Assignments:* UTS Online provides a 'digital drop box' facility where students can upload finished assignments for review by the instructor.
- *Wikis:* UTS Online also provides space for students through wikis. Wikis are created for students for their collaborative work where one or more online pages can be edited by the group members and comments/feedback can be given by the instructor.
- *Blogs and Journals:* Blogs are created for individual students where they reflect on their learning progress gained through lecture, tutorial activities, and readings.

Information cultures is an undergraduate first year subject for BA Communications (Major in Information and Media) programme and it carries eight credit points. The subject is designed to understand the complex interrelationship between people, information, knowledge, technologies and culture and the role of theory

and research in effective professional practices. Figure 1 shows some general features of UTS Online that can be used by academic staff and students for their specific activities in relation to the subject.

Figure 2 shows a typical page from UTS online displaying a reflective blog that the students are required to use to keep a record of their specific activities in the Information Cultures subject. Figure 3 shows a wiki that has been created for the students' group activities in relation to some specific events in the subject. Figure 4 shows a student discussion board that has been created to facilitate student participation in an online group discussion on specific aspects of the Information Cultures subject.

As detailed in the outline of the subject which is available on UTS Online (http://www.handbook.uts.edu.au/subjects/details/58127.html), the subject aims to:

a. explain a range of theories of information behaviour.
b. critically analyse and synthesise theoretical literature.
c. communicate effectively through writing and other media.
d. apply appropriate research methodologies in ethical practice-based research.
e. collaborate in team-based research projects.
f. constructively reflect on their learning.

Therefore, it is expected that after completing the subject, the students will be able to apply their knowledge and skills of the information behaviour, i.e., the relationship between people, information, knowledge, technologies and culture, and the corresponding theories and principles, to think analytically, work ethically and evaluate their own work as well as to work collaboratively.

There are three pieces of assessment in the subject. Each assessment is clearly linked with the subject objectives and therefore the general graduate attributes of BA

Figure 1: General features of UTS Online

Figure 2: A typical page from UTS online

Communications (in Information and Media). For example,

- *Assessment 1:* Students are required to reflect on their learning of the subject through lecture, readings, tutorial discussions and activities. They also make weekly entries into their blog. Therefore, the reflective blog helps the lecturer to understand students' thoughts and critical engagements on their learning. In other words, whether students are learning what the lecturer wants them to learn, this assessment meets the objectives a, b, c, and f;
- *Assessment 2:* Students are expected to explore and critically engage themselves and analyse a given concept/issue relating to the subject content. They are also expected to explore the implications of the concepts on professional practices. This assessment meets the subject objectives a, b, c and f.
- *Assessment 3:* Students are required to work collaboratively to investigate information seeking behaviour and practice of a specific community by using an appropriate research instrument and technique. This group work will require them to report on the research project following the research process by describing and justifying their research design decisions, presenting their preliminary findings and discussing their implications for professional practice. This assessment meets the subject objectives of all, i.e., a, b, c, d, e, and f.

Therefore, it is quite evident that through the three assessments, the graduate attributes are linked with the learning objectives of the subject. Furthermore, the subject takes an interactive teaching approach to learning through which professional experiences, reflections and discussions are integrated and shared amongst the students and the lecturer. Students learn to communicate effectively through class discussions and the UTS Online discussion board. Collaborative learning and research work enable students to develop their understandings of key concepts and teach them how to apply them in professional and research context in real-life situation.

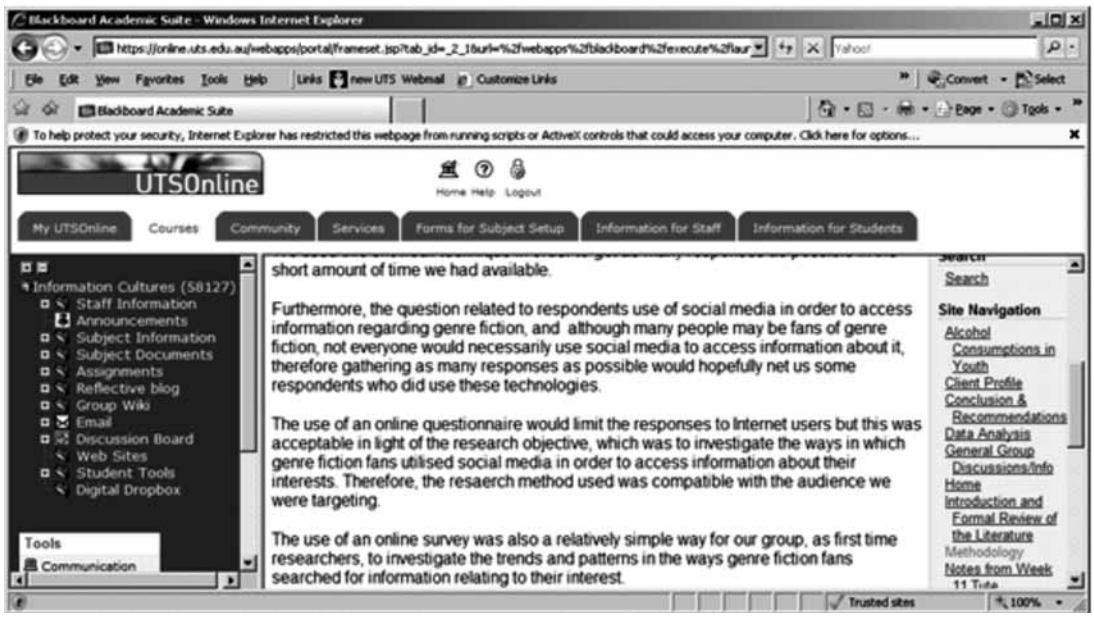

Figure 3: A Wiki created for students' group activities

Figure 4: A student discussion board

The course runs for 14 weeks with a three hours face-to-face teaching comprising a one hour lecture followed by two-hour computer-lab tutorials. The tutorials comprise lab-based practical work and group discussions. Students are also instructed and guided for the assigned activities.

Results

A simple open-ended questionnaire was designed and distributed among students to gather some basic information about the subject. There were some questions asking about features of UTS Online in relation to the subject. This report only focuses on students' feedback on the usefulness of UTS Online with regard to the subject. Out of 60 distributed questionnaires, 50 results were returned.

When asked about the usefulness of *subject documents* in a five-point Likert scale, 90% found it extremely useful (5 in a five-point Likert scale) whereas the rest found it useful (3 in a five-point Likert scale).

Discussion board was found very useful (4 in a five-point Likert scale) and useful (3 in a five-point Likert scale) by 60% and 30% respondents respectively. Respondents (10%) who found it less useful (2 in a five-point Likert scale) explained that they would like the discussion board to be constantly monitored throughout the semester.

Assignment guidelines were identified as useful (3 in a five-point Likert scale) to extremely useful (5 in a five-point Likert scale) by all the respondents. However, some respondents raised a little concern about the organization of the folder on UTS Online.

Responses about the usefulness of Blogs were quite dispersed among the respondents. Some respondents (42%) found blogs extremely useful (5 in a five-point Likert scale) while 28% found it very useful (4 in a five-point Likert scale). Blog had been identified as useful (3 in a five-point Likert scale), less useful (2 in a five-point Likert scale), and not useful (1 in a five-point Likert scale) by 19%, 6%, and 5% respectively.

Digital drop box was found extremely useful (5 in a five-point Likert scale) by 40% respondents followed by 20% respondents who found it very useful (4 in a five-point Likert scale). About 10% respondents found it not useful (1 in a five-point Likert scale) and the rest (30%) had not used it, hence they made no comments on the usefulness of the digital drop box.

Wikis were found very useful by 37% (4 in a five-point Likert scale) to extremely useful (5 in a five-point Likert scale) (63%) by all the respondents for their collaborative work.

Announcements were also found very useful by 59% (4 in a five-point Likert scale) to extremely useful (5 in a five-point Likert scale) (41%) by all the respondents. However, students would like to see more announcements on lectures, tutorials, and readings.

Following are some positive feedback given by the students. They also mentioned some points for future improvements.

Some positive feedback given by the students have been generalized below based on the theme:

- Students use UTS Online mainly to access information such as lecture notes, readings, announcements, assignments guidelines and discussion boards (15).
- They like timely online feedback which facilitates the achievement of learning outcomes through improved access to learning materials (20).
- The results show that availability of lecture notes, discussions board, group wikis, reflective blogs, announcements and other tools (availability of www links and email contact) made the strongest contribution to the students' overall perception of the VLE (12).
- Structures of the subject have been transparent and clear (33).
- Content is informative (35).

The following points were made by the students as suggestions for improvements:

- More interactive tutorials for this subject (22).
- Industrial links for getting the feel of 'reality' (10).
- Students prefer to have more online or asynchronous classes (15).

- Students also prefer to have more user-friendly interface on UTS Online (26).
- Students expect some standard structure on UTS Online which should be followed consistently by all the subjects across the faculty. It will also help the students follow the structure of the subject with great ease (12).
- More easily accessible readings are preferred (10).

Conclusion

UTS Online is a platform where students and lecturer can interact constructively. The learning process is more engaging since the staff and students become more accessible to each other for using a set of tools and digital content. Students have commented on the areas, such as, easy navigation, clear instructions, user friendliness, standard structure, off campus accessibility, interactivity on UTS Online which should be kept in mind when designing materials. Constructive comments will allow the subject designer to improve the online module to meet students' needs effectively and efficiently. However, there will always be some negative comments from frustrated students who experience technology failure or other technical glitches which are beyond the course designer's control.

The quality of teaching and learning of digital natives could be improved through some interactive activities for this subject. Some external industrial links would be beneficial that will enable the students to gain some experience from the real world. The teaching approach should be technology-based encouraging digital natives to explore and learn. Results suggest that the students' level of active participation with the readings as well as through group discussions allow them to respond critically but constructively both in lectures and tutorials. They showed a special interest in collaborative work through different tutorial activities such as, group discussions, working in a group for a specific activity and for the group assignment. The collaborative assignment seemed to engage students effectively and helped them to interact with each other through their analytical thinking.

The change in teaching method shows some cultural shift in learning. Class participation method encourages students to actively engage in discussions in the tutorial and make them more prepared for independent learning. Use of UTS Online for the subject, more specifically the discussions board, encourages students to take part in discussions with issues related to assignments, and other aspects of the subject during the semester. Overall, this study clearly shows that digital natives expect a blend of technology and content to gain an interactive and stimulating learning experience.

On the whole, this study shows that the teaching approach should be stimulating and more technology-based learning for the digital natives. The development of new teaching approach should focus more on the development of student-centric learning activities. According to Long (2005) 'learning is now vastly more multi-dimensional than the nineteenth-century paradigm of classroom instruction'. To sum up, it may be stated that societal growth profoundly depends on the success of teaching and learning (Wheeler, 2009) and therefore teachers should continue to explore new and dynamic ways of providing excellent pedagogical opportunities with emerging social software tools.

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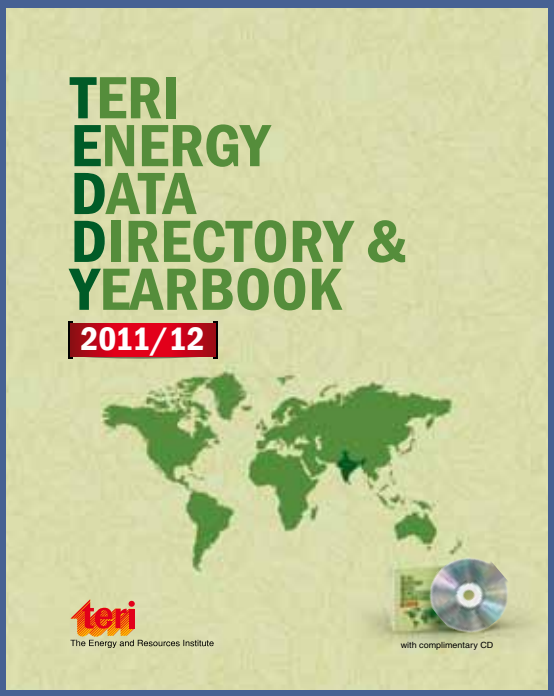

January 2012 • ISBN: 9788179933787 • Pages: 500 approx.
Binding: Hardback • Size: 220 mm × 280 mm • Price: ₹ 1995.00

TERI Energy Data Directory Yearbook, or ***TEDDY***, is an annual publication brought out by TERI since 1986. TEDDY is often used as a reference in other peer-reviewed books and journals for energy and environment-related data. It gives an annual overview of the developments in sectors such as energy supply and consumption as well as the environment sector. It also provides a review of the government policies that have implications for these sectors of the Indian economy.

Key features

- Exhaustive compilation of data from energy supply and demand sectors.
- Recent data along with data for the past years presented in the form of structured and easy-to-understand tables.
- Recent advances made in the energy sectors are represented in the book.
- Self-explanatory figures showing the latest trends in various sectors are also part of each chapter.
- The "in focus" section in every chapter highlights a topical issue.
- The book comes with a complimentary CD that contains all the chapters and additional tables.

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News

World Digital Libraries 4(2): 165–167

Libraries rethink digitization efforts after author sue

The author's lawsuit filed on September 2012, claims that Google and the five universities—Cornell, the University of Michigan, Indiana University, the University of Wisconsin, and the University of California have digitized about seven million books illegally. A majority of the contested texts are known as "orphan works"—books that are still subject to copyright, but whose copyright holders are unknown or cannot be located. The University of Michigan suspended its orphan works digitization project in response to the copyright infringement lawsuit filed against it. According to Dean of Libraries at the University of Michigan, the system for identifying orphan works is now being rebuilt to ensure that no mistakes are repeated. The re-examination of orphan works has already started, but there is no concrete date for when the university will next put up a set of works for use by its communities.

Source: http://cornellsun.com/section/news/content/2011/09/23/libraries-rethink-digitization-effort-after-authors-sue

You provide the search term, Green Energy portal provides the concepts

The US Department of Energy (DOE) Green Energy portal can now map your keyword query to scientific concepts. This semantic technique, called "keyword to concept mapping", is applied to your search behind the scenes and helps hone your search for more efficient knowledge access and discovery. DOE Green Energy affords you the use of the familiar and simple search box—yet provides the benefits of an advanced search technology to help get to the information you need. These sources include DOE databases of technical reports and patents, filtered for green energy related subjects, such as solar, hydro, geothermal, and wind energy, energy storage, tidal and wave power, direct energy conversion, nuclear fuel cycle, biomass and synthetic fuels, and much more. The content consists of over 34,500 technical reports and approximately 1,300 patents from R&D projects representing an investment of several billion dollars. The DOE Green Energy site organizes this green energy R&D and makes it freely accessible to researchers, scientists, educators, students, and the public.

Source: http://www.osti.gov/news/pressreleases/2011/september/green_energy.shtml

Research Libraries UK Consortium (RLUK) develops journal subscription analysis tool

As budgets become tighter and journal subscription prices increase, it is imperative that libraries look to new metrics to assess value for money. This is especially true in the case of "big deals"— large aggregations of journals

from publishers sold as a single package. Some of these packages now cost RLUK members over £1million per year and account for an ever increasing proportion of library budgets. Such deals have proved attractive as they allow libraries to expand the range of titles they provide to users for a relatively small additional fee. But, to date RLUK members have lacked a simple way to evaluate the cost-effectiveness of these packages. RLUK unveiled a powerful model that allows members to carefully analyse the value-for-money of publisher packages and to determine whether there would be cost savings to be made from moving back to title-by-title purchasing. The model allows each member to combine pricing information with the usage their community makes of the relevant journals. The library can then alter the combination of title-by-title subscriptions and document delivery options and compare the costs of these combinations to the cost of the big deals.

Source: http://www.rluk.ac.uk/content/press-release-rluk-develops-journal-subscription-analysis-tool

Cultural goldmine lurks in digitized books

Although the digitization of books by Google Books is controversial over issues of copyright and book sales, it is very useful for linguists and cultural historians as this project could offer an unprecedented treasure trove. In a paper published in *Science*, some interesting data was revealed. So far, Google has digitized more than 15 million books, representing about 12% of all those ever published in all languages. The resulting data set contained over 500 billion words. This is far more than any single person could read: a fast reader would, without breaks for food and sleep, need 80 years to finish the books for the year 2000 alone. Not all isolated strings of characters in texts are real words. Some are numbers, abbreviations or typos. In fact, 51% of the character strings in 1900, and 31% in 2000, were "non-words". According to this account, the English language has grown by more than 70% during the past 50 years, and about 8,500 new words are being added each year. Moreover, only about half of the words currently in use are apparently documented in standard dictionaries.

Source: http://www.nature.com/news/2010/101216/full/news.2010.677.html

Digitization of 40,000 Sanskrit manuscripts on at BISM

Under the National Manuscripts Mission, a collection of close to 40,000 manuscripts in Sanskrit are being digitized at the Bharat Itihas Sanshodhak Mandal (BISM) office in Pune. A team began work over a month ago. The work includes digitizing manuscripts from private sources in the city as well. The process of digitization began during August 2011, and 550 manuscripts on Ayurveda were the first of the lot to be scanned and uploaded. Dating back 600 years, the Sanskrit manuscripts pertain to various topics on Ayurveda, Puranas, Vedas, philosophy, and art. For instance, *Shivlilamrut*, *Pandav Pratap*, and *Hari Vijay*, authored by poet Shridhar, *Eknathi Bhagwat*, Sant Tukaram's "*gathas*" and *Dnyaneshwari*, are some of the manuscripts, which would be digitized soon. It is important to note here that these 40,000 manuscripts run into several thousand pages, the digitization of which is to be completed within the next two years. So far, BISM has digitized 2,000 manuscripts.

Source: http://forumforhinduawakening.org/dharma/news/2011/10/07/digitization-of-40000-sanskrit-manuscripts-on-at-bism/

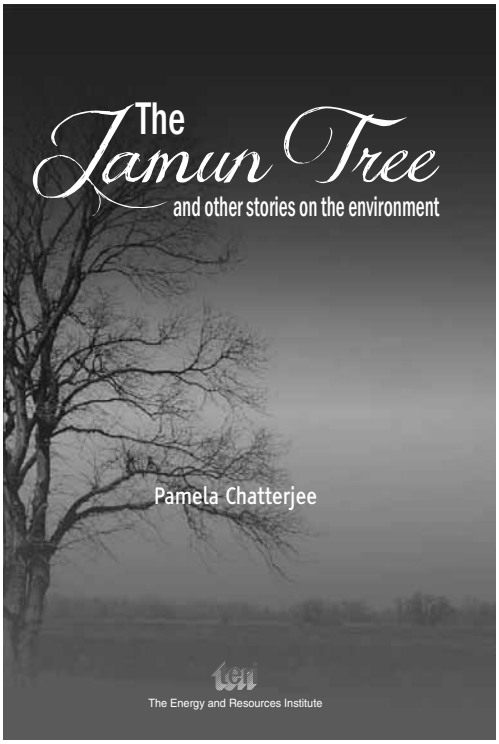
An initiative - light in the mountains

The Youth Library Network in Arunachal Pradesh has won national acclaim for its efforts in empowering rural children. Although the state has undergone a massive economic facelift in the past 40 years, the quality of human development still remains as uneven as its terrain. Eighty per cent of the population, which depends on subsistence agriculture, still lives in isolated pockets with no road or electrical

connectivity and hardly any access to basic health and education. The school drop-out rates are considerably high, especially among girls. The difficult terrains, differences in culture, language, and institutions among its 26 major and 110 minor tribal communities is a big challenge for educators and policy-makers.

It is with this mission that VT-AWIC Youth Library Network, came into force. Since 2007, the movement has dedicated itself to the educational empowerment of the rural tribal youth. Conceived by the Association of Writers and Illustrators (AWIC), New Delhi, the Network is monitored by the Vivekananda Trust, Mysore, with active support from local organizations, Lohit and Anjaw district administration, and the Border Roads and para-military forces. Its headquarters, the Bamboosa Library, Tezu, is the first youth library in the state. Today, the movement is getting much visibility, winning appreciation from someone no less than Dr A P J Abdul Kalam. Many writers and volunteers from both India and abroad are contributing whole-heartedly to the cause.

Source: http://www.thehindu.com/life-and-style/kids/article2662652.ece



The Jamun Tree
and other stories on the environment

Pamela Chatterjee

January 2012
ISBN: 9788179934401
Pages: 204
Binding: Paperback
Size: 152 × 229 mm
Price: ₹ 295.00

The Jamun Tree and other stories on the environment provides an insider's view–from the villages, of work related to natural resource management. It describes the process by which farmers were motivated and involved to regard the work to be done as their own. It is a narration of the personal experience of people in those village areas where the author worked.

Starting the endeavour with just 95 farmers on a mere 18 hectares land, the programme has benefitted over 10,000 farmers by reclaiming over 4,600 hectares in just two years. Till date, with the intervention of the World Bank, a total of 6.25 lakh hectares has been reclaimed and the work is still on. The action taken found an echo with local people as it followed the need of the hour, right there in the field, with innovative techniques and new ideas.

Key features

- An insider's view of work related to natural resource management and community development
- Establishes one of the most important tenets of development studies: involvement of people in the decision-making process is the key to any development initiative
- Reinforces the importance of a bottom-up approach of development initiatives
- Emphasizes the significance of adequate capacity-building of people
- The data accounted for is original and the experiences in most cases, are the author's own
- The narrative is in a story-telling pattern, though most of the incidents and people are from real life

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Forthcoming events

World Digital Libraries 4(2): 169–170

2–3 March 2012, Kolkata, India
e-tcm 2012 : Paradigm Shift in Education Technology and Content Management
Contact name: Prof Subhamita Mukherjee
Tel. 9830370605
E-mail: subhamita2010@yahoo.co.in
Web site: http://www.ticollege.ac.in/etcm/

26–27 March 2012, Wellington, New Zealand
Future Perfect Conference 2012: Digital Preservation by Design
10 Mulgrave Street, Thorndon, Wellington 6011, New Zealand
PO Box 12-050, Wellington, New Zealand
Phone: (64-4) 499 5595, Fax: (64-4) 495 6210
E mail: info@archives.govt.nz
Web site: http://archives.govt.nz/advice/government-digital-archive-programme/future-perfect-2012-digital-preservation-design

2–4 April 2012, Austin, Texas, USA
Electronic Resources & Libraries Conference, 2012
Contact: Bonnie Tijerina, Sandy Tijerina, Electronic Resources & Libraries, LLC, PO Box 1782 Claremont, CA 91711
E-mail: Bonnie.tijerina@gmail.com, Erl.sponsor@gmail.com
Web site: http://www.electroniclibrarian.com/

18–21 April 2012, Porto, Portugal
2nd International Conference on Cloud Computing and Services Science (CLOSER 2012)
Av. D. Manuel I, 27A, 2º esq., 2910-595 Setubal - Portugal
Tel.: +351 265 520 184, Fax: +44 203 014 8638
E-mail: closer.secretariat@scitevents.org
Web site: http://www.closer.scitevents.org/
19–20 April 2012, Hyderabad, India

International Conference on Business Intelligence, Analytics and Knowledge Management (BIAKM-2012)
Contact name: Dr. Nasina Jigeesh
IBS-HYDERABAD, Dontanapalli, Shankerpalli Road, Hyderabad, Andhra Pradesh, India - 501203
Tel: +91(8417) 236660–65
E-mail: info@ibshyderabad.org
Web site: http://www.ibshyderabad.org/Conference/BIAKM/BIAKM-2012.htm

27–28 April 2012, Bangkok. Thailand
International Conference on web Information system & Computing Education
Contact name: Prem Nepali
Open Learning Society (P) Ltd., PO Box 8027, Institute of Information System & Research Center
Nayabazar 16, Kathmandu, Nepal
E mail: registration@icwisce.com
Web site: http://www.icwisce.com

29 May–1 June 2012, Kuala, Lumpur, Malaysia
Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD),
Chin Kuan Ho, Kok Why Ng, Multimedia University, Malaysia
Email: ckho@mmu.edu.my, kwng@mmu.edu.my

10–14 June 2012, Washington DC, USA
JCDL 2012: sharing #linking #using #preserving
Conference Secretariat, George Washington University, 2121 I Street, NW, Washington, DC 20052
Tel. (202) 994-1000
Web site: http://www.jcdl.org

21–22 June 2012, Hong Kong
7th International Conference on e-Learning ICEL-2011
Academic Conferences Limited, Curtis Farm, Kidmore End, Nr Reading, RG4 9AY, England
Tel: +44 (0)1189 724148, Fax: +44 (0)1189 724691
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World Digital Libraries: an international journal

World Digital Libraries is an international peer-reviewed biannual journal. The journal seeks quality research papers that present original theoretical approaches. It also seeks experimental case studies related to digital library developments, maintenance, and dissemination of digital information focusing on research and integration of knowledge at the interface of resources and development. The journal will, therefore, keep readers abreast with the current developments and contain articles, reviews, current developments, and case studies, encompassing the following areas.

- Theoretical and methodological issues that relate to the interrelationships among electronic resources management, digital preservation, multiple access, multilinguality, copyright issues, and security aspects.
- Theoretical approaches as well as experimental case studies related to digital library development and maintenance.
- Initiatives towards digitization through lucid case studies.
- Current developments across the globe.
- Dialogues between the scientific community and society at large.

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