

Analysis of Usage of Electronic Resources by the Department of Science and Technology (DST) Institutions in India

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Abstract

In the digital era, research scientists are predominantly dependent on electronic resources (e-resources) to fulfill their information needs. Consortia have facilitated access to numerous electronic information resources in S&T institutions. The DST, Government of India supports 20 autonomous R&D institutions that have access to information resources through a consortium. This paper studies the electronic resource use pattern by DST institutes. Institutional downloads are given and the leading publishers relevant to the institutions are listed. Finally, for better utilization of e-resources, an information filtration model has been proposed.

Keywords: E-resources, Expert System, Information Management, Usage Pattern

1. Introduction

The Department of Science and Technology (DST)¹, established in 1971 by Government of India, is a nodal agency for organizing, coordinating and promoting science and technology activities in the country. The Department has the responsibility of formulating the S&T policies and their implementation, identification and promotion of thrust areas of research in different sectors of science and technology. It also plays a vital role in developing international collaboration for promotion of science and technology in the country. To fulfill its mandates, the DST has been funding 20 autonomous institutions which are engaged in Research and Development (R&D) activities in the country². The DST aided institutes joined the National Knowledge Resource Consortium (NKRC) to form a network of the libraries and information centres of CSIR laboratories and DST institutes in the country³. NKRC licenses e-resources for the DST and CSIR institutions. This paper looks at usage of e-resources among the DST institutes.

The 20 DST aided institutions located in different cities of India comprise old and new institutes such as the Indian Institute of Astrophysics that was established in 1786 and the Institute of Nanoscience and Technology that was established in 2013. All the institutes have access

to e-resources facilitated through the consortium. Some resources are common to all the institutes where as some others are specific depending on the research areas of the concerned institutes.

Usage data of 17 out of the 20 institutes have been studied. Two non-research entities National Accreditation Board for testing and calibration Laboratories (NABL) and National Innovation Foundation (NIF) have been excluded from this study. The more recent Institute of Nano Science and Technology was also not considered for the said study as the institute has only a limited number of scientists and researchers.

2. Review of Literature

E-resources are documents in electronic version that can be accessed online or offline and include books, journals, databases, magazines, theses, archives etc. It is found that different studies have been carried out regarding usage of e-resources. Manda⁴ studied usage of e-resources in ten academic and research institutions in Tanzania using questionnaire and interview methods. The objective was to assess the usage of e-resources through PERI (Programme for the Enhancement of Research Information). The author found that availability of basic technical and human resources influenced the usage

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of e-resources. Gowda and Shivalingaiah⁵ investigated attitude of research scholars towards use of e-resources in six universities in Karnataka. Alison and others⁶ discussed the factors affecting use of electronic health information resources in three universities in Uganda. The data analysis showed that usage of e-resources was impacted by human and institutional factors. The usage analysis helped in curriculum development and improvement of library services. Jotwani⁷ studied the trends in acquisition and usage of e-resources in Indian Institutes of Technology(IITs) - Kharagpur, Bombay, Madras, Delhi, Kanpur, Guwahati and Roorkee that have consortium based access as well as individual access to e-resources. It was found that usage of e-resources in IIT Kharagpur, Bombay and Madras libraries were considerably higher than in the other IITs. It was also seen that IIT libraries had been spending good amount of their budgets for subscribing to e-resources. Dadzie⁸ reports a questionnaire based survey to determine the level of use, the type of information accessed and the effectiveness of communication tools for information research in Ashesi University, Ghana. It revealed that IT infrastructure of the university had influenced the usage of e-resources and use of scholarly databases was low. Manjunatha and Shivalingaiah⁹ analyzed needs and factors influencing electronic resource sharing among academic libraries. Kaur and Verma¹⁰ analyzed the use of e-resources in Thapar University. It was found that usage of e-resources had increased while usage of printed journals had come down. Nyamboga¹¹ focused on the development of e-resources and management of libraries in electronic environment. Millawithanachchi¹² gave a picture on electronic resource use in the University of Colombo. The study was carried out to investigate the critical success factors for use of e-resources. It was found that technology, library support, information literacy, computer competency, usefulness and user attitude were the critical success factors for using e-resources. Susan Davis Herring¹³ did citation analysis to find use of e-resources over scholarly electronic journals. The findings reflected that research scholars preferred to access e-resources than traditional information sources. Chandel and Saikia¹⁴ examined the challenges and advantages of e-resources. There were challenges in selection, acquisition, preservation, maintenance and management. The advantages were remote access, search facilities, ease of access, speed of access, up-to-dateness, etc. E-resources had created opportunity for more cooperation, interaction and collaboration in research. Thanuskodi and Ravi¹⁵ gave a view on usage of resources in Manonmaniam Sundaranar University. It was found that usage of e-resources was very good. Users had been

accessing e-resources mainly for research purposes and learning the skills to browse e-resources through self study. Lal¹⁶ discusses consortia based electronic information sharing among biotechnology institutes, DeLCON. Bhatia¹⁷ studied the usage of e-resources in eleven degree colleges in Chandigarh. The objective was to find out barriers to access e-resources and possible solutions. The data analysis reflected that lack of information filtration mechanism and inadequate IT infrastructure were the main reasons for low utilization of e-resources. Josh Welker¹⁸ discussed Standardized Usage Statistics Harvesting Initiative (SUSHI) protocol an automated way to prepare download counter reports via web created by National Information Standards Organization (NISO). Welker presented state of e-resource usage data in libraries and also gave some recommendations for vendors, standards bodies, and librarians to improve e-resource usage data management.

There have also been studies related to effective management of e-resources. Sreekumar¹⁹ thought about a smart system for management of e-resources suggesting some strategies so that user could get value added information in less time. Ram and Rao²⁰ gave metadata description framework for integration of information resources. It included analysis and management of data in the field of bioinformatics where intention was to provide tailor made information service to users. Singh and Varalakshmi²¹ talked about cloud computing through an economic model for management and sharing of e-resources. Again Seetharama²² elaborated the challenges libraries had been facing for collection development and management in the digital environment. John and others²³ were interested in dynamics of e-resource management. It was Electronic Resource Management System (ERMS) in libraries. They discussed about some ERMS solutions available around the globe like CUFTS, TDNet Open ERAM Old, EBSCO's ERM Essentials, Ex Libris Verda, Gold Rush, HERMIS, Innovative Interfaces ERM, 360 Resource Manager and Swets-wise Source Manager.

The present study seeks to examine the lacuna in effective mechanism for e-resource management and systematic tailor-made access as per need of researcher. That is the area where the present study is interested upon.

3. Objectives

- To study the usage pattern of e-resources in the DST research institutes.
- To analyze the requirement of new mechanism for information searching and dissemination among the researchers with a proposed model.

4. Method

Paper download statistics has been collected from National Institute of Science Communication and Information Resources (NISCAIR). The consortium, National Knowledge Resource Centre (NKRC) works under the umbrella of NISCAIR. The DST institutes of India use NKRC for accessing e-resources. Download statistics of the years 2012, 2013, and 2014 have been collected and analyzed in various ways. NISCAIR could not provide data more than three years.

5. Usage Pattern Analysis Based on Download Statistic of Research Articles (Papers)

The DST institutes whose data (research articles download) has been considered for analysis is:

- International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad,
- Agharkar Research Institute (ARI), Pune,
- Aryabhatta Research Institute of Observational-Sciences (ARIES), Nainital,
- Bose Institute (BI), Kolkata,
- Birbal Sahni Institute of Palaeobotany (BISP), Lucknow,
- Centre for Nano and Soft Matter Sciences (CSMR), Bangalore,
- Indian Association for the Cultivation of Science (IACS), Kolkata,
- The Institute of Advanced Study in Science &

- Technology (IASST), Guwahati,
- Indian Institute of Astrophysics (IIAP), Bangalore,
- Indian Institute of Geomagnetism (IIGM), Mumbai,
- Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore,
- Raman Research Institute (RRI), Bangalore,
- Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Thiruvananthapuram,
- S.N. Bose National Centre for Basic Sciences (SNBNCBS), Kolkata,
- Technology Information, Forecasting and Assessment Council (TIFAC), Delhi,
- Wadia Institute of Himalayan Geology, Dehradun, and
- Vigyan Prasar, New Delhi.

The download data for journals of the following publishers are considered for analysis: American Chemical Society (ACS), American Institute of Physics (AIP), American Physical Society (APS), Institute of Physics (IOP), Royal Society for Chemistry (RSC), Nature Publishing Group (NPG), WILEY, Taylor & Francis (T&F), Institute of Electrical and Electronics Engineers (IEEE), American Association for the Advancement of Science (AAAS), Emerald, Annual Review, Springer, Oxford University Press (OUP), Cambridge University Press (CUP), SAGE, American Society for Testing and Materials (ASTM), Web of Science (WOS).

Table 1-3 represent download statistics of research paper by seventeen DST institutes in the year 2014, 2013 and 2012 respectively. NA is written in some places inside the tables means data is not available.

Table 1. Usage by DST institutions in 2014

Sl. No.	Lab	ACS	AIP	APS	Emerald	IEEE	IOP	NPG
1	ARCI, Hyderabad	7264	1678	NA	40	574	1169	3353
2	ARI, Pune	NA	14	NA	NA	27	NA	2367
3	ARIES, Nainital	NA	NA	15	40	1081	3817	232
4	BI, Kolkata	6479	1326	2373	38	228	2015	19202
5	BSIP, Lucknow	NA	NA	NA	NA	4	NA	850
6	CSMR, Bangalore	5832	3407	2420	NA	179	NA	917
7	IACS, Kolkata	NA	18373	14681	NA	744	10615	22116
8	IASST, Guwahati	3022	1240	NA	83	210	1080	2745
9	IIAP, Bangalore	216	394	515	14	455	11814	2417
10	IIGM, Mumbai	NA	903	NA	NA	148	581	547
11	JNCASR, Bangalore	66043	12787	19216	4	731	11923	45175
12	RRI, Bangalore	5932	2439	7507	NA	1996	6317	5285
13	SCTIMST, Thiruv.	5649	NA	NA	2	422		4606
14	SNBNCBS, Kolkata	9831	7014	9975		505	8343	5466
15	TIFAC, Delhi	NA	NA	NA	32	233	NA	75
16	VigyanPrasar, Noida	NA	NA	NA	NA	11	NA	9
17	WIHG, Dehradun	NA	14	NA	20	278	NA	1599

Sl. No.	Lab	OSA	OUP	RSC	SAGE	SPRINGER	T&F	WILEY
1	ARCI, Hyderabad	NA	35	4956	NA	3596	552	2197
2	ARI, Pune	NA	1008	56	NA	2942	983	NA
3	ARIES, Nainital	37	2040	8	NA	783	86	1862
4	BI, Kolkata	NA	4622	NA	NA	5108	1173	12746
5	BSIP, Lucknow	NA	330	11	NA	3659	1622	2395
6	CSMR, Bangalore	936	18	2933	NA	270	1332	1454
7	IACS, Kolkata	24	1030	NA	5	9497	1923	61561
8	IASST, Guwahati	NA	871	NA	NA	3281	999	5158
9	IIAP, Bangalore	964	3464	NA	NA	1810	100	2858
10	IIGM, Mumbai	NA	1	NA	NA	1775	139	9231
11	JNCASR, Bangalore	711	2070	NA	NA	9761	2263	46987
12	RRI, Bangalore	1645	1366	NA	NA	1795	2514	3241
13	SCTIMST, Thiruv.		9426	3811	2970	3801	588	17326
14	SNBNCBS, Kolkata	630	485	NA	NA	3569	659	2838
15	TIFAC, Delhi	NA	50	49	NA	NA	68	152
16	VigyanPrasar, Noida	NA	NA	NA	NA	NA	13	NA
17	WIHG, Dehradun	NA	NA	56	141	4170	779	6116

Table 2. Usage by DST institutions in 2013

Sl. No.	Lab	AAAS	AIP	Anu. Review	APS	ASTM	CUP	IEEE
1	ARCI, Hyderabad	2	968	43	516	231		232
2	ARI, Pune	NA	NA	145	NA	NA	128	55
3	ARIES, Nainital	22	18	93	25	NA	NA	96
4	BI, Kolkata	2444	684	3526	3443	51	NA	251
5	BSIP, Lucknow	3	NA	64	NA	NA	NA	10
6	CSMR, Bangalore	8	3099	NA	NA	NA	NA	176
7	IACS, Kolkata	2533	14625	408	17573	NA	363	1019
8	IASST, Guwahati	NA	694	33	NA	NA	56	106
9	IIAP, Bangalore	NA	693	258	NA	NA	272	443
10	IIGM, Mumbai	11	757	36	NA	NA	66	148
11	JNCASR, Bangalore	7108	11721	4692	17429	146	2061	1080
12	RRI, Bangalore	1467	2260	NA	7661	NA	NA	2296
13	SCTIMST, Thiruv.	435	NA	82	NA	503	71	518
14	SNBNCBS, Kolkata	865	7050	673	12285	NA	2	662
15	TIFAC, Delhi	NA	NA	NA	NA	NA	1	57
16	VigyanPrasar, Noida	NA	NA	17	NA	NA	NA	1
17	WIHG, Dehradun	612	26	66	NA	NA	107	72

Sl. No.	Lab	IOP	MANEY	NPG	OUP	SAGE	T&F	WILEY	WOS
1	ARCI, Hyderabad	1694	125	563	60	NA	NA	4068	18234
2	ARI, Pune	NA	NA	1846	781	NA	312	1301	243
3	ARIES, Nainital	7626	NA	329	3532	NA	92	2075	54
4	BI, Kolkata	1955	NA	NA	8250	NA	880	12449	130925
5	BSIP, Lucknow	NA	NA	831	NA	NA	1461	1675	155
6	CSMR, Bangalore	NA	NA	607	NA	NA	NA	1355	NA
7	IACS, Kolkata	10055	19	17042	949	115	NA	56326	79651
8	IASST, Guwahati	963	NA	529	NA	NA	NA	3106	100
9	IIAP, Bangalore	13212	NA	1832	2226	NA	NA	1424	60340
10	IIGM, Mumbai	384	NA	427	NA	NA	NA	8531	3068
11	JNCASR, Bangalore	9710	NA	35451	3692	NA	NA	43047	33498
12	RRI, Bangalore	6502	NA	3158	1173	NA	NA	1951	1148
13	SCTIMST, Thiruv.	NA	NA	1695	9666	3625	NA	19795	78212
14	SNBNCBS, Kolkata	8390	NA	4209	629	NA	NA	4258	6648
15	TIFAC, Delhi	NA	NA	50	18	NA	NA	47	784
16	VigyanPrasar, Noida	NA	NA	13	6	NA	NA	NA	58
17	WIHG, Dehradun	NA	NA	1853	45	126	NA	4821	1703

Table 3. Usage by DST institutions in 2012

Sl. No.	Lab	AAAS	AIP	Anu. Review	APS	ASTM	CUP	EMERALD
1	ARCI, Hyderabad	380	1185	42	283	432	NA	742
2	ARI, Pune	438	NA	232	NA	NA	NA	138
3	ARIES, Nainital	177	86	77	31	NA	NA	152
4	BI, Kolkata	451	596	2288	1762	44	NA	78
5	BSIP, Lucknow	451	NA	19	NA	NA	20	16
6	CSMR, Bangalore	309	2435	NA	2446	NA	NA	NA
7	IACS, Kolkata	4402	16992	427	21163	NA	NA	248
8	IASST, Guwahati	NA	1008	20	542	NA	NA	152
9	IIAP, Bangalore	NA	630	221	416	NA	NA	321
10	IIGM, Mumbai	86	126	NA	NA	NA	NA	50
11	JNCASR, Bangalore	9172	12997	2029	NA	45	NA	750
12	RRI, Bangalore	619	2532	NA	7483	NA	NA	568
13	SCTIMST, Thiruv.	594	NA	380	NA	545	NA	184
14	SNBNCBS, Kolkata	1273	7059	552	14768	NA	NA	8
15	TIFAC, Delhi	NA	NA	2	NA	NA	NA	42
16	VigyanPrasar, Noida	NA	NA	NA	NA	NA	NA	NA
17	WIHG, Dehradun	NA	82	96	NA	NA	NA	122
Sl. No.	Lab	IEEE	IOP	NPG	RSC	SAGE	T&F	WILEY
1	ARCI, Hyderabad	298	1676	NA	1505	NA	979	4655
2	ARI, Pune	60	NA	4468	1123	NA	9	NA
3	ARIES, Nainital	405	6119	548	NA	NA	850	NA
4	BI, Kolkata	217	1511	16111	2050	NA	768	NA
5	BSIP, Lucknow	3	NA	752	NA	NA	1016	6294
6	CSMR, Bangalore	173	NA	725	NA	NA	1014	NA
7	IACS, Kolkata	942	10439	15898	66998	210	3009	54317
8	IASST, Guwahati	NA	819	152	NA	NA	1021	2213
9	IIAP, Bangalore	625	11448	1982	31	NA	1009	NA
10	IIGM, Mumbai	261	509	518	63064	NA	66	NA
11	JNCASR, Bangalore	1253	23280	38379	32727	NA	1926	51696
12	RRI, Bangalore	1144	6596	4280	2349	NA	2148	1892
13	SCTIMST, Thiruv.	633	NA	2233	NA	3116	591	23999
14	SNBNCBS, Kolkata	745	8224	5047	NA	NA	207	4329
15	TIFAC, Delhi	33	NA	57	NA	NA	NA	NA
16	VigyanPrasar, Noida	NA	NA	NA	NA	NA	NA	NA
17	WIHG, Dehradun	25	NA	NA	NA	85	261	NA

Here it is found that paper download of three institutes (sl. nos. 15-17) are very low compared to other institutes. It may be due to lack of regular research scholars and their different objectives. Therefore out of seventeen institutes, data of fourteen institutes have been considered for

study. Table 4-6 represent download pattern of fourteen institutes where some low used publishers have been skipped. Based on the Table 4-6 the Figure 1-3 are drawn respectively.

Table 4. Paper downloaded by DST institutes in the year 2014

Sl. No.	Institutes	ACS	AIP	APS	IEEE	IOP	NPG	OUP	SPRINGER	T&F	WILEY
1	ARCI, Hyderabad	7264	1678	NA	574	1169	3353	35	3596	552	2197
2	ARIES, Nainital	NA	NA	15	1081	3817	232	2040	783	86	1862
3	BI, Kolkata	6479	1326	2373	228	2015	19202	4622	5108	1173	12746
4	CSMR, Bangalore	5832	3407	2420	179	NA	917	18	270	1332	1454
5	IACS, Kolkata	NA	18373	14681	744	10615	22116	1030	9497	1923	61561
6	IASST, Guwahati	3022	1240	NA	210	1080	2745	871	3281	999	5158
7	IIAP, Bangalore	216	394	515	455	11814	2417	3464	1810	100	2858
8	IIGM, Mumbai	NA	903	NA	148	581	547	1	1775	139	9231
9	JNCASR, Bangalore	66043	12787	19216	731	11923	45175	2070	9761	2263	46987
10	RRI, Bangalore	5932	2439	7507	1996	6317	5285	1366	1795	2514	3241
11	SCTIMST, Thiruv.	5649	NA	NA	422	NA	4606	9426	3801	588	17326
12	SNBNCBS, Kolkata	9831	7014	9975	505	8343	5466	485	3569	659	2838

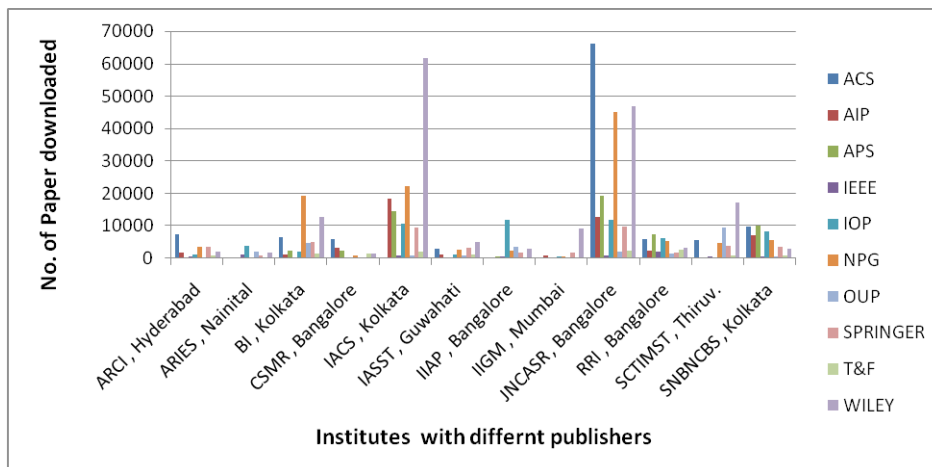


Figure 1. Paper downloaded by DST institutes in the year 2014.

Table 5. Paper downloaded by DST institutes in the year 2013

Sl. No.	Institutes	AAAS	AIP	Anu. Review	APS	IEEE	NPG	OUP	IOP	WILEY	WOS
1	ARCI, Hyderabad	2	968	43	516	232	563	60	1694	4068	18234
2	ARIES, Nainital	22	18	93	25	96	329	3532	7626	2075	54
3	BI, Kolkata	2444	684	3526	3443	251	NA	8250	1955	12449	130925
4	IACS, Kolkata	2533	14625	408	17573	1019	17042	949	10055	56326	79651
5	IASST, Guwahati	NA	694	33	NA	106	529	NA	963	3106	100
6	IIAP, Bangalore	NA	693	258	NA	443	1832	2226	13212	1424	60340
7	IIGM, Mumbai	11	757	36	NA	148	427	NA	384	8531	3068
8	JNCASR, Bangalore	7108	11721	4692	17429	1080	35451	3692	9710	43047	33498
9	RRI, Bangalore	1467	2260	NA	7661	2296	3158	1173	6502	1951	1148
10	SCTIMST, Thiruv.	435	NA	82	NA	518	1695	9666	NA	19795	78212
11	SNBNCBS, Kolkata	865	7050	673	12285	662	4209	629	8390	4258	6648

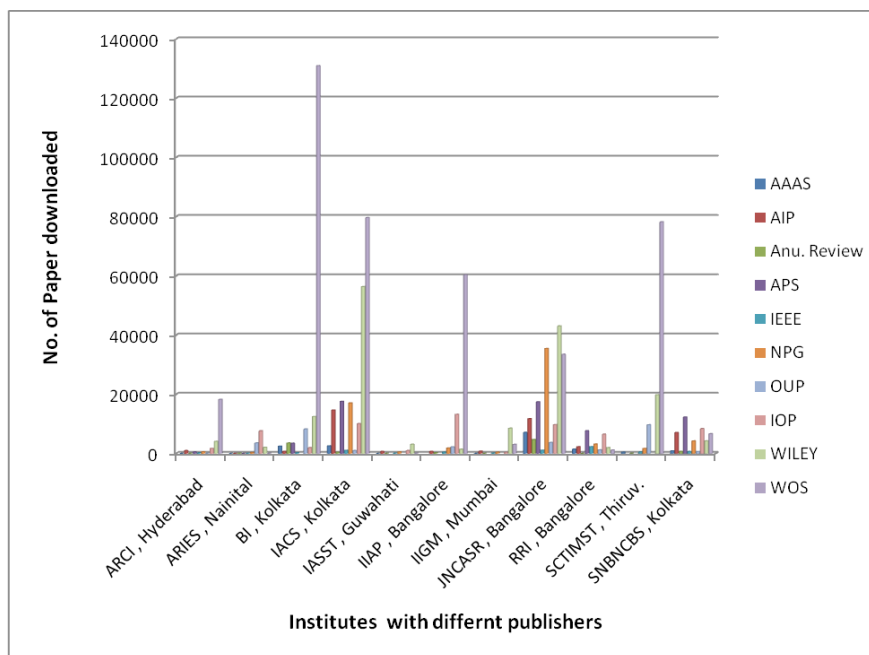


Figure 2. Paper downloaded by DST institutes in the year 2013.

Table 6. Paper downloaded by DST institutes in the year 2012

Sl. No.	Institutes	AAAS	AIP	Anu. Review	APS	T&F	RSC	EMERALD	IEEE	IOP	NPG
1	ARCI, Hyderabad	380	1185	42	283	979	1505	742	298	1676	
2	ARI, Pune	438	NA	232	NA	9	1123	138	60	NA	4468
3	ARIES, Nainital	177	86	77	31	850	NA	152	405	6119	548
4	BI, Kolkata	451	596	2288	1762	768	2050	78	217	1511	16111
5	IACS, Kolkata	4402	16992	427	21163	3009	66998	248	942	10439	15898
6	IASST, Guwahati	NA	1008	20	542	1021	NA	152	NA	819	152
7	IIAP, Bangalore	NA	630	221	416	1009	31	321	625	11448	1982
8	IIGM, Mumbai	86	126	NA	NA	66	63064	50	261	509	518
9	JNCASR, Bangalore	9172	12997	2029	NA	1926	32727	750	1253	23280	38379
10	RRI, Bangalore	619	2532	NA	7483	2148	2349	568	1144	6596	4280
11	SNBNCBS, Kolkata	1273	7059	552	14768	207	NA	8	745	8224	5047

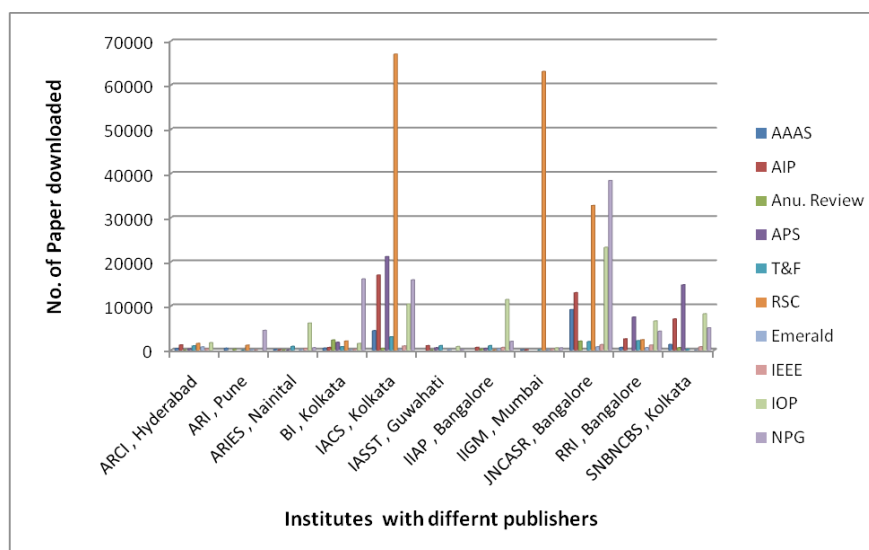
**Figure 3.** Paper downloaded by DST institutes in the year 2012.

Figure 4-6 show paper download data for different publishers by DST institutes for the three years 2014, 2013 and 2012. While all DST institutes report good usage, JNCASR, IACS and BI report downloads of many research papers. Other institutes like SNBNCBS and RRI are looking quite consistent in yearly average download. It is seen that number of downloads is related and directly proportional to the age and size of the institute. Old institutes are having more downloads. It is also found that the consortium (NKRC) has been playing an active role in facilitating access to e-resources to DST institutes. Year wise data shows that some additions and deletions of publishers have been made as per need of research institutes in different years. It expresses the dynamic nature of NKRC activities.

Table 7 shows the year wise total download (consortium provided e-resources) of different DST institutes. It is found that total download of IACS is higher in the year 2013, 2012 and next is JNCASR compared to other DST institutes. Obvious reason is IACS is an old institute having large number of research scholars. But in 2014,

JNCASR is having much higher downloads than IACS. Overall the Table 7 clearly says that usage of e-resources is very good in all DST institutes and e-resources are also popular among the research scholars.

Table 7. Year-wise total download

Sl. No.	Institutes	Year-wise total downloads		
		2014	2013	2012
1	ARCI, Hyderabad	25414	26736	12177
2	ARI, Pune	7397	4811	6468
3	ARIES, Nainital	10001	13962	8445
4	BI, Kolkata	55310	164858	25876
5	BSIP, Lucknow	8871	4199	8571
6	CSMR, Bangalore	19698	5245	7102
7	IACS, Kolkata	140569	200678	195045
8	IASST, Guwahati	18689	5587	5927
9	IIAP, Bangalore	25021	80700	16683
10	IIGM, Mumbai	13325	13428	64680
11	JNCASR, Bangalore	217671	169635	174254
12	RRI, Bangalore	40037	27616	29611
13	SCTIMST, Thiruv.	48601	114602	32275
14	SNBNCBS, Kolkata	49315	45671	42212

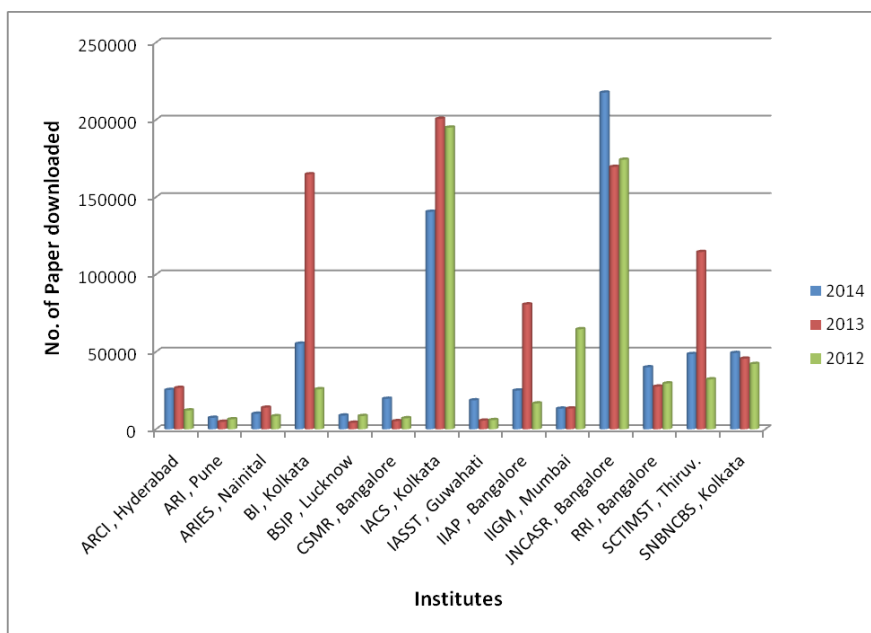


Figure 4. Year-wise total download by DST institutes.

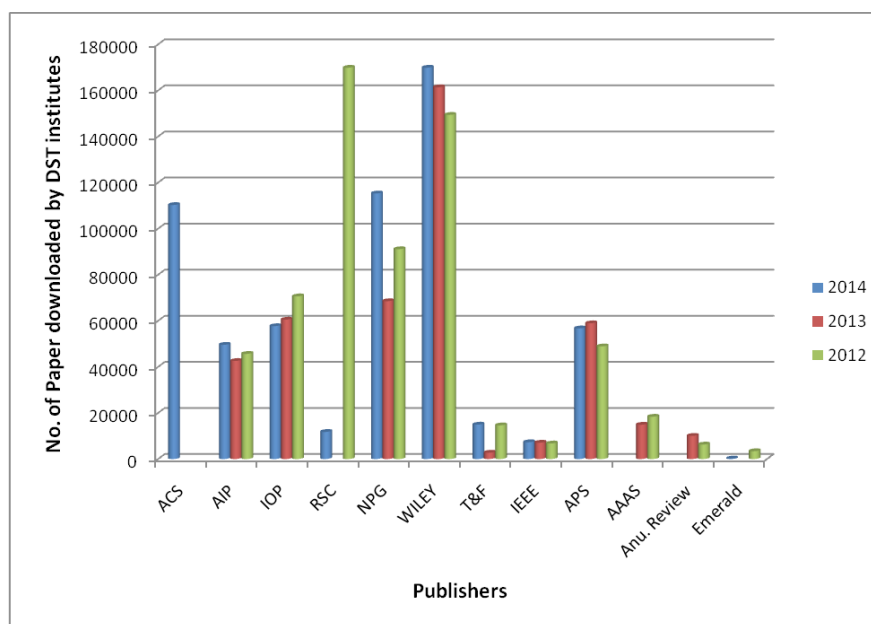


Figure 5. Publisher wise paper downloaded by DST institutes together in three years.

Table 8 shows publisher wise total downloads. It is found that Wiley holds the leading position. The reason may be it's dominant position in holding a wide range of scientific journals those mostly cover the research areas of DST institutes. But it is quite interesting to notice that RSC had maximum download (169847) in the year 2012. Again, in the year 2014 there is a sharp fall in downloads.

Though data for the year 2013 is not available which could have given the true picture whether RSC is having sudden fall of download or there is gradual fall of download. AIP, IOP and APS are having consistent download for all three years. The ACS and NPG are also having good download. These two are holding almost second position in paper download. IEEE is having very consistent average

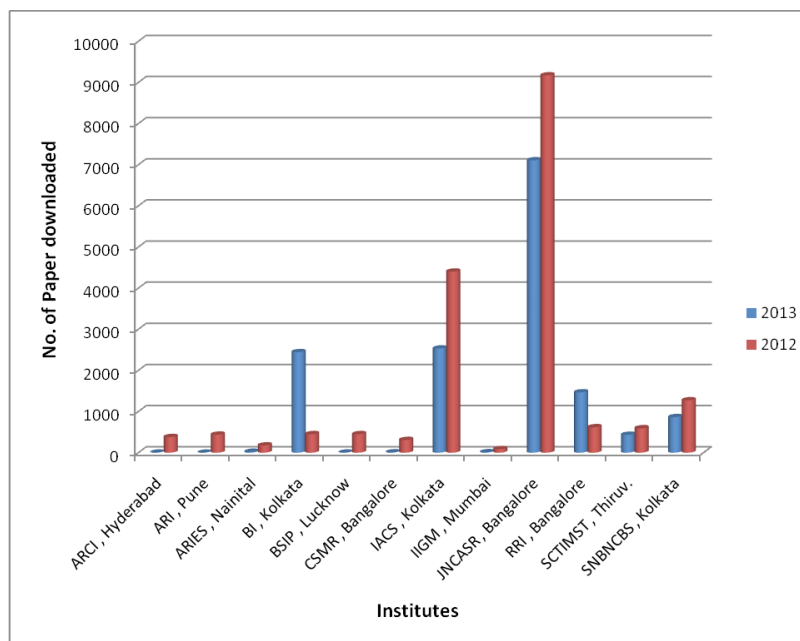


Figure 6. Usage of online scientific magazine AAAS.

Table 8. Publisher-wise paper downloaded by DST institutes together in three years

Year	ACS	AIP	IOP	RSC	NPG	WILEY	T&F	IEEE	APS	AAAS	Annual Review	Emerald
2014	110268	49575	57674	11775	115278	169854	14933	7304	56702	NA	NA	221
2013	NA	42569	60491		68519	161361	2745	7092	58932	14898	10053	NA
2012	NA	45646	70621	169847	91093	149395	14613	6759	48894	18352	6287	3407

download. There is not much fluctuation in download of IEEE in three years. Again, it is important to mention that researchers of some institutes are not interested in IEEE and Emerald and don't have access to these publishers.

Table 9. Usage of online scientific magazine AAAS

Sl. No.	Institutes	Year-wise paper download	
		2013	2012
1	ARCI, Hyderabad	2	380
2	ARI, Pune	NA	438
3	ARIES, Nainital	22	177
4	BI, Kolkata	2444	451
5	BSIP, Lucknow	3	451
6	CSMR, Bangalore	8	309
7	IACS, Kolkata	2533	4402
8	IIGM, Mumbai	11	86
9	JNCASR, Bangalore	7108	9172
10	RRI, Bangalore	1467	619
11	SCTIMST, Thiruv.	435	594
12	SNBNCBS, Kolkata	865	1273

Table 9 represents usage of online scientific magazine AAAS. It has been found that paper download of AAAS is going down from the year 2012 to 2013 for all the DST institutes apart from BI and RRI. Data shows that researchers of JNCASR are highly interested to access

AAAS. It is also found that there is rapid growth of usage of AAAS for Bose Institute (BI) in the year 2013 compared to the year 2012.

Table 10 shows the data for Web of Science and gives access to research papers through respective publishers. It is found that Bose Institute is the highest user of WOS; IACS, SCTIMST, IIAP and JNCASR are also heavy users (Figure 7).

Table 10. Usage of database WOS

Sl. No.	Institutes	WOS
1	ARCI, Hyderabad	18234
2	ARI, Pune	243
3	ARIES, Nainital	54
4	BI, Kolkata	130925
5	BSIP, Lucknow	155
6	IACS, Kolkata	79651
7	IASST, Guwahati	100
8	IIAP, Bangalore	60340
9	IIGM, Mumbai	3068
10	JNCASR, Bangalore	33498
11	RRI, Bangalore	1148
12	SCTIMST, Thiruv.	78212
13	SNBNCBS, Kolkata	6648

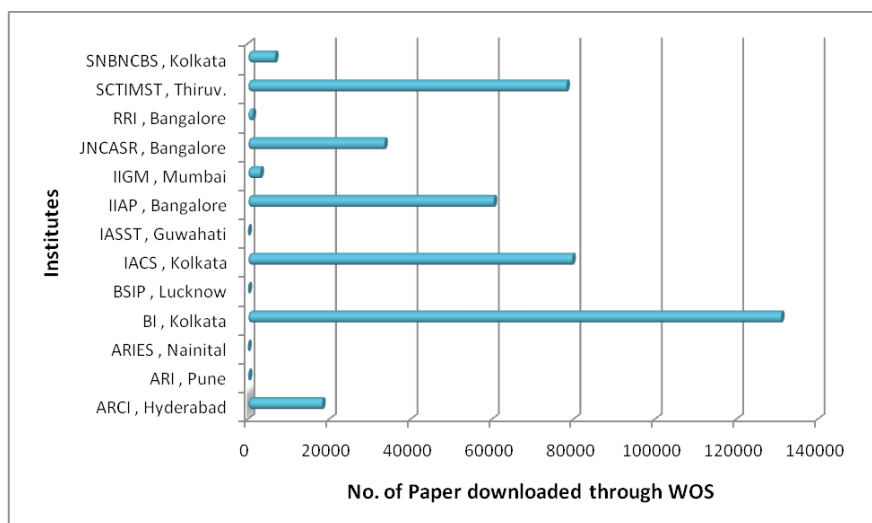


Figure 7. Usage of database WOS.

ACS and RSC are seen mainly as chemistry publishers and IOP, AIP and AIP as physics publisher. This is not entirely true as there is a considerable overlap and areas of common interest. Many scientists are working and publishing in this overlapping region (Table 11).

Table 11. Use of Physics and Chemistry resources for year 2014

Sl. No.	Institutes	ACS + RSC	IOP+AIP+APS
1	ARCI, Hyderabad	12220	2847
2	ARI, Pune	56	14
3	ARIES, Nainital	8	3832
4	BI, Kolkata	6479	5714
6	CSMR, Bangalore	8765	5827
7	IACS, Kolkata	NA	43669
8	IASST, Guwahati	3022	2320
9	IIAP, Bangalore	216	12723
10	IIGM, Mumbai	NA	1484
11	JNCASR, Bangalore	66043	43926
12	RRI, Bangalore	5932	16263
13	SCTIMST, Thiruv.	9460	NA
14	SNBNCBS, Kolkata	9831	25332

It is found that for most of the institutes, downloads from physics and chemistry publishers run parallel. Although in this regard it is important to point out that some institutes are not having access to RSC (Figure 8).

6. Requirements of Effective Mechanism for E-Resource Management and Access

The data analysis shows (Table 4-6) that researchers of

DST institutes have been browsing electronic journals. The NKRC has enhanced access to e-resources for all DST institutes. Based on the data analysis it is also found that Physics based institutes are having good number of download on chemistry, biotechnology and computer science, etc. suggesting a trend in research towards multidisciplinary areas. Therefore, research libraries have got more responsibilities for proper management of e-resources to fulfill the needs of research scholars. As the number of e-resources is increasing, searching for relevant papers in so many different journals is a time consuming task for researchers.

It has been found that researchers search different journals by subject key words. Every search returns many links to papers. Most of the users see only the first few links. They need some sort of search filtration mechanism which will provide sorted links of papers (based on relevance) from major journals. Assistance in the form of systems that return a list of links to a ranked list of papers will certainly be helpful. Libraries should also consider building mechanisms for SDI (selective dissemination of information) service which will search most of the important journals and provide only ranked list of relevant papers. Libraries attached to research institutes need to have sophisticated mechanisms for proper dissemination of information so that scientists should not waste time to get their required information. Such mechanisms should consider the barriers in the process of information access and dissemination. Some of the major barriers are:

- Restricted access to journals of different subjects. This problem is acute for the researchers who are working in multidisciplinary area. For example, a physics based research institute does not have access to medical science journals. A researcher who is

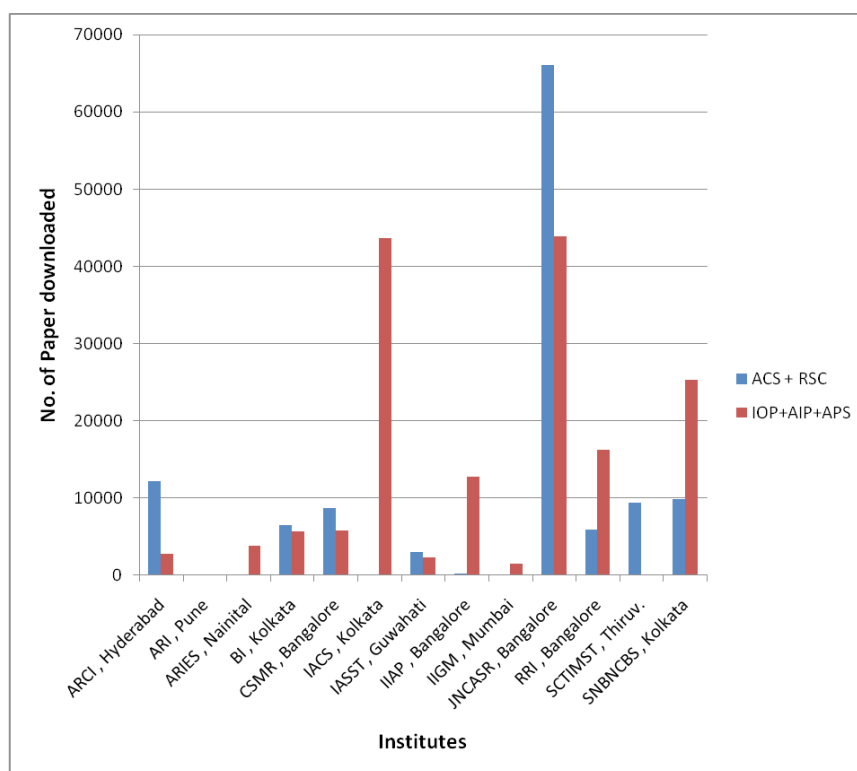


Figure 8. Physics vs. Chemistry (in layman's view) for year 2014.

trying to develop an instrument for medical diagnosis (application of physics in medical science) is facing problem to get his required information,

- To find out relevant papers in any particular subject area, it is always time consuming to browse so many e-resources,
- Lack of awareness about the relevant resources,
- Retrieval of large number of irrelevant papers,
- Password based access to e-resources,
- Restricted Wi-Fi connectivity, and
- Lack of user orientation activities in the Library for new research scholars.

7. Conclusion

The usage of e-resources in DST institutes reveals use of a wide range of e-resources of different subjects. To use e-resources optimally and to assist researchers in information searching it is the responsibility of the library professionals to develop an information filtration mechanism. It will save the time of research scientists. If they get relevant information from several e-resources on regular basis they will be encouraged to go ahead with their research work without wasting time on browsing multiple journals and databases. The development of such model is under progress to fulfill the proposed idea.

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