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WEB-RESOURCES IN NUCLEAR SCIENCE AND TECHNOLOGY

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ABSTRACT

This paper attempts to analyse the growth and development of web-resources in Nuclear Science and Technology as reflected in the International Nuclear Information System (INIS) (1996-2005) database. During 1996-2005, a total of 102,720 publications appeared in 1,526 web-resources contributed by the nuclear scientists in various areas of research namely, Physics (52,590), Other Aspects of Nuclear and Non Nuclear Energy (23,148), Life and Environmental Sciences (13,843), Engineering and Technology (10,380), and Chemistry, Materials and Earth Sciences (2,759). The publications in web-resources have started appearing in the INIS database in 1996 with three publications. The highest number of publications in web-resources published were 25,813 in 2005. The average number of publications in web-resources published per year were 10,272. The top websites were http://www.iop.org with 30,711 publications, followed by https://www.osti.gov with 25,241 publications, and http://www.dx.doi.org with 8,569 publications. The websites with the domain name .org have published 51,602 followed by .gov with 26,613 publications and .jp with 6,565 publications. More than 91.8 percent of publications in web-resources were in English. More than 45 percent of the web-resources were published in journals followed by reports (41.66%). The most preferred web-journals by the scientists were Journal of Physics-Condensed Matter with 6,677 publications, followed by Journal of Physics-A with 5,186 publications and Journal of High Energy Physics with 4,799 publications. Also analysed were the locations of web-resources in various fields in a record in the database.

Keywords: Web-resources; E-resources; Information Storage and Retrieval; Global Information Access; Nuclear Science and Technology; Databases; INIS; Open Archives.

INTRODUCTION

The impact of Information and Communication Technology revolution in libraries over the last decade is tremendous and the developments in Internet technology has surpassed an individual's imagination The Internet technology introduces both challenges and opportunities for libraries as well as information providers, database vendors and others

involved in information handling. The developments in the electronic publishing have also made a great impact on the users' information seeking behaviour. These developments have provided us with a distribution channel that makes it cheap and easy to share information with others. Many individual researchers, research organisations, universities, government agencies, professional associations and commercial organisations have discovered that the Internet is simply a cheaper and more effective way of disseminating their information compared to print-based resources. There are also many Open Archive Initiatives (OAIs) all over the world on various subjects to keep the users abreast of the developments in their respective fields. Many commercial publishers are also providing the information content at least partially free of charge which was not available in the past.

While there are many useful resources added to the World Wide Web, many more trash and junk items also have found their way there. Finding quality resources among all of the web resources takes time, effort and a good deal of retrieval skill. Even though there is a virtual abundance of free and high quality information available on the Web, only a fraction of it has been made use of by individuals because of lack of time, skill and knowledge to track it down. Therefore, the role of Abstracting and Indexing databases is very essential to track down the relevant information available on the Internet and make it available in a standard format in an easily retrievable manner as it is not desirable to lose any useful information. Studies related to nuclear science and technology publications have been conducted (Kademani et al., 2006b; Verma, Sharma and Khatri, 1982). Web networks of the science system in universities and research institutes have also been studied (Horlesberger and Schiebel, 2006). This paper attempts to further analyse the growth and development of web-resources in nuclear science and technology as reflected in the International Nuclear Information System (INIS) (1996-2005) database.

INTERNATIONAL NUCLEAR INFORMATION SYSTEM (INIS)

The International Nuclear Information System (INIS) is a cooperative, computerised information system set up by the International Atomic Energy Agency (IAEA) and its member states in 1970. Its main objective is to provide a comprehensive bibliographic database relating to nuclear science and technology and its peaceful applications (Balakrishnan, 1986; International Atomic Energy Agency, 1987). As on 31st May 2006, there were 115 countries and 22 international organisations participating in INIS (www.iaea.org/inis).

OBJECTIVES

The main objective of the study is to present the growth of web-resources in nuclear science and technology by way of analyzing the following features of research output:

(a) To find out year-wise growth of publications in web-resources;
(b) To find out the subject-wise publications in web-resources;
(c) To find out language-wise distribution of publications in web-resources;
(d) To find out the channels of communications used by the scientists;
(e) To find out top websites in nuclear science and technology;
(f) To find out listing of alternative and multiple websites in the database;
(g) To find out distribution of websites as per domain names; and
(h) To find out how the web-resources have been recorded in the database.

Materials and Methods

The data source for the study was INIS on disc (CD-ROM), published by the INIS Central Secretariat at IAEA Head Quarters at Vienna, Austria. By using suitable search strategy [(http*) or (www*) and (UD=0001-3699)] in Words Anywhere Field, records pertaining to web-resources were downloaded from CDs released by INIS during the 10 year period (1996-2005). A total of 102,720 records were downloaded. The bibliographic details for each record included websites, type of web-documents, year of publication, language and country of input. After data cleaning, all the records were transferred to a spread sheet application. The data was analysed as per objectives of the study.

RESULTS AND DISCUSSION

Year-wise Growth of Publications in Web-resources in Nuclear Science and Technology

During 1996-2005 there were a total of 102,720 publications appeared in 1,526 web-resources. The publications in web-resources have started appearing in INIS database with three publications in 1996, 66 publications in 1997 and 96 publications in 1998. The spurt of publications in web-resources appearing in INIS began in 1999 with 1,080 publications and thereafter, an exponential growth of publications was observed. Figure 1 presents the year-wise and cumulative growth of publications in web-resources. The highest number of publications was 25,813 in 2005, and the average number of publications per year was 10,272.

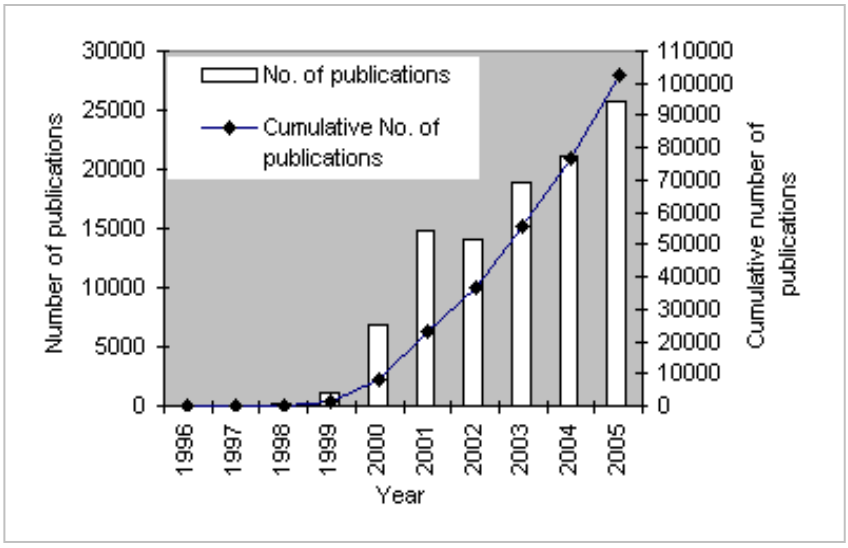

Figure 1: Year-wise Growth of Publications in Web-resources in Nuclear Science and Technology as per INIS (1996-2005) Database

Subject Category-wise Growth of Publications in Web-resources in Nuclear Science and Technology

During 1996-2005, there is a significant growth of publications in web-resources in the field of nuclear science and technology. The publications have been broadly grouped into five major subject categories. Figure 2 presents the *Subject Category-wise* distribution of publications. There were 52,590 (56.23%) publications in 'Physics' subject category followed by 23,148 (24.75%) publications in 'Other Aspects of Nuclear and Non Nuclear Energy', 13,843 (14.80%) publications in 'Life and Environmental Sciences', 10,380 (11.09%) publications in ' Engineering and Technology', and 2,759 (2.95%) publications in 'Chemistry, Materials and Earth Sciences'.

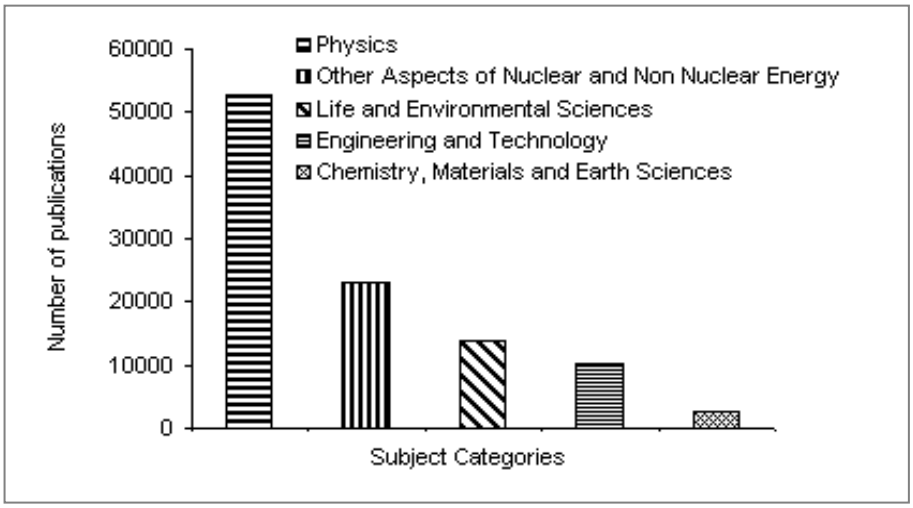

Figure 2: Subject Category -wise Distribution of Publications in Web-resources in Nuclear Science and Technology as per INIS (1996-2005) Database

Types of Channels of Communication in Web-Resources

Figure 3 depicts that more than 45% of the publications in web-resources in nuclear science and technology research were published in journals followed by reports (41.66%), and the rest was published in books (1.7%), computer media (0.5%), films (0.02%) and miscellaneous (10.63) channels of communication.

Table 1 provides the list of 21 important web-journals publishing > 1% of the total publications by the nuclear scientists. There were 377 journals publishing 46,681 publications. The leading journals preferred by the scientists were *Journal of Physics-Condensed Matter* with 6,677 (14.30%) publications, *Journal of Physics*-A with 5,186 (11.11%) publications, *Journal of High Energy Physics* with 4,799 (10.28%) publications, *Journal of Physics-D* with 2,508 (5.37%) publications, *Journal of Physics-B* with 2,407 (5.16%) publications, *Superconductor Science and Technology* with 2,206 (4.73%) publications and *Classical and Quantum Gravity with* 1,928 (4.13%) publications.

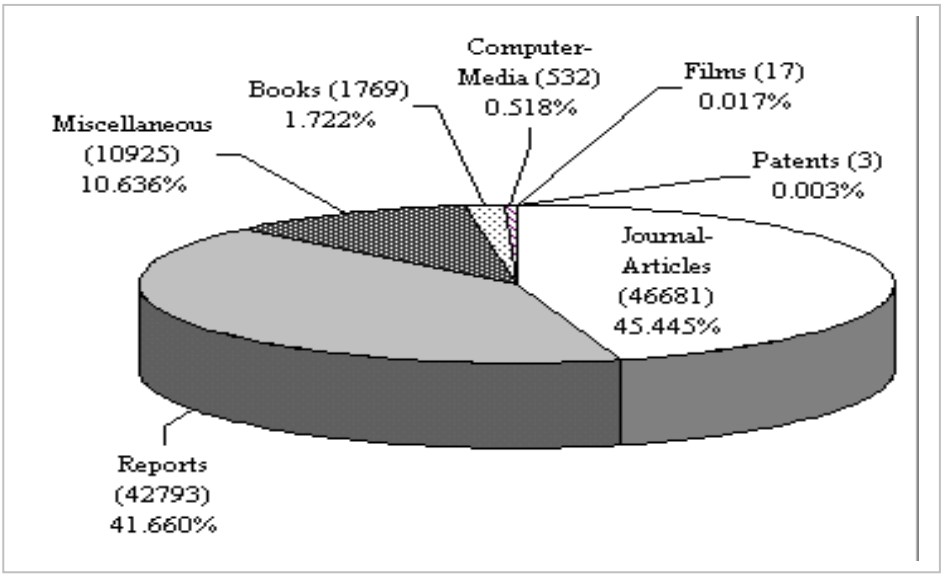

Figure 3: Types of Channels of Communication in Web-resources used by the Nuclear Scientists as per INIS (1996-2005) Database

Table 1: Web-journals Publishing > 1% of Total Publications by the Nuclear Scientists

No.	Journal Title	Number of publications	%	Cumulative %
1.	*Journal-of-Physics.-Condensed-Matter*	6677	14.30	14.30
2.	*Journal-of-Physics.-A,-Mathematical-and-General*	5186	11.11	25.41
3.	*Journal-of-High-Energy-Physics*	4799	10.28	35.69
4.	*Journal-of-Physics.-D,-Applied-Physics*	2508	5.37	41.07
5.	*Journal-of-Physics.-B,-Atomic,-Molecular-and-Optical-Physics*	2407	5.16	46.22
6.	*Superconductor-Science-and-Technology*	2206	4.73	50.95
7.	*Classical-and-Quantum-Gravity*	1928	4.13	55.08
8.	*Physics-in-Medicine-and-Biology*	1730	3.71	58.78
9.	*Journal-of-Physics.-G,-Nuclear-and-Particle-Physics*	1592	3.41	62.19
10.	*European-Physical-Journal.-C*	1293	2.77	64.96
11.	*European-Physical-Journal.-A*	1086	2.33	67.29

No.	Journal Title	Number of publications	%	Cumulative %
12.	*European-Radiology*	956	2.05	69.34
13.	*Nuclear-Fusion*	944	2.02	71.36
14.	*Plasma-Physics-and-Controlled-Fusion*	925	1.98	73.34
15.	*New-Journal-of-Physics*	677	1.45	74.79
16.	*Applied-Physics.-A*	620	1.33	76.12
17.	*Journal-of-Optics.-B,-Quantum-and-Semiclassical-Optics-Print*	619	1.33	77.45
18.	*European-Journal-of-Nuclear-Medicine-and-Molecular-Imaging*	585	1.25	78.70
19.	*Acta-Physica-Polonica.-Series-B*	547	1.17	79.87
20.	*European-Journal-of-Physics*	483	1.03	80.91
21.	*World-Journal-of-Nuclear-Medicine*	481	1.03	81.94
				truncated

Types of Website Organisation

Table 2 provides the websites which have covered publications related to nuclear science and technology by various types of organisations. The websites with the domain name .org has 51,602 publications followed by the domain .gov with 26,613 publications and .jp with 6,565 publications.

Table 2: Types of Website Organisation hosting > 100 publications

Internet Domain Names	Number of Publications	%	Internet Domain Names	Number of Publications	%
.org	51602	50.236	.de	393	0.383
.gov	26613	25.908	.at	361	0.351
.jp	6565	6.391	.uk	349	0.34
.it	2406	2.342	.dk	348	0.339
.br	2287	2.226	.by	336	0.327
.pl	2152	2.095	.ru	252	0.245
.se	1035	1.008	.ch	251	0.244
.ca	880	0.857	.cl	216	0.21
.com	748	0.728	.be	209	0.203
.nl	662	0.644	.no	198	0.193
.au	609	0.593	.yu	195	0.19
.fr	552	0.537	.76	172	0.167

Internet Domain Names	Number of Publications	%	Internet Domain Names	Number of Publications	%
.ro	551	0.536	.net	163	0.159
.sk	537	0.523	.lt	152	0.148
.fi	502	0.489	.int	125	0.122
.cz	425	0.414	.edu	111	0.108
					truncated

Top Websites Covered in Nuclear Science and Technology

All in all, INIS has covered 1526 websites during 1996-2005. Table 3 provides the websites which have published more than 100 publications. The top websites were http://www.iop.org with 30,711 (29.89%) publications followed by https://www.osti.gov with 25,241 (24.57%) publications, http://dx.doi.org with 8,569 (8.342%) publications, http://www.-pub.iaea.org with 5,199 (5.061%) publications and http://www.iaea.org with 3,032 (2.952%) publications.

Table 3: Top Websites Covered by INIS Database with > 100 Publications

No.	Websites	Number of publications	Percentage
1.	http://www.iop.org	30711	29.89
2.	https://www.osti.gov	25241	24.57
3.	http://dx.doi.org	8569	8.34
4.	http://www-pub.iaea.org	5199	5.06
5.	http://www.iaea.org	3032	2.95
6.	http://jolisf.tokai.jaeri.go.jp	2570	2.50
7.	http://jhep.sissa.it	1706	1.66
8.	http://jolisf.tokai-sc.jaea.go.jp	1557	1.52
9.	http://www.kek.jp	1186	1.16
10.	http://arxiv.org	1174	1.14
11.	www.jst.go.jp	843	0.82
12.	http://www.ifj.edu.pl	826	0.80
13.	http://www.ictp.trieste.it	583	0.57
14.	http://th-www.if.uj.edu.pl	547	0.53
15.	http://www.sbf.if.usp.br	537	0.52
16.	www.als.lbl.gov	510	0.50
17.	http://www.scielo.br	509	0.50
18.	http://www.sbf1.if.usp.br	504	0.49

No.	Websites	Number of publications	Percentage
19.	www.wjnm.org	478	0.47
20.	http://www.ipj.gov.pl	450	0.44
21.	http://www.fjfi.cvut.cz	398	0.39
22.	http://epub.iaea.org	370	0.36
23.	http://www.td.anl.gov	358	0.35
24.	http://www.fesbe.org.br	346	0.34
25.	http://www.skb.se	341	0.33
26.	www.omr.med.by	333	0.32
27.	http://www-nds.iaea.org	324	0.32
28.	http://www.physicsweb.org	295	0.29
29.	http://www.risoe.dk	281	0.27
30.	http://www.sbf1.sbfisica.org.br	266	0.26
31.	http://www.ntp.org.uk	262	0.26
32.	http://www.ski.se	257	0.25
33.	http://www1.jinr.ru	245	0.24
34.	http://www.publish.csiro.au	235	0.23
35.	http://www.alasbimnjournal.cl	205	0.20
36.	http://www.aip.org.au	202	0.20
37.	http://www.stuk.fi	192	0.19
38.	http://documentation.in2p3.fr	187	0.18
39.	http://www.llnl.gov	177	0.17
40.	http://www.sckcen.be	173	0.17
41.	http://143.107.52.76	172	0.17
42.	http://www.ssi.se	165	0.16
43.	http://ipnweb.in2p3.fr	163	0.16
44.	http://www.euronuclear.org	152	0.15
45.	http://www.eurosafe-forum.org	152	0.15
46.	http://vin.bg.ac.yu	151	0.15
47.	http://www.iync.org	150	0.15
48.	http://www.ecn.nl	135	0.13
49.	http://wccm.tuwien.ac.at	131	0.13
50.	http://lam27.iae.kyoto-u.ac.jp	130	0.13
51.	www.etrend.sk	125	0.12
52.	http://ns.nipne.ro	121	0.12
53.	http://conference.kek.jp	120	0.12

No.	Websites	Number of publications	Percentage
54.	http://www.savba.sk	119	0.12
55.	http://www.vtt.fi	116	0.11
56.	http://fpce4.fizica.unibuc.ro	114	0.11
57.	http://www.rcnp.osaka-u.ac.jp	114	0.11
58.	http://hosting.jrc.cec.eu.int	111	0.11
59.	http://www.ifpilm.waw.pl	107	0.10
60.	www.balwois.net	107	0.10
61.	http://hnd.zvne.fer.hr	103	0.10
62.	http://rsphysse.anu.edu.au	102	0.10
63.	http://www.vatesi.lt	101	0.10
			truncated

Language-wise Distribution of Publications in Web-resources

Table 4 depicts the language-wise distribution of publications in web-resources in nuclear science and technology. English is the most predominant language of communication preferred by the scientists with 94,384 (91.88%) publications, followed by Japanese with 3,215 (3.13%), Portuguese with 1,278 (1.24%) publications, multilingual with 611 (0.59%) and German with 610 (0.59%) publications.

Table 4: Language-wise Distribution of Web-resources

No.	Language	Number of publications	Percentage
1.	English	94384	91.885
2.	Japanese	3215	3.130
3.	Portuguese	1278	1.244
4.	Multilingual	611	0.595
5.	German	610	0.594
6.	Russian	524	0.510
7.	French	446	0.434
8.	Dutch	401	0.390
9.	Spanish	322	0.313
10.	Swedish	241	0.235
11.	Slovak	188	0.183
12.	Norwegian	166	0.162
13.	Polish	111	0.108

14.	Finnish	78	0.076
15.	Danish	47	0.046
16.	Lithuanian	22	0.021
17.	Chinese	16	0.016
18.	Czech	15	0.015
19.	Italian	15	0.015
20.	Latvian	12	0.012
21.	Korean	8	0.008
22.	Arabic	5	0.005
23.	Estonian	2	0.002
24.	Thai	2	0.002
25.	Romanian	1	0.001
Total		102720	100

Location of Web-resources in INIS Database

The web-resources are recorded in various fields in the INIS database. The field NT (Notes) had the maximum 10,1232 publications followed by SO (Source) field with 1,013 publications, AB (Abstract) field with 410 publications, AU (Author) field with 57 publications, OT (Original non-English Title) field with three publications, CA (Corporate Conference Author) and TI (Title) fields with two publications each and ST (Series Title Information) with one publication.

Alternative Web-site Listing and Multiple Links of Web-resources

Table 5 provides the data related to the listing of similar web-resources in more than one site and providing alternative links. There were 21,071 publications listed in two websites, and 555 publications listed in three websites.

Table 5: Alternative Websites/Multiple Links

Websites /locations	Number of publications	Total Websites	%
One website	81089	81089	78.942
Two websites	21071	42142	20.513
Three websites	555	1665	0.5403
Four websites	4	16	0.0039
Five websites	1	5	0.001
Total	102720	124917	100

CONCLUSION

The web-resources in nuclear science and technology on the Internet are growing at a tremendous pace. These include web-resources published in on-line journals, open access journals, articles and reports – either self-archived by the authors, or the institutes responsible for the creation of these resources. There are many challenging issues confronting librarians, database producers as well as information providers in dealing with these web-resources. There is a need to have a standard bibliographic presentation for web-resources in the databases as the potential of these quality resources to support nuclear scientists' information needs is very high.

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